**King Abdulaziz University**
**Department of Mathematics**

**1st Semester 1439-1440**
**Faculty of Sciences**

# Math 444 Syllabus

## Textbook: Elementary Number Theory with Applications, 2nd Edition
## Authors: Thomas Koshy

| | | Lectures | |
|---|---|---|---|
| **Chapter Title** | **Section Title** | **Subtitle** | **Examples** |
| **Chapter 2**<br>**Divisibility** | **2.1 The Division Algorithm** | • Div and Mod Operators.<br>• The Divisibility Relation.<br>• Union, Intersection, and Complement.<br>• Even and Odd Integers. | **2.1, 2.2, 2.3, 2.4** |
| | **2.5 Prime and Composite Numbers** | • Prime and Composite Numbers.<br>• Primes and Pi.<br>• The Sieve of Eratosthenes.<br>• A Number-Theoretic Function. | **2.22, 2.23, 2.24,** |

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| **Chapter 3**<br><br>**Greatest Common Divisors** | **3.1 Greatest Common Divisor** | • Greatest Common Divisor.<br>• A Symbolic Definition of gcd.<br>• Relatively Prime Integers.<br>• Linear Combination.<br>• An Alternate Definition of gcd.<br>• A Linear Combination of n Positive Integers.<br>• Pairwise Relatively Prime Integers. | **3.1, 3.2, 3.3, 3.4** |
| | **3.2 The Euclidean Algorithm** | • The Euclidean Algorithm. | **3.5, 3.6, 3.7** |
| | **3.3 The Fundamental Theorem of Arithmetic** | • Canonical Decomposition.<br>• Factor Tree. | **3.9, 3.10, 3.11, 3.12** |
| | **3.4 Least Common Multiple** | • Least Common Multiple.<br>• A Symbolic Definition of lcm. | **3.14, 3.15, 3.16** |
| | **3.5 Linear Diophantine Equations** | • Linear Diophantine Equations. | **3.17, 3.18** |
| **Chapter 4**<br><br>**Congruences** | **4.1 Congruences** | • Congruence Modulo m.<br>• Congruence Classes.<br>• A Complete Set of Residues Modulo m.<br>• Modular Exponentiation. | **4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.16, 4.18** |
| | **4.2 Linear Congruences** | • Modular Inverses. | **4.20, 4.21, 4.23, 4.24, 4.25** |

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| **Chapter 5**<br>**Congruence Applications** | **5.1 Divisibility Tests** | • Divisibility Test for 10.<br>• Divisibility Test for 5.<br>• Divisibility Test for $2^i$.<br>• Divisibility Tests for 3 and 9.<br>• Divisibility Test for 11. | |
| **Chapter 6**<br>**Systems of Linear Congruences** | **6.1 The Chinese Remainder Theorem** | • The Chinese Remainder Theorem. | **6.1, 6.2, 6.3** |
| **Chapter 7**<br>**Three Classical Milestones** | **7.1 Wilson's Theorem** | • Factorial, Multifactorial, and Primorial Primes. | **7.1, 7.2** |
| | **7.2 Fermat's Little Theorem** | • An Alternate Proof of Wilson's Theorem. | **7.3, 7.4, 7.5, 7.7, 7.8, 7.9** |
| | **7.4 Euler's Theorem** | • Euler's Phi Function. | **7.15, 7.16, 7.18, 7.19, 7.20, 7.21** |
| **Chapter 8**<br>**Multiplicative Functions** | **8.1 Euler's Phi Function Revisited** | • Multiplicative Function. | **8.1, 8.2, 8.5, 8.6** |
| | **8.2 The Tau and Sigma Functions** | • The Tau Function,<br>• The Sigma Function. | **8.10, 8.11, 8.12, 8.13, 8.14** |
| | **8.3 Perfect Numbers** | • Perfect Number. | |
| | **8.4 Mersenne Primes** | • Mersenne Primes.<br>• A New Mersenne Conjecture.<br>• Number of Digits in $M_p$.<br>• Primality of Mersenne Numbers. | **8.16, 8.17, 8.18** |

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| | **8.5 The Möbius Function** | • **The Möbius Function $\mu$.** | **8.23, 8.24** |
| **Chapter 11**<br>**Quadratic Congruences** | **11.1 Quadratic Residues** | • **Quadratic Residue.** | **11.1, 11.2, 11.3, 11.4** |
| | **11.2 The Legendre Symbol** | • **The Legendre Symbol.**<br>• **Gauss' Lemma.** | **11.5, 11.6, 11.8, 11.9, 11.12, 11.13, 11.14, 11.15** |

# Remarks:

1. Any student who misses 25% of the class will receive DN.

2. Students should solve all assignments in Blackboard: [HW (1) - HW (2) - HW (3)].

3. If one of the students is absent from one of the exams due to an acceptable excuse by the instructor, and then the mark will be calculated as a percentage from the total of the other exams.

4. The requirements to get an IC grade due to being absent from the final exam are: an attendance of at least 80% of the total lectures, attendance of the first and second exams and an acceptable excuse by the Educational Affairs.

# Marks distribution:

| | HW (1) | HW (2) | HW (3) | Take Home Exam | Final Exam (Open Book) | Total |
|---|---|---|---|---|---|---|
| **Time; marks** | **15 marks** | **15 marks** | **15 marks** | **15 marks** | **120 min; 40 marks** | **100** |
| **Curriculum** | **Ch(2+3+4)** | **Ch(5+6+7)** | **Ch(8+11)** | | **ALL** | |