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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, B.E. - Semester End Examination; May - 2022

Engineering Mathematics - I

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1 - Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

CO2 - Explain mean value theorems and evaluate indeterminate form and power series using Taylor's and Maclaurin's series.

CO3 - Differentiate the function of several variables and composite functions. Evaluate the vector differentiation.

CO4 - Evaluate some standard integrals by applying reduction formula and solve application problems.

CO5 - Solve differential equations of first order and solve application problems in engineering field.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*

II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for a Maximum of* ***18 marks*** *from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	Find the angle between radius vector and the tangent for the curve $r = a(1-\cos\theta)$.	2	L1	CO1	PO1
b.	Evaluate: $\lim_{x\to \pi/2} \dfrac{\log(\sin x)}{\left(\dfrac{\pi}{2}-x\right)^2}$.	2	L1	CO2	PO1
c.	Find curl(curl $\vec{A}$), given that $\vec{A} = xy\hat{i} + y^2z\hat{j} + z^2y\hat{k}$.	2	L1	CO3	PO1
d.	Evaluate: $\int_0^{\pi} \sin^6 x \cos^4 x\, dx$ using reduction formula.	2	L1	CO4	PO1
e.	Define Bernoulli's equation linear in y.	2	L2	CO5	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Find the angle of intersection of the curves $r = 2\sin\theta,\ r = \sin\theta + \cos\theta$.	9	L3	CO1	PO1
b.	Find the radius of curvature for the curve $y = \dfrac{ax}{a+x}$, show that $\left(\dfrac{2\rho}{a}\right)^{2/3} = \left(\dfrac{x}{y}\right)^2 + \left(\dfrac{y}{x}\right)^2$.	9	L2	CO1	PO1
c.	Find the evolute of the parabola $y^2 = 4ax$.	9	L3	CO1	PO2
	UNIT - II	**18**			
2 a.	State Lagrange mean value theorem. Verify the Lagrange mean value theorem for the function $\cos^2 x$ *in* $[0, \pi/2]$.	9	L2	CO2	PO1
b.	Expand $tan^{-1} x$ in powers of $(x-1)$ up to the terms containing fourth degree.	9	L2	CO2	PO1

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c.	Evaluate: $\lim_{x\to 0}\left[\frac{1}{x^2}-\cot^2 x\right]$.	9	L2	CO2	PO2
	UNIT - III	**18**			
3 a.	If $u=e^{ax-by}\sin(ax+by)]$ show that $b\frac{\partial u}{\partial x}-a\frac{\partial u}{\partial y}=2abu.$	9	L3	CO3	PO2
b.	If $z=f(x,y)$ where $x=e^u+e^{-v}$, $y=e^{-u}-e^v$ prove that, $x\frac{\partial z}{\partial x}-y\frac{\partial z}{\partial y}=\frac{\partial z}{\partial u}-\frac{\partial z}{\partial v}$.	9	L3	CO3	PO2
c.	If $\vec{F}=(x+y+az)\hat{i}+(bx+2y-z)\hat{j}+(x+cy+2z)\hat{k}$, find a, b, c such that curl $\vec{F}=0$ and then find ϕ such that $\vec{F}=\nabla\phi.$.	9	L2	CO3	PO2
	UNIT - IV	**18**			
4 a.	Obtain the reduction formula for $\int\sin^n x\,dx$ *and* $\int_0^{\pi/2}\sin^n x\,dx$, n is a positive integer.	9	L2	CO4	PO1
b.	Evaluate: $\int_0^1\frac{x^\alpha-1}{\log x}dx$, $(\alpha\geq 0)$ using differentiation under the integral sign where α is the parameter. Hence find $\int_0^1\frac{x^3-1}{\log x}dx$.	9	L3	CO4	PO1
c.	Trace the curve $r=a(1+\cos\theta), a>0$ [*cardioid*].	9	L2	CO4	PO1
	UNIT - V	**18**			
5 a.	Define exact differential equation and solve, $\frac{dy}{dx}+\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0.$	9	L1	CO5	PO1
b.	Find the orthogonal trajectories of the family of curves, $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$, where λ is the parameter.	9	L2	CO5	PO2
c.	A body of air at 25°C cools from 100°C to 75°C in one minutes. Find the temperature of the body at the end of 3 minutes from the original.	9	L3	CO5	PO2

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