



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR SECOND SEMESTER SUPPLEMENTARY/SPECIAL EXAMINATION

FOR

BACHELOR OF ELECTRICAL AND ELECTRONICS ENGINEERING

MECHANICAL ENGINEERING

CIVIL AND BUILDING ENGINEERING

ECU 105: ENGINEERING MATHEMATICS II

DATE:

TIME: 2 HOURS

Attempt *question one (compulsory)* and *any other two* questions.

QUESTION ONE (30 MARKS)

- a) A committee of 6 people is to be selected from 4 women and 7 men. In how many ways:
- i) Can the committee be selected? (2 marks)
 - ii) Can the committee be selected if three men must be in the committee? (3 marks)
- b) Solve for x , $3^{2x} - 1 = 0.07$ (5 marks)
- c) If $\log_3(2x + 3) = \log_3 4 + 3$ solve for x (5 marks)
- d) The first term of a G.P. is 5, and the common ratio is -3, which term is equal to -135 (5 marks)
- e) Simplify $\frac{1}{\sqrt{x^2 - a^2}}$ when $x = a \operatorname{cosec} \theta$ (5 marks)
- f) Solve the equation $1 + \cos \theta = 2 \sin^2 \theta$, for the values of θ from 0° to 360° (5 marks)
- g) Sketch the graph of $y = 3 \sin 2(x - \frac{\pi}{4})$ for $0 \leq x \leq 2\pi$. Find its wavelength and amplitude. (5 marks)

QUESTION TWO (20 MARKS)

- a) Differentiate $f(t) = \frac{e^t}{\sin t}$ (3 marks)
- b) Simplify $\frac{16!}{9!7!} + \frac{16!}{10!6!} + \frac{16!}{11!5!}$ (3 marks)
- c) Determine the value of x for which the following form an AP.
 $8 - 6x, 2x^2 - 2, 18x - 20$ (3 marks)
- d) Rationalize the denominator of the following surd $\frac{1}{\sqrt{5+2\sqrt{6}}}$ (3 marks)
- e) How many possible sets of 12 glass pearls can be formed if there are 5 possible colors? (3 marks)
- f) Find all complex cube roots of $27i$ (5 marks)

QUESTION THREE (20 MARKS)

- a) Solve the equation $2^{2x+3} + 2^{x+3} = 1 + 2^x$ (4 marks)
- b) Show using the modulus-argument representation that $z\bar{z}$ is real (6 marks)
- c) A 3 hour river cruise goes 15 km upstream and then back again. The river has a current of 2 km a in hour. What is the boat's speed and how long was the upstream journey? (10 marks)

QUESTION FOUR (20 MARKS)

- a) A phone company charges \$50 a month and 2 cents a minute for each minute used over 400 minutes. Angela's cell phone bill is \$54.92. How many minutes did she use? (3 marks)
- b) Given that $\log_{10}4 + 2 \log_{10}p = 2$, calculate the value of p without using tables or calculator. (4 marks)
- c) Prove that $\frac{1}{1-\sin x} - \frac{1}{1+\sin x} = 2\tan x \sec x$ (6 marks)
- d) The line joining the top of a hill to the foot of the hill makes an angle of 30° with the horizontal through the foot of the hill. There is one temple at the top of the hill and a guest house half away from the foot to the hill. The top of the temple and top of the guesthouse both make an elevation of 32° at the foot of the hill. If the guest house is 1 km away from the foot of the hill along the hill, find the heights of the guest house and the temple. (7 marks)

QUESTION FIVE (20 MARKS)

- a) Without using tables, evaluate $\log_{10} \frac{41}{35} + \log_{10} 70 - \log_{10} \frac{41}{2} + 2\log_{10} 5$ (5 marks)
- b) Let $z = 1 - i$ find z^{10} (7 marks)
- c) Prove that $\cos 5\theta = 16\cos^5 \theta - 20\cos^3 \theta + 5\cos \theta$ (8 marks)