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University of Ruhuna- Faculty of Technology
Bachelor of Engineering Technology Honours
Level 1 (Semester II) Examination, May/June 2026
Academic year 2024/2025

Course Unit: TMS1213: Applied Calculus II **Duration: 3 hours**

Instructions to Candidates

- This paper contains **five (05)** questions on **three (03)** pages.
- Answer **all** questions, every question carries equal marks and the maximum mark attainable for the sub parts of each question is indicated in the bracket.
- This examination accounts for 60% of the module assessment.
- This is a close book examination.
- Electronic communication devices and calculators are not permitted.

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1)

a) Integral I is given as;

$$I = \int_1^2 \frac{1}{x^2\sqrt{x^2-1}}dx$$

Show that $I = \frac{\sqrt{3}}{2}$, using the substitution $x = \sec\theta$. (50 marks)

b) Evaluate the following indefinite integral using a proper substitution;

$$\int x\ln(x^2+1)\,dx$$

(50 marks)

2) Let $f(x) = (x^2-2x-3)(x-3)$ $;x \in \mathbb{R}$

a) Determine the $x-$ axis and $y-$ axis intersection points of f(x). (10 marks)

b) Locate the turning points of f(x) and find the intervals where the function is increasing and decreasing(simplify to nearest first decimal). (30 marks)

c) Find the intervals where f(x) is concave up or concave down. (10 marks)

d) Determine the inflection points. (20 marks)

e) Find the behavior of the funtion when, $x \to \infty$ and $x \to -\infty$. (10 marks)

f) Based on the information you have obtained from the above parts, sketch the shape of the function f(x) on a 2D cartesian plane. (20 marks)

3) Calculate the arc length of the following function over the given interval.

$$(3x)^2 = (y^2+2)^3 \quad ; \quad y \in [1,4]$$

(100 marks)

4)

a) Sketch the functions f(x) and g(x) on the same 2D cartesian plane. (20 marks)

$$f(x) = -\frac{x^2}{2} + 2$$

$$g(x) = -x + 2$$

b) Define R as the region bounded by f(x) and g(x). Find the intersection points of f(x) and g(x), and shade the region R in above graphs. (10 marks)

c) Hence calculate the volume of the solid of revolution formed by revolving R around $y-$ axis. (70 marks)

5) Show that the area of the surface generated by revolving the function

$$g(x) = \frac{x^2}{2} - \frac{1}{4}\ln x$$

over the interval $x \in [1,2]$ *about* $x-$ axis is equals to;

$\pi\left\{\frac{9}{2} - \ln 2 - \frac{(\ln 2)^2}{16}\right\}$. (100 marks)

... End of paper...