



MERU UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY

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University Examinations 2012/2013

SECOND YEAR, FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF SCIENCE
IN INFORMATION TECHNOLOGY

SMA 2104: MATHEMATICS FOR SCIENCES

DATE: AUGUST 2012

TIME: 2 HOURS

INSTRUCTIONS: Answer question *one* and any other *two* questions

QUESTION ONE (30 MARKS)

- a) i) Simplify the following express in the form $\sqrt{p/q}$ where p and q are integers. $\frac{\sqrt{180}-\sqrt{80}}{\sqrt{3125}}$ (4 Marks)
- ii) given that $\sqrt{2} = 1.4142$ correct to 4 decimal places find without using mathematical tables or a calculator the value of $(\sqrt{3} + \sqrt{2})^3 - (\sqrt{3} - \sqrt{2})^3$. (5 Marks)
- b) solve without using mathematical tables or a calculator
- $2^x = 32$
 - $2^x = 10$ and give your answer correct to 3 decimal places.
 - Hence find the possible values of x which satisfy $2^{2x} - 42(2^x) + 320 = 0$. (6 Marks)
- c) In how many ways can be the letters of the word SIMMERS be arranged in a row? (4 Marks)
- d) A car has an initial value of Ksh. 5 million. The rate of depreciation is 15% per annum. After how long will a willing buyer buy the car at Ksh. 2 million? (3 Marks)
- e) Evaluate without using a mathematical tables or a calculator $\frac{\sec^2 150(1-\cos 300^\circ)}{(1+\tan^2 210)(1+\sin 330^\circ)}$. (4 Marks)
- f) A bag contains 6 blue balls, 4 red balls and 3 green balls. 3 balls are picked at random from the bag without replacement. What is the probability that
- All the balls are of different colours. (4 Marks)
 - All the three balls are of the same colours

QUESTION TWO (20 MARKS)

- a) Show that the sum of the first n -terms of the series $\log p + \log 2p + \log 4p + \log 8p \dots$ is $\log \left[p^n 2^{\frac{n(n-1)}{2}} \right]$ (5 Marks)
- b) A geometric progression has the third term as 81 and the sixth term as 3. Determine
- The first term
 - The common ratio
 - The sum of the first ten terms. (6 Marks)
- c) Simplify without using mathematical tables or a calculator the following expression (take positive roots only)
- $\frac{(3^2)^{3/2} \times (8^{1/3})^2}{3^2 \times (4^3)^{1/2} \times 9^{-1/2}}$
 - $\log 64 - \log 128 + \log 32$. (4 Marks)
- d) A polynomial $f(x)$ has a remainder 9 when divided by $x - 3$ and a remainder -5 when divided by $2x + 1$. Find the remainder when $f(x)$ is divided by $(x - 3)(2x + 1)$. (5 Marks)

QUESTION THREE (20 MARKS)

- a) Find the roots of the following polynomial equation $x^4 - 9x^2 + 8 = 0$. (4 Marks)
- b) Determine the values of K for which the equation $4x^2 - 2kx + (2k - 3) = 0$ has
- Equal roots
 - Real roots (6 Marks)
- c) How many car registration numbers can be given from KAA OO1A to KZZ 999Z inclusive assuming that the letters I and O are not included in any of the registration numbers? (4 Marks)
- d) How many odd numbers greater than 5000 can be formed from the digits 2,5,7,9,8 if each digit can be used only once? (6 Marks)

QUESTION FOUR (20 MARKS)

- a) i) Use binomial theorem to show that if x^4 and higher powers of terms of x are neglected $(1 + 2x - x^2)^{\frac{1}{2}} \cong 1 + x - x^2 + x^3$ for small x .
- ii) Putting $x = 0.1$ in your expression or otherwise, estimate $\sqrt{1.19}$ correct to 3 decimal places. (6 Marks)
- b) If $\cos \theta = \frac{15}{17}$ and hence $\tan \theta < 0$, find the value of $\sin \theta$ without using mathematical tables or a calculator. (4 Marks)
- c) Using sine and cosine rule show that for any triangle ABC $\sin^2 A = \sin^2 B + \sin^2 C + 2 \sin B \sin C \cos(B + C)$. (6 Marks)
- d) Sketch the graph of $y = \tan \theta$ on $\left[\frac{-3\pi}{2}, \frac{5\pi}{2} \right]$ (4 Marks)

QUESTION FIVE (20 MARKS)

- a) The data below shows time in seconds taken by a group of students to answer a mathematical question 20,25,24,33,13,26,8,19,31,11,16,21,17,11,34,14,15,21,18,37
- i. Construct a frequency distribution table having a class width of 5 seconds for this data.
 - ii. Find the
 - (i) Mean
 - (ii) Median
 - (iii) Mode
 - (iv) Standard deviation. (10 Marks)
- b) A machine is producing a large number of bolts automatically. In a box of these bolts, 95% are within allowable tolerance values respect to diameters, the remainder being outside of the diameter tolerance values. If bolts are drawn at random from the box. Determine the probability that
- i. All are within allowable tolerance
 - ii. 2 are outside of the diameter tolerance values.
 - iii. More than 2 of the seven are outside of the diameter tolerance values. (10 Marks)