(*Knowledge for Development*)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2016/2017 ACADEMIC YEAR

SECONDYEAR FIRST SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: **MAT 210**

COURSE TITLE: CALCULUS II

DATE: 18/09/17 **TIME:** 8 AM -10 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

Question One (30 Marks)

a. Evaluate the integral $\int\left(6e^x - \frac{3}{1+x^2}\right)dx$ (3 Marks)

b. Find $\int \frac{4x^2+13x-9}{x^3+2x^2-3x}dx$ (5 Marks)

c. Evaluate $\int(1 - sin^3 3x)cos3xdx$ (3 Marks)

d. The region enclosed by the curves $y = x$ and $y = x^2$ is rotated about the x axis. Find the volume of the resulting solid (5 Marks)

e. Evaluate $\iint(x - 3y^2)dydx$ for the region $\{(x, y): 0 \le x \le 2, 1 \le y \le 2\}$ (5 Marks)

f. Evaluate $\int x^2 sinxdx$ (4 Marks)

g. Find the Riemann sum for $f(x) = x^2 + 1$ taking the sample points to be the right endpoints and $a = 0, b = 2$ and $n = 5$ (5 Marks)

Question Two (20 Marks)

a. Evaluate the integrals

i. $\int t^2 e^t dt$ (4 Marks)

ii. $\int tan^3 x sec^2 x dx$ (4 Marks)

iii. $\int sin^2 x cos^2 x dx$ (4 Marks)

b. Determine the position function $s(t)$ of an object if its velocity is $v(t) = 3 - 12t$ and the initial position is $s(0) = 3$ (3 marks)

c. Use partial fractions to evaluate $\int \frac{x^4}{x^2 - 1}dx$ (5 marks)

Question Three (20 Marks)

a. Find the average value of the function $f(x) = x^2 + 3x - 1$ on the interval $[-1,3]$ (3 Marks)

b. Evaluate the following integrals

i. $\int_0^2 \sqrt{x^2 + 9}\,dx$ (4 Marks)

ii. $\int \frac{dx}{\sqrt{4-x^2}}$ (3 Marks)

iii. $\int \frac{xdx}{\sqrt{1-4x^2}}$ (4 Marks)

iv. $\int_0^1 \int_1^x e^y dydx$ (2 Marks)

v. Find the area of the region bounded above by $y = x^2 + 1$, bounded below by $y = x$ and bounded on the sides by $x = 0$ and $x = 1$ (4 Marks)

Question Four (20 Marks)

a. Define $I_n = \int tan^n x dx$. Show that $I_n = \frac{tan^{n-1}x}{n-1} - I_{n-2}$. Hence evaluate $\int tan^7 x dx$

(10 Marks)

b. Find the value of c that satisfies the conclusion of the integral Mean Value Theorem in the function below (3 Marks)

$$f(x) = x^2, 0 \leq x \leq 2$$

c. The arc of the parabola $y = x^2$ from $(1,1)$ to $(2,4)$ is rotated about the x axis. Find the area of the resulting surface (4 Marks)

d. Find the arc length of the curve $y = e^{2x}$ from $x = 0$ to $x = 2$ (3 Marks)

Question Five (20 Marks)

a. Decompose $\frac{x^3+2}{(x-1)(x+2)(x+3)}$ into partial fractions. Hence or otherwise evaluate

$\int \frac{x^3+2}{(x-1)(x+2)(x+3)} dx$ (10 Marks)

b. Evaluate $\int_1^3 \frac{x+2}{x+1} dx$ (5 Marks)

c. Find $\frac{d}{dx} \int_{x^2}^1 \frac{1}{\sqrt{t^4+2}} dt$ (5 Marks)