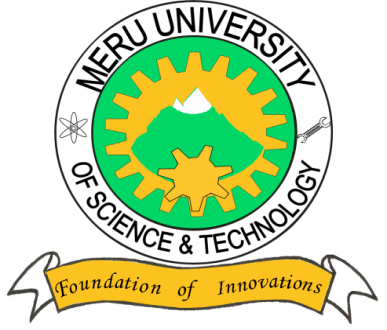
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**University Examinations 2014/2015**

SECONDYEAR, SPECIAL/SUPPLEMENTARY EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN STATISTICS

**SMA 2202: ALGEBRAIC STRUCTURES**

**DATE: JULY 2015 TIME: 2 HOURS**

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

**QUESTION ONE (30 MARKS)**

1. (i) Define an abelian group (2 marks)

(ii) Show that the set of all integers under the binary operation defined by b, is an abelian group (4 marks)

1. Let and find  (3 marks)
2. Prove that  is a cyclic group generated by 1. (4 marks)
3. Given the and prove that  (4 marks)
4. Given that a,b,cand is a group. Prove that  (4 marks)
5. Show that the binary operation over, defined by commutative is but not associative. (4 marks)
6. (i) Show that the set is a commutative ring under addition modulo 8 (3 marks)

(ii) Show that the ring in (i) above is not an integral domain (2 marks)

**QUESTION TWO (20 MARKS)**

1. Let and be two permutations of where and find
2. (5 marks)
3.  (5 marks)
4. List all the symmetries of an equilateral triangle 1

(6 marks)

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1. Let . The binary operation on G is given by the table below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 |
| 1 | 1 | 2 | 3 | 4 |
| 2 | 2 | 4 | 2 | 4 |
| 3 | 3 | 2 | 1 | 4 |
| 4 | 4 | 4 | 4 | 4 |

1. Find the identity element in G (1 mark)
2. Which elements have inverses? (2 marks)
3. Are the inverses unique? (1 mark)

**QUESTION THREE (20 MARKS)**

1. Prove that the set of non-zero integers modulo 6 under is not a group (8 marks)
2. Show that if is a group, then the unique solution of the equation is  (4 marks)
3. Show that is a cyclic group generated by 3 and 2 only (8 marks)

**QUESTION FOUR (20 MARKS)**

1. Given that is a subgroup of the group . Define a left coset of H in G. (3 marks)
2. Show that the left cosets of decomposes into two disjoint sets (6 marks)
3. Prove that the order of each subgroup of a finite group divides the order of the group (7 marks)
4. Consider the binary operation table defined over a set 

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | a | b | c | d |
| a | a | b | c | d |
| b | b | a | c | d |
| c | c | d | c | d |
| d | d | c | c | d |

Determine whatever in the table satisfies:

1. Commutative law (2 marks)
2. Associative law (2 marks)

**QUESTION FIVE (20 MARKS)**

Prove that the set G composed of of the 4 transformations of the set C of complex numbers on itself defined by and is an abelian group with the composite operation i.e where and  (20 marks)