



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: 020-2069349, 061-2309217. 064-30320 Cell phone: +254 712524293, +254 789151411

Fax: 064-30321

Website: www.mucst.ac.ke Email: info@mucst.ac.ke

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## University Examinations 2014/2015

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL  
ENGINEERING, DIPLOMA IN ELECTRICAL ENGINEERING, MECHARTONICS  
ENGINEERING

### SMA 0101: ENGINEERING MATHEMATICS I

DATE: DECEMBER 2014

TIME:  $1\frac{1}{2}$  HOURS

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

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#### QUESTION ONE (30 MARKS)

- a) Define the following terms:
- (i) Area (1 mark)
  - (ii) A vector (1 mark)
- b) Solve  $\cos x = 0.3$  for  $0^\circ \leq x \leq 360^\circ$  (3 marks)
- c) Find the cross product  $\vec{u} \times \vec{v}$ , given  $\vec{u} = 2i + j - 3k$  and  $\vec{v} = 4j + 5k$  (3 marks)
- d) Find the area of quadrilateral below (3 marks)

#### DRAWING

- e) Simplify  $3x^4y^4 \div 6xy^4xy^{-6}$  (2 marks)

- f) Solve for  $x$  in  $\log_2^{(2x-3)} + 2\log_2^3 = 4$  (3 marks)
- g) Draw on the grid provided, the functions  $x + y = 6$  and  $2x - 3y = 9$  (4 marks)
- h) Given  $z = 1 - 2i$ , find  $\frac{2}{z}$  (3 marks)
- i) Solve  $x + 1^2 = -9$  (3 marks)
- j) Express  $5 + 2i$  in polar form (4 marks)

### QUESTION TWO (15 MARKS)

- a) Express  $z = -1 + 3i$  in trigonometric form (3 marks)
- b) Draw the graph of  $y = 3 - x - 2x^2$ ,  $-3 \leq x \leq 3$ , hence use your graph to solve the equation  $3 + x - 2x^2$  (7 marks)
- c) Expand  $(x - 2)(x - 3)$  (2 marks)
- d) Find the angle between  $\vec{v} = 2i + 3j + k$  and  $\vec{w} = 4i + j + 2k$  (3 marks)

### QUESTION THREE (15 MARKS)

- a) (i) State the de Moivre's theorem (1 mark)
- (ii) Use de Moivre's theorem to compute  $(1 + i)^{12}$  (4 marks)
- b) Given  $\tan Q = \frac{3}{4}$ , find  $\cos Q$  and  $\sin Q$  (2 marks)
- c) Find the angles of a triangle with sides 3cm, 5cm, and 7cm. (5 marks)
- d) Given  $z = 4 - 2i$  and  $w = 2 + i$ , find  $z w$  (2 marks)

### QUESTION FOUR (15 MARKS)

- a) On the grid provided, draw the graph of  $y = x^2 - 3x - 1$ ,  $-3 \leq x \leq 3$  (5 marks)
- b) Solve for  $x$  in:  $\frac{625^{(x-1)} \times 25^x}{5} = \frac{1}{25}$  (3 marks)

- c) Three towns A, B and C are such that town B is 200km from A on a bearing of  $080^{\circ}$  while C is 180km from B on a bearing of  $240^{\circ}$ . By scale drawing:
- (i) Show the position of the three towns (4 marks)
  - (ii) What is the distance between A and C (2 marks)
  - (iii) What is the bearing of A from C (1 mark)

**QUESTION FIVE (15 MARKS)**

- a) (i) Simplify:  $\log^8 - 2\log^4 + \log^6$  (2 marks)
- (ii)  $4(2x - 3) - 3(x + 1)$  (2 marks)
- b) (i) Define the term complex numbers (1 marks)
- (ii) Given  $\vec{OA} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$  and  $\vec{OB} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$ , find  $\vec{AB}$  (3 marks)
- c) Express  $5 + 2i$  in polar form (3 marks)
- d) (i) Given  $z = 2 - 3i$ , find  $|z|$  (3 marks)
- (ii) Trigometric form of  $z$  (2 marks)