MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING AND MECHANICAL ENGINEERING

ECU 0100: ALGEBRA (MATHS I)

DATE: 5/12/2017 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

Answer question One (Compulsory) and any other TWO questions

1. a) Simplify the following expressions

i) $$\frac{\sqrt{ab} \times a^{1/3} \times 2b^{1/4}}{(a^{10}b^{9})^{1/12}}$$

ii) $$\frac{(2-3j)\ (3+2j)}{(4-3j)}$$ (8 marks)

b) Given that $\log 4 + 2 \log x = 2$, find x (4 marks)

c) Solve the following simultaneous equations

i) $x + y = 17$

$x/5 – y/7 = 1$

ii) $2x – 5y – 3z = 14$

$5x + 3y – 2z = 4$

$3x + 2y + 5z = 2$ (13 marks)

d) The second term of a geometrical progression is 2 and the 5^{th} term is 128. Calculate the first term and the common ratio.

QUESTION TWO (20 MARKS)

a) Solve for x

i) $\text{Log}_2 (x^2 – 8x + 1) = 0$

ii) $e^{2x} – 2e^x – 15 = 0$

iii) $2x^2 + 8x + 9 = 0$ (13 marks)

b) i) Find the middle term in the expansion of $(2x +3)^{10}$ and the value of this term when $x = 1/12$

ii) Simply $(\sqrt{3} + \sqrt{2})^4 – (\sqrt{3} - \sqrt{2})^4$ (7 marks)

QUESTION THREE (30 MARKS)

a) Find the remainder when $4x^3 + 6x^2 + 3x + 2$ is divided by $2x + 3$ (3 marks)

b) Show that $2x^3 + 11x^2 + 17x + 6$ is divisible by $x + 2$ and find the factors of the expression. (7 marks)

c) i) Evaluate

${}^{11}P_4$ and ${}^{10}C_9$

ii) Proof that ${}^{n+1}C_1 - {}^{n}C_1 = 1$

iii) In how many arrangements can be made with letters in THIRTIETH *(10 marks)*

QUESTION FOUR (20 MARKS)

a) Water fills a tank at a rate of 150 litres during the first hour, 350 litres during the second hour, 550 litres during the third hour and so on. Find the number of hours necessary to fill a rectangular tank 16m by 7 m by 7m *(8 marks)*

b) Simplify

i) $\dfrac{\text{Cos } 4x + j \text{ Sin } 4x}{\text{Cos } x + j \text{ Sin } x}$

ii) $(p - j2p)(p + j2q)$ *(5 marks)*

c) Find the polar form of the complex number $(4 - j3)$ and illustrate in a diagram. *(7 marks)*

QUESTION FIVE (20 MARKS)

a) Evaluate

i) $\dfrac{(3^2)^{3/2} \times (8^{1/3})^2}{(4^3)^{1/2} \times 9^{-1/2} \times 3^3}$ *(5 marks)*

ii) $\dfrac{4 \times 6! - 12 \times 5!}{3 \times 5!} \mp \dfrac{9!}{8 \times 7!}$ *(5 marks)*

b) If $z = 4(\text{Cos } 20^o + j \sin 20^o)$, find z^3 in polar form (3 marks)

c) Write down the first four terms of the expansion $(3 + \frac{1}{4}x)^{11}$. Hence find the value f $(3.025)^{11}$, correct to the nearest whole number. (7 marks)