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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; Dec. - 2019

Engineering Mathematics - I

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcome's

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 the indeterminate form and power series using Taylors and Maclaurin's series.

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

CO4 - Evaluate some standard integrals by applying reduction formula and solve application problems. Solve differential equations of first order and solve application problems in engineering field.

Note: i) Part - A is compulsory, one question from each unit

ii) Part - B : Answer Two sub-questions for Maximum of 18 marks from each unit.

Q. No.		Questions	Marks	BLs	COs
		I : PART - A	**10**		
I.	a.	Find the n[th] derivative of $\sin 4x \cos 2x$	2	L1	CO1
	b.	State the Rolle's theorem.	2	L1	CO1
	c.	Find the total differential of the function $u = x^3 + xy^2 + x^2y + y^3$.	2	L1	CO3
	d.	Evaluate $\int_0^{\pi/2} \sin^6 x.\cos^5 x dx$	2	L1	CO4
	e.	Show that the differential equation $\left(y^3 - 3x^2y\right)dx - \left(x^3 - 3xy^2\right)dy = 0$ is exact.	2	L1	CO5
		II : PART - B	**90**		
		UNIT - I	**18**		
1	a.	State Leibritz theorem. If $y = \left(\sin^{-1} x\right)^2$ Show that, $\left(1-x^2\right)y_{n+2} - (2n+1)xy_{n+1} - n^2y_n = 0$	9	L1	CO1
	b.	i) Find the angle between the radius vector and the tangent for the polar curve $r = a(1-\cos\theta)$ ii) Find the pedal equation of the curve $r(1-\cos\theta) = 2a$	9	L1	CO1
	c.	Define radius of curvature. Find the radious of curvature for the curve. $y^2 = \frac{4a^2(2a-x)}{x}$ Where the curve meets the x-axis.	9	L2	CO1
		UNIT - II	**18**		
2	a.	i) State the Lagrange's mean value theorem ii) Verify the Cauchy's mean value theorem for the function $\sqrt{x+9}$ and $\sqrt{x}$ in [0, 16]	9	L2	CO2
	b.	i) State the Taylor's series expansion about the point $x=a$ upto the fourth degree term ii) Expand log(sec$x$) up to the term containing x^6 using Maclaurin's series.	9	L2	CO2

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		Marks	Level	CO
c.	Evaluate the following limits: i) $\lim_{x\to a}\frac{x^x - a^x}{x^a - a^a}$ ii) $\lim_{x\to\frac{\pi}{2}}(\sin x)^{\tan x}$	9	L2	CO2
	UNIT - III	**18**		
3 a.	If $u=\tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$ then prove that using, Euler's theorem i) $xu_x + yu_y = \sin 2u$ ii) $x^2u_{xx} + 2xyu_{xy} + y^2u_{yy} = \sin 4u - \sin 2u$	9	L2	CO3
b.	i) Define velocity and acceleration and also give the examples. ii) Find the directional derivatives of, $\phi = x^2yz + 4xz^2$ at $(1,-2,-1)$ along $2i - j - 2k$.	9	L2	CO3
c.	i) Define solenoidal and irrotational vector fields. ii) Find the div $\vec{F}$ and curl $\vec{F}$ where $\vec{F} = \nabla\left(x^3+y^3+z^3-3xyz\right)$	9	L2	CO3
	UNIT - IV	**18**		
4 a.	Obtain the reduction formula for $\int \sin^n x dx$ and $\int_0^{\pi/2} \sin^n x dx$ where n is a positive integer and find $\int_0^{\pi/2} \cos^6 x dx$	9	L2	CO4
b.	i) Trace the curve $y^2(a-x) = x^3, a>0$ (cissoid). ii) Write the shape of the cardioid $r = a(1+\cos\theta)$	9	L2	CO4
c.	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 and hence find $\int_0^1 \frac{x^3-1}{\log x}dx$	9	L2	CO4
	UNIT - V	**18**		
5 a.	i) Define Homogeneous differential equation. ii) Solve: $\left(1+e^{x/y}\right)dx + e^{x/y}\left(1-\frac{x}{y}\right)dy = 0$	9	L2	CO5
b.	i) State exact differential equation ii) solve: $\frac{dy}{dx} + 3x^2y = x^5e^{x^3}$	9	L2	CO5
c.	If the air is maintained at 30ºC and the temperature of the body cools from 80ºC to 60ºC in 12 minutes. Find the temperature of the body after 24 minutes.	9	L2	CO5

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