Exam Code 556

NOV-DEC 2023 EXAMINATION
I B.E./B.TECH. (4YDC) EXAM
MA10001: MATHEMATICS - I

Time : 3 Hrs.] [Max. Marks :70

TOTAL NO. OF QUESTIONS IN THIS PAPER : 5

Note : Each question carry five subparts a, b , c, d and e. Attempt subparts a, b, c and any one from d or e in each question. All questions carry equal marks.

			Marks	CO	BL	PI
Q.1	(a)	Find the Jacobian $\frac{\partial(x,y)}{\partial(u,v)}$ of the transformation $x = u^2 - v^2$, $y = u^2 + v^2$.	02	CO1	BL-2	1.1.1
	(b)	Find the first order partial derivative of $u = cos^{-1}\left(\frac{x}{y}\right)$.	02	CO1	BL-2	1.1.1
	(c)	If $u = x^2 - y^2$ where $x = 2r - 3s + 4$ and $y = -r + 8s - 5$ then find $\frac{\partial u}{\partial r}$ and $\frac{\partial u}{\partial s}$.	03	CO1	BL-2	1.1.1
	(d)	If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ then by Euler's theorem prove that (i) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}\tan u$ (ii) $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y} = \frac{-\sin u \cos 2u}{4\cos^3 u}$	07	CO1	BL-2	1.1.1
		OR				
	(e)	Compute the approximate value of $\sqrt{11}$ correct upto four decimal places by Taylor's series expansion.	07	CO1	BL-3	1.1.1
Q.2	(a)	Define Curvature and write the formula of radius of curvature for Cartesian curve.	02	CO2	BL-1	1.1.1
	(b)	Write only the Lagrange's equation for the function $x^2 + y^2 + z^2$ subject to the condition $xyz = a^3$.	02	CO2	BL-1	1.1.1
	(c)	Find the radius of curvature at (3,3) for the implicit equation $x^3 + xy^2 - 6y^2 = 0$	03	CO2	BL-2	1.1.1
	(d)	Find the equation of circle of curvature for the curve $xy=12$ at the point (3, 4).	07	CO2	BL-2	1.1.1
		OR				
	(e)	Find all asymptotes of the equation $y^2(x^2 - a^2) = x^2(x^2 - 4a^2)$.	07	CO2	BL-2	1.1.1
Q.3	(a)	Evaluate value of $\Gamma(1)$ using formula of Gamma function.	02	CO3	BL-2	1.1.1
	(b)	Evaluate $\int_0^1 x^2(1-x)^3\,dx$ using beta function.	02	CO3	BL-2	1.1.1
	(c)	Evaluate $\int_0^{2\pi}\int_{a\sin\theta}^{a} r\,dr\,d\theta$.	03	CO3	BL-2	1.1.1
	(d)	Evaluate $\iint_R r^3\,dr\,d\theta$ over the area included between the circles $r = 2a\cos\theta$ and $r = 2b\cos\theta$, $b < a$.	07	CO3	BL-2	1.1.1

	(e)	Change the order of integration and evaluate $\int_0^{\frac{a}{\sqrt{2}}} \int_x^{\sqrt{a^2-x^2}} y^2 dydx$	07	CO3	BL-3	1.1.1
Q.4	(a)	Find the point of intersection for the curve $x=(y-1)(y-2)(y-3)$.	02	CO4	BL-1	1.1.1
	(b)	Find the number of loops in the curve $r=a\sin 3\theta$.	02	CO4	BL-1	1.1.1
	(c)	Find the length of the arc of the semi-cubical parabola $ay^2 = x^3$ from its vertex to the point (a, a).	03	CO4	BL-2	1.1.1
	(d)	Find the surface area of solid generated by the revolution arc of the parabola $y^2 = 4ax$ bounded by its latus rectum about the x- axis.	07	CO4	BL-2	1.1.1
		OR				
	(e)	Trace the curve $r = a\cos 3\theta$	07	CO4	BL-3	1.1.1
Q.5	(a)	State the De-Morgan's law for Boolean algebra.	02	CO5	BL-1	1.1.1
	(b)	Sketch the following network $(x+y).z$.	02	CO5	BL-2	1.1.1
	(c)	Show that for the Boolean algebra $[B,+,.,']$: $a.b + a.b' + a'.b + a'.b' = 1 \quad \forall a,b \in B$	03	CO5	BL-2	1.1.1
	(d)	Draw the circuit for the following function and simplify it $xy(z+x') + y(y'+z')$	07	CO5	BL-3	1.1.1
		OR				
	(e)	Convert the function into conjunctive normal form $F(x,y) = x.y'+x'.y'+x'.y$	07	CO5	BL-3	1.1.1

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