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**University Examinations 2015/2016**

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF PHYSICAL SCIENCE AND BACHELOR OF COMPUTER SCIENCE AND FORENSICS

**SMA 3212: NUMBER THEORY**

**DATE: November, 2015 TIME:** $2$**HOURS**

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

**QUESTION ONE - (30 MARKS)**

1. Given that $a|b$ and a|c and that m and n are integers, show that a|(mb + nc).(3 Marks)
2. Write a in the form a = bq + r, 0$\leq r<\left|b\right|$ given that;
3. a = -17, b = 5 (2 Marks)
4. a = - 39 , b = - 8 (2 Marks)
5. (i) Define a linear diophantine equation. (2 Marks) (ii) State any two possible solutions of the linear Diophantine equation 2x + 3y = 2

(2 Marks)

1. Use the Euclidean algorithm to calculate the greatest common divisor of (381, - 216, 48, 918) (5 Marks)
2. If we define Nk = $P\_{1}P\_{2}…..P\_{k}$ + 1, where Pi are prime numbers in ascending order, write down the first five Nk. (5 Marks)
3. Find the solution to 42x$ ≡$ 50 (mod 91) (3 Marks)
4. (i) State Euler’s theorem in number theory. (2 Marks)

(ii) If n = q, verify Euler’s theorem. (4 Marks)

**QUESTION TWO (20 MARKS)**

1. (i) State the Fermat’s little theorem. (2 Marks)

(ii) Using the theorem in (i) calculate $7^{1015}$(mod 31). (8 Marks)

1. Calculate;
2. The gcd (12, 378,3054) (6 Marks)
3. the lcm $\left[12, 378, 3054\right]$ (4 Marks)

**QUESTION THREE ( 20 MARKS)**

1. Define a residue class, modulo n. (3 Marks)
2. There are five, residue classes, modules. State them. (5 Marks)
3. (i) Define the Euler phi-function $∅(n)$ (2 Marks)

(ii) Determine $∅(3 o)$ and list them. (5 Marks)

1. Find the exponent to which 19 belongs (mod7) (5 Marks)

**QUESTION FOUR (20 MARKS)**

1. Use Euler’s method to solve the Diophantine equation 738 x+621y = 45. (10 Marks)
2. solve 42x $≡$ 50 (mod 76) (5 Marks)
3. List the quadratic residues and quadratic non residues (mod17) (5 Marks)

**QUESTION FIVE (20 MARKS)**

1. Write (136,232) as a sum of multiples of 136 and 232. (6 Marks)
2. Solve 6x $≡$15 (mod 21) (4 Marks)
3. (i) Define a primitive Pythagorean triple. (2 Marks)

(ii) Give three examples of Pythagorean triples. (3 Marks)

1. If m and n are each the sum of two squares, then prove that Mn their product, is also a sum of two squares. (5 Marks)