



# MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR  
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING  
BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING  
BACHELOR OF SCIENCE IN CIVIL ENGINEERING  
ECU 105: ENGINEERING MATHEMATICS II

DATE: 11/12/2017

TIME: 8.30-10.30 AM

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INSTRUCTIONS: answer question one and any other two questions.

## QUESTION ONE 30 MARKS

- a) Simplify  $\frac{x^{\frac{2}{3}} \times y^{\frac{-1}{3}}}{(x^4 y^2)^{\frac{-1}{6}}}$  (3 marks)
- b) Solve the inequality  $|1 + 2t| \leq 5$  (3 marks)
- c) Find  $\frac{x^4 + 2}{x^2 + x + 1}$  (3 marks)
- d) Find the value of  $\sin(120 + 45)$  (4 marks)
- e) Find  $n$  given  
 ${}^n P_4 = 42({}^n P_2)$  (4 marks)
- f) Prove that  $2ch^2\theta - 1 \equiv ch2\theta$  (4 marks)
- g) Determine the value of  $(3.039)^4$  correct to 6 significant figures (4 marks)
- h) Find the modulus and the argument of  $\frac{7 - i}{3 - 4i}$  (5 marks)

**QUESTION TWO (20 MARKS)**

- a) Rationalize the denominator of  $\frac{\sqrt{2} + 2\sqrt{5}}{\sqrt{5} - \sqrt{2}}$  (3 marks)
- b) Simplify  $\frac{2\sin^2 x + \sin x - 3}{1 - \cos^2 x - \sin x}$  (4 marks)
- c) Determine the sixth term of  $\left(3p + \frac{q}{3}\right)^{13}$  (4 marks)
- d) Evaluate  $\frac{\log 25 - \log 125 + \frac{1}{2} \log 625}{3 \log 5}$  (4 marks)
- e) The equation  $3x^2 - 5x + 1 = 0$  has roots  $\alpha$ , and  $\beta$ . Find the value of  $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$  (5 marks)

**QUESTION THREE (20 MARKS)**

- a) Simplify  $\frac{35!}{16!19!} + \frac{3 \times 35!}{17!18!}$  (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 the inequality  $t^2 - 2t - 8 < 0$  (5 marks)
- c) Find in factor form the coefficient of  $x$  in the expansion of  $\left(2x^2 - \frac{1}{x}\right)^{50}$  (5marks)
- d) Evaluate  $4\angle 30^\circ + 3\angle -60^\circ - 5\angle -135^\circ$  (6 marks)