MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

ECU 105: ENGINEERING MATHEMATICS II

University Supplementary Examinations

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) Find [2 Mks]

$\log_8 \frac{1}{64}$

b) Write down the modulus of the complex number $4-4i$ expressing the answer in simplest radical form [2 Mks]

c) Solve each quadratic inequality, and graph the solution on a number line [4 Mks]

$2x^2 \leq 5x-2$

d) Solve the following quadratic equation by using factorization method [4 Mks]

$6x^2-5x=4$

e) Solve the equation $\log_2 x^2 = 4+\log_2(x-3)$ [4 Mks]

f) Evaluate $\sqrt{28}-\sqrt{175}+\sqrt{112}$ [3 Mks]

g) A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has [5 Mks]

i. no girls

ii. at least one boy and one girl

h) The polynomial $f(x)$ is defined by $f(x)=x^4+4x^2+3x-7$. By using remainder theorem find the remainder when $f(x)$ is divided by $(x+3)$ [3 Mks]

i) If $\tan\theta = \frac{-4}{3}$, find $\sin\theta$ if θ is in the second quadrant [3 Mks]

SECTION B: ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) Simplify $2\log_3 5 - \log_3 10 + 3\log_3 4$ [3 Mks]

b) Solve the following equations by completing the square [4 Mks]
$3x^2 = 15 - 4x$

c) How many distinguishable horizontal arrangements are there of the letters in the word **MISSISSIPPI**? [3 Mks]

d) Find the full binomial expansion of $(1+2x)^5$, giving each coefficient as an integer. Hence using a suitable substitution approximate $(1.02)^5$ correct to 5 S.F [6 Mks]

e) Simplify the following, leaving your answer in the form $a+bi$ [4 Mks]

$$\frac{3+2i}{4-i}$$

QUESTION THREE (20 MARKS)

a) Rationalize the denominator of the following [3 Mks]

$$\frac{\sqrt{7}}{2\sqrt{3}-\sqrt{2}}$$

b) Solve the equation [5 Mks]

$$3^{2x+1} + 9 = 3^{x+3} + 3^x$$

c) The cubic polynomial $f(x)$ is defined by $f(x) = 4x^3 - 7x - 3$

i) By using remainder theorem find the remainder when $f(x)$ is divided by $(x-2)$ [2 Mks]

ii) Show that $(2x+1)$ is a factor of $f(x)$ and hence factorize $f(x)$ completely. [6 Mks]

d) Prove that $\dfrac{\sin 4A + \sin 2A}{\cos 4A + \cos 2A} = \tan 3A$ [4 Mks]

QUESTION FOUR (20 MARKS)

a) Convert $\frac{7\pi}{6}$ to degrees [1 Mk]

b) Express the following as a sum or difference $\sin 40^\circ \sin 30^\circ$ [4 Mks]

c) Find the exact value of $\cos 75^\circ$ [3 Mks]

d) Express:

i) $2\sinh x + 3\cosh x$ in terms of e^x and e^{-x}. [4 Mks]

ii) $\frac{7e^x}{\left(e^x - e^{-x}\right)}$ in terms of $\sinh x$ and $\cosh x$, and then in terms of $\coth x$ [5 Mks]

e) Calculate $\left\{2\left(\cos\frac{\pi}{5} + i\sin\frac{\pi}{5}\right)\right\}^5$ [3 Mks]

QUESTION FOUR (20 MARKS)

a) Solve the equation $12\cos^2\theta + \sin\theta = 11$ on the domain $0^\circ \leq \theta \leq 360^\circ$ [7 Mks]

b) Simplify the following trigonometric expressions [4 Mks]

$$\frac{2\sin^2\theta + \sin\theta - 3}{1 - \cos^2\theta - \sin\theta}$$

c) Find the conjugate, modulus and argument it $z = 5 + 3i$ [5 Mks]

d) Find angle A, angle B and length a if triangle ABC is given as C=40°, b=23cm and c=19cm

[4 Mks]