THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF CIVIL AND BUILDING ENGINEERING

DIPLOMA IN CIVIL ENGINEERING & CAD
DIPLOMA IN BUILDING ENGINEERING & CAD

SEMESTER EXAMINATIONS

APRIL/MAY 2010 SERIES

AH 2204 - CALCULUS III

TIME: 2 HOURS

Instructions to Candidates

This paper consists of **TWO** Section i.e. Section **A** and **B.**
Section **A** is **COMPULSORY.**
Answer any **TWO** Questions in Section **B**.
Maximum marks for each Question is shown.
You should have material calculation for this exam.

Question ONE (COMPULSORY)

(a). (i). Using L'Hospital's Rule, determine $\lim_{x \to o} \frac{\tan x - x}{\sin x - x}$ **(5 Marks)**

(ii). Find the limit of the function, $f(x) = \frac{x-4}{3\sqrt{x-2}}, \quad x \neq 4$ **(5 Marks)**

(b). (i). Evaluate, $\int \tan^n x dx$. Hence use the integral to solve.

$$\int_o^{\pi/2} \tan^5 dx$$ **(12 Marks)**

(ii). Test the convergence of the series;

$$1 + \frac{2x}{2!} + \frac{3^2 x^2}{3!} + \frac{4^3 x^3}{4!} + \ldots\ldots\ldots\ldots$$ **(8 Marks)**

SECTION B (CHOOSE ANY TWO)

Question TWO

(a) (i). Prove that, $\int \frac{x^h}{\sqrt{a^2 + x^2}} dx = \frac{x^{h-1}\sqrt{a^2 + x^2}}{h} - \frac{(h-1)}{h} a^2 \int \frac{x^{h-2}}{\sqrt{(a^2 + x^2}} dx$

(ii). Use above integral to evaluate;

$$\int_o^2 \frac{x^5}{\sqrt{(5+x)}} dx$$ **(12 Marks)**

(b). If $Sin^{-1}(x/y) + \tan^{-1}(x/y)$ then find the value of $x\frac{\delta u}{\delta x} + y\frac{8u}{\delta y}$ **(8 Marks)**

Question THREE

Evaluate, $\iint (x^2 + y^2) dxdy$ throughout the area enclosed by the curves $y = 4x, \quad x + y = 3, \quad y = 0,$ and $y = 2$. **(20 Marks)**

Question FOUR

(a). (i). Evaluate, $\iiint_R (x + y + z) dxdydz$, where

$R: 0 \leq \times \leq 1, \qquad 1 \leq y \leq 2, \qquad 2 \leq z \leq 3.$ **(5 Marks)**

(ii). Using Taylor's or Maclaurin's series find the value of sin 31° correct to five decimal places. **(7 Marks)**

(b). Determine an expression of $\int x^h \sin x dx$ and hence solve $\int_o^{\pi/3} x^4 \sin x dx$.

(8 Marks)

Question FIVE

(a). using mean value theorem, find the limits within which $\int_{1.5}^{1.6} \log_e x^2 dx$ Must lie.

(5 Marks)

(b). (i). The height h and semi-vertical angle α of a cone are measured, and from there A, the total area of the cone, including the base is calculated. If h and α are in error by small quantities δh and $\delta\alpha$ respectively.

(i). Find corresponding error in the area.

(ii). Show that if $\alpha = \pi/6$, an error of +1% in h will be approximately compensated by an error of -19.8 in α. **(15 marks)**