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

Autonomous Institute Affiliated to VTU

February / March 2024 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: Answer FIVE FULL questions, choosing one from each unit.

UNIT - I

1	a)	Find the angle between the curves $r^n \cos(n\theta) = a^n$ and $r^n \sin(n\theta) = b^n$.	**06**
	b)	Find the radius of curvature for the curve $y^2 = 4ax$ at any point on it.	**07**
	c)	Obtain the Maclaurin's series expansion of the function $\sqrt{1+\sin(2x)}$.	**07**

UNIT - II

2	a)	If $z(x+y) = x^2 + y^2$, then show that $\left[\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right]^2 = 4\left[1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right]$.	**06**
	b)	If $u = x + 3y^2 - z^3$, $v = 4x^2yz$ and $w = 2z^2 - xy$ evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at the point $(1,-1,0)$.	**07**
	c)	Obtain the Maclaurin's series expansion of the function $f(x,y) = e^x \cos(y)$ upto second degree terms.	**07**

OR

3	a)	If $u = f(2x-3y, 3y-4z, 4z-2x)$, then prove that $6u_x + 4u_y + 3u_z = 0$.	**06**
	b)	Expand $f(x,y) = e^{xy}$ in Taylor's series at (1,1) upto second degree terms.	**07**
	c)	Find the extreme values of the function $f(x,y) = x^3 + y^3 - 3y - 12x + 20$.	**07**

UNIT – III

4	a)	Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2)\,dy\,dx$.	**06**
	b)	Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$ by changing into polar coordinates. Hence show that $\int_0^\infty e^{-x^2}\,dx = \frac{\sqrt{\pi}}{2}$.	**07**
	c)	Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.	**07**

OR

5	a)	Evaluate: $\int_{-c}^{c} \int_{-b}^{b} \int_{-a}^{a} (x^2 + y^2 + z^2)\,dx\,dy\,dz$.	**06**
	b)	Find the area enclosed by the curve $r = a(1+\cos(\theta))$ between $\theta = 0$ and $\theta = \pi$.	**07**

c) Express $\int_0^\infty \frac{dx}{1+x^4}$ in terms of Beta function and hence evaluate. **07**

UNIT – IV

6 a) Solve: $\frac{dy}{dx} - y\tan(x) = y^2 \sec(x)$. **06**

b) Solve: $x^2 y\, dx - (x^3 + y^3)\, dy = 0$. **07**

c) Show that $y^2 = 4a(x + a)$, where a is the parameter is a self-orthogonal family of curves. **07**

UNIT – V

7 a) Solve: $(D^2 - 4D + 4)y = \cos(2x)$. **06**

b) Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} + y = \tan(x)$. **07**

c) Solve: $(1 + x)^2 \frac{d^2y}{dx^2} + (1 + x)\frac{dy}{dx} + y = \sin[\log(1 + x)^2]$. **07**

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