# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

## UNIVERSITY EXAMINATION FOR:

**THE DEGREE OF BACHELOR OF**

**BTMD/BSMD**

AMA 4101: **ALGEBRA**

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

# SERIES:

# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

**UNIVERSITY EXAMINATION FOR:**

. **BACHELOR OF SCIENCE AND COMPUTER SCIENCE**

**AMA 4420: DIFFERENTIAL GEOMETRY**

END OF SEMESTER EXAMINATION

**SERIES:** FEBRUARY 2018

**TIME:** 2 HOURS

**DATE:** FEBRUARY 2018

**Instructions to Candidates**

You should have the following for this examination

-*Answer Booklet, examination pass and student ID*

This paper consists of Choose No questions. Attempt QUESTION ONE AND ANY OTHER TWO QUESTIONS

**Do not write on the question paper.**

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**Question ONE**

a) Find the constant $a$ such that the vectors $2\hat{i}-\hat{j}+\hat{k}, \hat{i}+2\hat{j}-3\hat{k}$ and $3\hat{i}-a\hat{j}+5\hat{k}$ are coplanar. (5mks)

b) Find the equation of a plane passing the point $(3,-1,-2)$ and perpendicular to the vector $6\vec{i}+5\vec{j}-8\vec{k}$ (5mks)

c) Determine the equation of the tangent line to the curve $\vec{r}=e^{t}\vec{i}-e^{-t}\vec{j}+t^{2}\vec{k}$ at $t=1$ (5mks)

d) Find the length of the arc $\vec{r}=e^{t}\cos t\vec{e}_1+e^{t}\vec{e}_2+e^{t}\vec{e}_3, 0\le t\le \pi$ (5mks)

e) Find the first fundamental magnitude for surface of revolution $x=f(u)\cos v, y=f(u)\sin v, z=\varphi(u)$ (5mks)

f) Find the curvature of the helix $\vec{r}(t)=a\cos\omega t\hat{i}+a\sin\omega t\hat{j}+bt\hat{k}$ (5mks)

**TIME:**2HOURS

**DATE:**24Nov2017

**Instructions to Candidates**
You should have the following for this examination
-*Answer Booklet, examination pass and student ID*
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
**Do not write on the question paper.**

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**Question ONE (30 MARKS)**

a) Solve for x in the following equations

   i) $3^x = 81$ (2 marks)

   ii) $5^x = 4$ (3 marks)

   iii) $\log_x 3 + \log_x 27 = 2$ (4 marks)

b) Find the value of k if $x^2 + 8x + k$ is a perfect square (4 marks)

c) Express $-5 + 5i$ in polar form (4 marks)

d) A committee of 5 people is to be chosen from a group of 6 men and 4 women. How many committees are possible if there are restrictions (4 marks)

e) Find the sum of the first 10 terms in the following series

   i) 5 + 9 + 13 + … (4 marks)

   ii) $12 + 4 + \frac{4}{3} + \ldots$ (5 marks)

**Question TWO (20 MARKS)**

a) Given $\frac{2}{3\sqrt{3} - 2\sqrt{2}} + \frac{1}{3\sqrt{3} + 2\sqrt{2}} = a\sqrt{b + c\sqrt{d}}$ where a, b, c, d are constants. Determine the values a, b, c, d

(5 marks)

b) Show that $\log_a b = \frac{1}{\log_b a}$, hence evaluate $\log_5 80$ (5 marks)

c) Solve the following equations using the method indicated in brackets.

   i) $2x^2 + 14x + 9 = 0$ (Completing the square) (5 marks)

   ii) $2x^2 + x - 12 = 0$ (Quadratic formula) (5 marks)

**Question THREE (20 MARKS)**

a) Find the values of a and b if $ax^4 + bx^3 - 8x^2 + 6x - 6$ has a remainder of 2x + 1 when divided by $x^2 - 1$ (8 marks)

b) Show that $2x^3 + x^2 - 13x + 6$ is divisible by x – 2, and find the other factors of the expression (8 marks)

c) Given $a_n = f(n) = \frac{n-2}{3}$, Find the first five terms of the finite sequence (4 marks)

**Question FOUR (20 MARKS)**

a) Draw the graph of $y = x^3 - 3x^2 + 5x - 5$ for $-3 \leq x \leq 5$ and use your graph to solve:

   i) $x^3 - 3x^2 + 5x - 5 = 0$ (5 marks)

   ii) $x^3 - 3x^2 + 2x - 9 = 0$ (5 marks)

b) Solve for x given that $\log_2 5(x) - \log_4 2x = 3$ (8 marks)

c) Find C(7, 3) (2 marks)

**Question FIVE (20 MARKS**)

a) Find the sixth term in the expression $(2a + b)^9$ (3 marks)

b) Show that $2^n \leq 2^{n+1} \leq 2^{n-1} - 1$ (8 marks)

c) Determine the modulus and argument of $\mathbb{Z} = 2 + 2\sqrt{3i}$ and express $\mathbb{Z}$ in polar form (4 marks)

d) Perform the indicated division leaving your answer as a complex number (5 marks)

$$\frac{1 + \sqrt{-4}}{3 - \sqrt{-9}}$$