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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary 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 to Candidates: Answer FIVE FULL questions, choosing one from each unit.

UNIT - I

1	a)	Derive an expression for the angle between radius vector and tangent in the form of $\tan(\emptyset) = r\frac{d\theta}{dr}$.	**6**
	b)	Show that ρ for the curve $r^n = a^n cosn\theta$ varies inversely as r^{n-1}.	**7**
	c)	Obtain the Maclaurin's series expansion of the function $\log\left(\sqrt{\frac{1+x}{1-x}}\right)$ up to third degree term.	**7**

UNIT - II

2	a)	If $u = e^x \sin(yz)$ where $x = t^3, y = t - 1$ and $z = \frac{1}{t}$, then find $\frac{du}{dt}$ at $t = 1$.	**6**
	b)	If $z = f(x, y)$ where $x = r\cos(\theta)$ and $y = r\sin(\theta)$, then show that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2$.	**7**
	c)	Obtain the Maclaurin's series expansion of the function $e^x\log(1 + y)$ up to the third degree terms.	**7**

OR

3	a)	If $x = r\sin(\theta)\cos(\emptyset)$, $y = r\sin(\theta)\sin(\emptyset)$ and $z = r\cos(\theta)$, then find $J = \frac{\partial(x,y,z)}{\partial(r,\theta,\phi)}$.	**6**
	b)	Obtain the extreme values of the function $f(x, y) = x^3 + 3xy^2 - 15y^2 - 15x^2 + 72x$.	**7**
	c)	Expand $xy^2 + \cos(xy)$ about the point $\left(1, \frac{\pi}{2}\right)$ using the Taylor's theorem up to the second degree terms.	**7**

UNIT - III

4	a)	Evaluate $\int_1^2 \int_1^{x^2} (x^2 + y^2)dydx$ by changing the order of integration.	**6**
	b)	Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z}dzdydx$.	**7**

c) Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **7**

OR

5 a) Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx\, dy$ by changing into polar coordinates. **6**

b) Find the area enclosed by the curve $r = a(1 + cos\theta)$ between $\theta = 0$ and $\theta = \pi$. **7**

c) Show that $\int_0^{\pi/2} \sqrt{sin\theta}\, d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{sin\theta}}\, d\theta = \pi$. **7**

UNIT - IV

6 a) Solve: $x^3 \frac{dy}{dx} - x^2 y = -y^4 \cos(x)$. **6**

b) Solve: $y(2x - y + 1)dx + x(3x - 4y + 3)dy = 0$. **7**

c) Find the orthogonal trajectories of the family of curves $r = 4a \sec(\theta) \tan(\theta)$. **7**

UNIT - V

7 a) Solve: $(D^2 - 4D + 4)y = 8(e^{2x} + \sin(2x) + x^2)$. **6**

b) Apply the method of variation of parameters to solve $(D^2 + 2D + 2)y = e^{-x} sec^3 x$. **7**

c) Solve: $(3x + 2)^2 y'' + 3(3x + 2)y' - 36y = 3x^2 + 4x + 1$. **7**

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