Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER, 2023 - 2024
Course Handout Part II

09-01-2024

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : MATH F231
Course Title: Number Theory
Instructor In-charge: Rohit Gupta

Scope and Objective of the Course:
In this course we cover the basic mathematical notation and methods which include mathematical induction, properties of divisors, prime numbers, integer functions, equations in integers and the applications of some of the concepts. The main objective of this course is to understand the divisibility properties of integers and other related topics as a basis for studying more advanced topics in Number Theory, Modern Algebra, and the number theoretic cryptography algorithms.

1. Text Book:
Thomas Koshy: Elementary Number Theory with Applications, Second Edition, Academic Press, 2007.

2. Reference Books:
(i) Kenneth H. Rosen: Elementary Number Theory and its Applications, Addison – Wesley publishing Company, 1986.
(ii) Neal Koblitz: A Course in Number Theory and Cryptography, 2ndEdition, Springer, 1994.
(iii) Tom M. Apostol: Introduction to Analytic Number theory, Springer, 1976.

3. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	To explain the fundamental properties of integers	Fundamental properties, the summation and product notations, mathematical induction, recursion, the binomial theorem	1.1 – 1.5
2 – 3	To examine the	The division algorithm	2.1

	correctness of a division problem		
4 – 6	To classify the various classes of positive integers	Prime numbers, composite numbers, Fibonacci numbers, Lucas numbers, Fermat numbers	2.5 – 2.7
7	To list the fundamental operations on integers	Greatest common divisor	3.1
8 – 9	To know how to find the greatest common divisor of two numbers having prime factorizations.	The Euclidean algorithm	3.2
10	To know how to factorize any positive integer	The fundamental theorem of arithmetic	3.3
11 – 13	To learn linear Diophantine equations	Least common multiple, linear Diophantine equations	3.4 – 3.5
14-16	To define what is congruence and explain their fundamental properties	congruence, linear congruence	4.1 – 4.2
17 – 22	To explain the four classical mile stone theorems in number theory	Chinese remainder theorem, Wilson's theorem, Fermat's little theorem, Euler's theorem	6.1 – 6.3, 7.1, 7.2, 7.4
23 – 26	To define the multiplicative functions and to explain their properties	Euler's phi function, the tau and sigma functions, the Mobius function	8.1 – 8.2, 8.5
27 – 29	To explain perfect numbers	Perfect numbers, Mersenne primes	8.3 – 8.4
30 – 33	To define the order of an integer and primitive roots	The order of a positive integer, primality tests, primitive roots for primes	10.1 – 10.3
34 – 38	To define quadratic residues and to explain the famous law of quadratic reciprocity	Quadratic residues, the Legendre symbol, quadratic reciprocity, the Jacobi symbol,	11.1 – 11.4
39 – 40	To explain the continued fractions	Finite continued fractions, infinite continued fractions	12.1 – 12.2

4. **Evaluation Scheme:**

EC No.	Evaluation Component	Duration	Weightage (%)	Date	Nature of Component

1.	Quiz-I	To be announced later	10	To be announced later	**Closed Book**
2.	Mid Semester Exam	90 min.	25	12/03 - 9.30 - 11.00AM	**Open Book**
3.	Assignment	To be announced later	10	To be announced later	**Open Book**
4.	Quiz-II	To be announced later	10	To be announced later	**Closed Book**
5.	Comprehensive Exam	180 min.	45	08/05 FN	**Closed Book**

Total marks: 100

5. **Chamber consultation hour:** Will be announced in the class.

6. **Notices:** The notices concerning this course will be displayed in CMS.

7. **Make-up Policy**: Make-up for tests will be given only for very genuine cases and prior permission has to be obtained from Instructor In-charge.

8. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor In-charge

MATH F231