GRETSA UNIVERSITY - THIKA

UNIVERSITY EXAMINATIONS

MAY - AUGUST 2018 SEMESTER

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: BSCS 110

COURSE TITLE: CALCULUS II-INTEGRAL

DATE: 6 AUGUST 2018 **TIME: 8.00AM – 11.00AM**

INSTRUCTIONS TO CANDIDATES

1. SECTION A IS **COMPULSORY.**
2. SECTION B: ANSWER ANY OTHER **THREE** QUESTIONS.
3. **DO NOT** WRITE ANYTHING ON THIS QUESTION PAPER AS IT WILL BE AN EXAM IRREGULARITY.
4. ALL ROUGH WORK SHOULD BE AT THE BACK OF YOUR ANSWER BOOKLET AND CROSSED OUT.

CAUTION: *All exam rooms are under CCTV surveillance during the examination period.*

SECTION A: COMPULSORY

Question One

a) Explain what you understand by a tangent line. Hence consider the curve in the xy-plane defined by the equation $x^2 + 3xy - y^2 = 3$. Find the tangent line and normal line to the curve at the point $(1, 2)$ **[6 Marks]**

b) Evaluate the each of the following integrals

i. $\int_0^{\pi} \sin^5(3x)\cos(3x)\,dx$ **[3 Marks]**

ii. $\int \frac{x^2}{\sqrt{4-x^2}}\,dx$ **[5 Marks]**

iii. $\int x \ln x dx$ **[3 Marks]**

iv. $\int t^3 e^t dt$ **[4 Marks]**

c) Given that $x = \cos^3 t$ and $y = \sin^3 t$. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ **[5 Marks]**

d) Define

(i) Slant Asymptote line **[1 mark]**

(ii) Vertical Asymptote line **[1 mark]**

Hence determine all the asymptotes of the function $f(x) = \frac{3x+1}{x-2}$ **[3 marks]**

e) Find the length of the curve $y = e^x$ from $x = 0$ to $x = 2$ **[5 marks]**

f) A bacteria population starts with 400 bacteria and grows at a rate of $r'(\mathrm{x}) = (450.268)e^{1.12567t}$ bacteria per hour. How many bacteria will be there after 4 hours? **[4 marks]**

SECTION B: ANSWER ANY THREE QUESTIONS

Question Two

a) The population of bacteria changing at the rate of $\frac{dp}{dt} = \frac{3000}{1+0.25t}$ where t is the time in days. Assuming that the initial population (when $t = 0$) is 1000. Write an equation that gives the population at any time t and then find the population when $t = 3$ days.

[6 marks]

b) Discuss and sketch the curve $y = \frac{-2x^2}{x^2-4}$ **[7 marks]**

c) Evaluate $\int \coth 5x dx$ **[5 marks]**

d) Find the derivative of $y = \cos ech^{-1}(2x)$ **[3 Marks]**

Question three

a) The rate at which a body eliminates a drug (in millimeters per hour) is given by

$$R'(t) = \frac{60t}{(t+1)^2(t+2)}, \; R(0) = 0$$

Where the number of hours since the drug is administered is t. How much of the drug is eliminated during the first four hours after the drug was administered.

[10 marks]

b) Find the area of the surface generated by rotating the portion of the curve $y = \frac{1}{3}\left(x^2+2\right)^{\frac{3}{2}}$

between $x = 0$ to $x = 3$ **[6 marks]**

c) Evaluate $\int \frac{dt}{t^2 - 6t + 13}$ **[4 marks]**

Question Four

a) Given the initial condition $y(0) = 1$, find the particular solution to the equation

$xydx + e^{-x^2}(y^2 - 1)\,dy = 0$ **[7 marks]**

b) Use Simpson's rule with $n = 8$ to approximate $\int_0^2 \frac{dx}{\sqrt[3]{5+x^2}}$ **[8 marks]**

c) Find the volume of the solid obtained by revolving the region bounded by the curves

$y = x$ and $y = x^3$ about the x-axis. [5 marks]

Question five

a) Show that $\sinh^{-1}(x) = \ln|x + \sqrt{x^2+1}|$ **[6 marks]**

b) use trapezoidal rule with $n = 6$ to approximate $\int_0^{0.5} \sqrt{1+x^3}\, dx$ **[5 marks]**

c) Evaluate $\int \frac{dx}{5 + 4\sin x}$ **[6 marks]**

d) Find the second derivative of the function $x^2 + y^2 = 25$ **[5 marks]**