MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE AND IT)

SCO 110: MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

SIT 190: FOUNDATIONS OF MATHEMATICS FOR IT

DATE: 29/8/2022 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

Answer question one (**compulsory**) and any other **two** questions

QUESTION ONE (30 MARKS)

a) Using remainder theorem solve the equation $2x^3 - x^2 - 7x + 6 = 0$ (3 marks)

b) Resolve the partial fraction $\frac{4(x-4)}{x^2-2x-3}$ (3 marks)

c) Evaluate $24 + e^{2x} = 45$ (3 marks)

d) Evaluate $x^2 - 6x + 10 + 0$ and express the solution in the Argand diagram. (3 marks)

e) Consider the mapping $f: x \to x^2 + 2$. Show that the mapping is a function in the domain $D = \{-2, -1, 0, 1, 2\}$ (3 marks)

f) Solve for θ given that $\tan\theta = 2\sin\theta$ for $0^0 \leq \theta \leq 360^0$ (3 marks)

g) Evaluate $\cos 6x + \cos 4x + \cos 2x = 0$ for $0^0 \leq x \leq 180^0$ (3 marks)

h) Consider a mobile number 0720377822. Determine the number of permutations of the digits of the telephone number. (3 marks)

i) In a panel of 8 people, 3 people are up for selection. Determine the number of ways they can be selected. (2 marks)

j) How many terms of the sequence 1, 4, 7, 10 are needed to give a sum greater than 590 starting from the first term (2 marks)

k) In the binomial expansion of $\left(1+\frac{1}{4}\right)^n$, the second and third terms are equal, find the value of n. (2 marks)

QUESTION TWO (20 MARKS)

a) Using the power series of e^x evaluate $x^{\frac{1}{2}}(2e^{x^2})$ (6 marks)

b) Resolve the partial fraction (6 marks)

$$\frac{3(2x^2-8x-1)}{(x+4)(x+1)(2x-1)}$$

c) Find the number of terms of the series $1+3+9+27+\cdots$ that must be taken so that the sum exceeds 1.40×10^5. (4 marks)

d) Using the general binomial theorem expand $(1+x)^{\frac{1}{2}}$ (4 marks)

QUESTION THREE (20 MARKS)

a) Find the inverse of the f : $x\to\sqrt{\frac{1+x}{1-x}}$; $-1<x<1$ (5 marks)

b) Consider the complex numbers $Z_1=1-3i$ and $Z_2=-2+5i$. Evaluate,

$$\frac{Z_1Z_2}{Z_1+Z_2}$$ (5 marks)

c) Show that the terms of the sequence $U_n=2(4^n)+1$ are divisible by 3 ∀ n ∈ ℕ. (10 marks)

QUESTION FOUR (20 MARKS)

a) Consider the function $f{:}\,x\to y$ is such that $f{:}\,2\to4$ and $f{:}-1\to-5$. Determine the function $y=f(x)$ and hence find the image of $f(-2)$, under the same mapping. (4 marks)

b) Consider the function $f{:}\,x\to x+2$ and $g{:}\,x\to 2x-3$;

i) $fg(x)$ (2 marks)

ii) $gf(x)$ (2 marks)

iii) The inverse of (i) and (ii) above. (4 marks)

c) A function f is defined such that $f{:}\,x\to2-\frac{1}{x+3}$. Given that $g(x)=f^{-1}$and

$g^2(x)=\frac{ax+b}{cx+d}$ Determine the values of a, b, c and d. (8 marks)

QUESTION FIVE (20 MARKS)

a) Given that $x=a\sin\theta$ and $y=b\tan\theta$, show that $\left(\frac{a}{x}\right)^2-\left(\frac{b}{y}\right)^2=1$ (8 marks)

b) Show that $\tan 3A=\frac{3\tan A-tan^3A}{1-3tan^2A}$ (8 marks)

c) Determine the number of ways in which the letters of the word TOKYO can be arranged;

(i) If the zeros must always come together. (2 marks)

(ii) If the zeros must not come together. (2 marks)