MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR SPECIAL /SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SCO 110/SIT 190: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

DATE: 24/3/2021 **TIME: 8.30-10.30 AM**

INSTRUCTIONS TO CANDIDATES

Answer questions ONE and ANY TWO Questions

QUESTION ONE (30 MARKS) (COMPULSORY)

a) Four men and their wives sit on the bench. In how many ways can they be arranged if

i) There is no restriction (2 marks)

ii) Each man must sit next to his wife. (3 marks)

b) Determine $\log_2(8\times 32)$ (3 marks)

c) Simplify $\frac{16!}{9!7!}+\frac{16!}{10!6!}+\frac{16!}{11!5!}$ (3 marks)

d) Use binomial theorem to determine $(9.9)^9$ to the nearest whole number (3 marks)

e) Find without using tables, calculator, exact values of $\sin 60^o$, $\cos 60^o$, $\sin 30^o$ and $\cos 30^o$. (4 marks)

f) Rationalize the denominator in

$$\frac{\sqrt[3]{3}}{\sqrt[3]{9}+\sqrt[3]{7}}$$ (4 marks)

g) If $z_1=\left[2,45^o\right]$ by $z_2=\left[3,15^o\right]$. Find the product z_1z_2 (4 marks)

h) Sketch the graph of $y=4+3\sin 2\left(x-\pi/4\right)$ (4 marks)

QUESTION TWO (20 MARKS)

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

b) Let $p(x) = 3x^3 - 5x^2 + 3x - 10$

i. Find $p(-2)$ (3 marks)

ii. Divide $p(x)$ by $x+2$ (5 marks)

c) Expand $(1-5x)^{1/3}$ in ascending powers of x up to and including the term in x^4. State the range of values of x for which the expansion is valid. Use the expansion to obtain $\sqrt[3]{0.95}$ correct to 4dp. (5 marks)

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

QUESTION THREE (20 MARKS)

a) Determine the number of ways in which the letters of the word STATISTICS can be arranged in a row. (3 marks)

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

c) If the quadratic equation $x^2 - px + q = 0$ has roots α and β, form the equation whose roots are α/β^2 and β/α^2 (6 marks)

d) Solve for all x in the equation $\sin x + \sqrt{2} = -\sin x$ (7 marks)

QUESTION FOUR (20 MARKS)

a) Divide the complex number $5+2i$ by $4-2i$ (3 marks)

b) In how many ways can four students be chosen from eight students and in how many of those ways will a particular student be included? (3 marks)

c) Prove that the square of an even integer is even and the square of an odd integer is odd. (4 marks)

d) Find the value of $\sin 2\theta$ and $\cos 2\theta$ given that $\sin\theta = \frac{7}{25}$ and $\cos\theta = \frac{3}{5}$ where θ is an acute angle. (4 marks)

e) By using DeMoivre's theorem show that $\tan\theta = \frac{2\tan\theta}{1-\tan^2\theta}$ (6 marks)

QUESTION FIVE (20 MARKS)

a) If one root of equation $ax^2 + bx + c = 0$ is three times the other, $3b^2 = 16ac$ (4 marks)

b) Prove that $\sin 2\theta = 2\sin\theta\cos\theta$ (4 marks)

c) Determine whether $x+2$ is a factor of the polynomial $p(x) = x^4 - 7x^2 - 6x$. if so, find the other factors by long division. (5 marks)

d) Find z if $z^3 = \left[8, \frac{2}{3}\pi\right]$ (7 marks)