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**University Examinations 2016/2017**

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COM PUTER SECURITY AND FORENSICS, BACHELOR OF SCIENCE.

**SMA 3212: NUMBER THOERY**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

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

**QUESTION ONE (30 MARKS)**

1. Show that if $a,b$ and $c$ are integers with $a/b$, and $b/c$, then $a/c$. (3 marks)
2. (i) State the Euclidean Algorithm. (3 marks)

(ii) Find (20785, 44350) using Euclidean Algorithm. (4 marks)

1. Using Fermat’s factorization method, factorize 8051. (4 marks)
2. For the linear Diophantine equation  either find all solutions or show that there are no integral solution. (4 marks)
3. Show that if $a$ is an even integer, then  and if $a$ is an odd integer, then  (6 marks)
4. State the fermat’s last theorem. (2 marks)
5. Find all the solutions of the system of linear congruence



 (4 marks)

**QUESTION TWO (20 MARKS)**

1. Find all primitive Pythagorean triples $x,y,z$ with  (10 marks)
2. Prove that there are infinitely many prime numbers. (3 marks)
3. (i) Define the Euler’s Phi-function, , where $n$ is a positive integer. (2 marks)

(ii) State the Euler’s theorem (2 marks)

(iii) Solve the linear congruence  using Euler’s theorem. (3 marks)

**QUESTION THREE (20 MARKS)**

1. State and prove the fundamental theorem of arithmetics (8 marks)
2. (i) State the Fermat’s little theorem. (2 marks)

(ii) Using Fermat’s little theorem, find the least positive residue of 21000000 modulo 17. (3 marks)

1. Let m be a positive integer. Show that congruences modulo m satisfy the reflexive, symmetric and transitive properties. (7 marks)

**QUESTION FOUR (20 MARKS)**

1. A postal clerk has only 14-cents and 21-cent stamps to sell. What combinations of these may be used to mail a package requiring postage of exactly sh. 3.50. (10 marks)
2. Find the solutions of the system of linear congruence



 (6 marks)

1. Using Fermat’s little theorem, find all solutions to the linear congruence  (4 marks)