First Semester FYUGP Mathematics Examination November 2024 (2024 Admission onwards) KU1DSCMAT116 (CALCULUS AND COORDINATE SYSTEMS) (EXAM DATE : 06-12-2024)

Time : 120 min	Maximum Marks : 70
Part A (Answer any 6 questions. Each carries 3 mark	as)
 Use the laws of exponents to simplify the following expression (a)4^{1/3}.4^{1/6} (b) (8^{1/9})³. 	ions: 3
2. Simplify the expression: $\ln(e^{2\ln x})$.	3
3. Find $\lim_{y \to 0} \frac{y^2}{y^3 + 6}$.	3
4. Apply Chain rule to differentiate $y = e^{cosx}$.	3
5. If $g(t) = \frac{1}{t^2}$, find $g'(t)$ at $t = -1$.	3
6. State the Mean Value Theorem for definite integrals.	3
7. Evaluate $\int_0^{3b} x^2 dx$.	3
8. Evaluate $\int a \sin bx dx$.	3
Part B (Answer any 4 questions. Each carries 6 ma	rks)
9. If $f(x) = \frac{x+2}{x-1}$, find $f^{-1}(x)$ and identify the domain and re-	ange of $f^{-1}(x)$ 6
10. Calculate the value of the limit $\lim_{v \to 2} \frac{v^2 - 4}{v^4 - 16}$.	6
11. Find a closed-form for the inverse hyperbolic function	
$y = \tanh^{-1} x.$	
	6

12. Evaluate $\int_0^{\frac{\pi}{6}} (\sec x + \tan x)^2 dx.$ 6

13. Evaluate
$$\int \frac{1}{x(x+1)} dx$$
 6

14. Evaluate $\frac{d}{dx} \int_0^3 (t^3 + 1)dt$

Part C (Answer any 2 question(s). Each carries 14 marks)

- 15. (a) Graph the curve $r = 1 + \cos \frac{\theta}{2}$
 - (b) Describe the set of points $P(\rho, \phi, \theta)$ whose spherical co-ordinates satisfy the equations $\rho = 1, \phi = \frac{\pi}{3}$.

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- 16. (a) Find the Cartesian equivalent of the polar equation $r = 1 + 2r \cos \theta$
 - (b) Translate the equation $x^2 + y^2 + z^2 = 4z$ from the given coordinate system into equations in the other two coordinate systems.

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- 17. (a) Find dy/dx using the method of logarithmic differentiation, if y = (x² + 1)(x⁴ + 2)^{1/2}.
 (b) Find dy/wing the method of logarithmic differentiation if
 - (b) Find $\frac{dy}{dx}$ using the method of logarithmic differentiation, if $y = \frac{x^5 + 5}{(x+3)^2}$.
 - (c) Show that there is a root of the equation $x^3 x 1 = 0$ between 1 and 2.

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