MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 110: MATHEMATICS FOUNDATION FOR COMPUTER SCIENCE

DATE: 18/12/2017 **TIME: 8:30 – 10:30 AM**

INSTRUCTION: (COMPULSORY)
QUESTION ONE (30 MARKS)

a) Evaluate $\dfrac{\sqrt{7}-\sqrt{3}}{\sqrt{7}+\sqrt{3}}$ (3 marks)

b) Define the following terms in relation to functions
   i) Injunctive function (2 marks)
   ii) Surjective function (2 marks)
   iii) Bijective function (2 marks)

c) Determine the inverse for the function $f : x \to \dfrac{4x+5}{7x-7}; x \neq 1$ (4 marks)

d) If $f : \Re \to \Re$ and $g : \Re \to \Re$ defined by $f : x \to 2x+1$ and $g : x \to x-3$ respectively. Determine
   i) $f \circ g$ (2 marks)
   ii) $f^{-1} \circ g^{-1}$ (4 marks)

e) State the Remainder theorem (2 marks)

f) State the Binomial theorem (2 marks)

g) Find the value of $\sin 2\theta$ and $\cos 2\theta$ given that $\sin\theta = \dfrac{7}{25}$ and $\cos\theta = \dfrac{3}{5}$ where θ is an acute angle. (5 marks)

h) Find the modulus of the complex number $z = 4i$ (2marks)

QUESTION TWO (20 MARKS)

a) Prove that $\sqrt{3}$ is irrational (4 marks)

b) State the De moivres theorem (2 marks)

c) In how many ways can 4 boys and 2 girls be seated in a row if the girls must not be separated? (3 marks)

d) Using the double angle formula, evaluate $\sin 120^\circ$ (3 marks)

e) Express the following complex number $z = -4 + \sqrt{3}i$ in polar form (3 marks)

f) A polynomial has a remainder 9 when divided by $x - 3$ and a remainder -5 when divided by $2x + 1$. Find the remainder when $f(x)$ is divided by $(x - 3)(2x + 1)$ (5 marks)

QUESTION THREE (20MARKS)

a) Determine whether the following functions are odd, even or neither

i) $f(x) = x^5 + 1$

ii) $f : x \rightarrow 4x^2 - 3$

iii) $f(x) = \frac{1}{x}; x \in \Re^+$ (6 marks)

b) Given that $z = -2 + 5i$, represent it in a well labelled Argand diagram. (4 marks)

c) State the Factor theorem and hence apply it to $x^2 + 2x + 1 \div x + 1$ (6 marks)

d) Determine the domain and range for the function

i) $f(x) = \dfrac{1}{x^2 + 2x + 1}$ (2 marks)

ii) $g(x) = \sqrt{x - 5}$ (2 marks)

QUESTION FOUR (20MARKS)

a) Distinguish between monotone increasing and decreasing function (4 marks)

b) Express the following in partial fraction $\dfrac{3x^2 - 8x - 63}{x^2 - 3x - 10}$ (5 marks)

c) Express the complex number $z = x + iy$ in polar form (3 marks)

d) State atleast 3 laws of logarithms. (3 marks)

e) Apply the remainder theorem to determine the remainder in each case

i) $(5x^3 - 4x^2 - 3x + 6) \div (x - 2)$

ii) $(x^3 + 3x^2 - 13x - 10) \div (x + 5)$ (5 marks)

QUESTION FIVE (20MARKS)

a) Prove that $\sin 2\theta = 2\sin\theta\cos\theta$ (5 marks)

b) Find the value of c and d if $cx^4 + dx^3 - 8x^2 + 6$ has a remainder $2x+1$ when divided by $x^2 - 1$. (5 marks)

c) Split the following in to partial fractions $f(x) = \dfrac{x+1}{x^2 + 2x + 1}$ (5 marks)

d) Verify the trigonometric identity $\sin\theta + \sin\phi = 2\sin\dfrac{\theta+\phi}{2}\cos\dfrac{\theta-\phi}{2}$ (5 marks)