MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECU 105: ENGINEERING MATHEMATICS II

DATE: 15/3/2022 **TIME: 8.30-10.30 AM**

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Simplify $\dfrac{x^{\frac{2}{3}} \times y^{\frac{-1}{3}}}{\left(x^4 y^2\right)^{\frac{-1}{6}}}$ (2 marks)

b) Find $\dfrac{x^4+2}{x^2+x+1}$ (4 marks)

c) Find the value of $\sin(120+45)$ (4 marks)

d) Find n given

$^{n}p_4 = 42\left(^{n}P_2\right)$ (4 marks)

e) Prove that $2ch^2\theta - 1 \equiv ch2\theta$ (4 marks)

f) Determine the value of $(3.039)^4$ correct to 6 significant figures (4 marks)

g) Find the modulus and the argument of $\dfrac{7-i}{3-4i}$ (4 marks)

h) Find without using tables or a calculator the value of x given that

$x = \dfrac{\log 75 + \log 9 + \log 5}{\log 5 + \log 45}$ (4 marks)

QUESTION TWO (20 MARKS)

a) Rationalize the denominator of $\frac{\sqrt{2}+2\sqrt{5}}{\sqrt{5-\sqrt{2}}}$ (3 marks)

b) Simplify $\frac{2\sin^2 x+\sin x-3}{1-\cos^2 x-\sin x}$ (3 marks)

c) Determine the sixth term of $\left(3p+\frac{q}{3}\right)^{13}$ (3 marks)

d) Evaluate $\frac{\log 25-\log 125+\frac{1}{2}\log 625}{3\log 5}$ (3 marks)

e) The equation $3x^2-5x+1=0$ has roots α, and β. Find the value of $\frac{\alpha^2}{\beta}+\frac{\beta^2}{\alpha}$ (4 marks)

QUESTION THREE (20 MARKS)

a) Determine the middle term of $(2a-5b)^8$ (4 marks)

b) Solve the equation $\cos 2x=\cos x$ (4 marks)

c) Find the number of integers between 1000 and 4000, which can be formed using the digits 1, 2, 3, and 4.

i. If each digit may be used only once (2 marks)

ii. If each digit may be used more than once (2 marks)

d) When the expression x^5+4x^2+ax+b is divided by (x^2-1) the remainder is $2x+3$. Find the values a and b (4 marks)

e) Prove that $chAchB-shAshB\equiv ch(A-B)$ (4 marks)

QUESTION FOUR (20 MARKS)

a) Show that $ch^2x-sh^2x=1$ (3 marks)

b) Solve the equation $4^{x+1}+15(4^{-x})-16=0$ (5 marks)

c) Solve triangle ABC A triangle ABC has sides $a=9.0cm$, $b=7.5cm$, and $c=6.5cm$. (6 marks)

d) How many odd numbers greater than 60,000 can be formed from the digits 5,6,7,8,9,0 if no number contains any digit more than once (6 marks)

QUESTION FIVE (20 MARKS)

a) Show that $\frac{\cos 6x + \cos 2x}{\sin 6x + \sin 2x} = \cot 4x$ (4 marks)

b) Solve for $\log_3 x - 4\log_x 3 + 3 = 0$ (5 marks)

c) Find in factor form the coefficient of x in the expansion of $\left(2x^2 - \frac{1}{x}\right)^{50}$ (5 marks)

d) Evaluate $4\angle 30^0 + 3\angle -60^0 - 5\angle -135^0$ (6 marks)