Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER, 2020 - 2021
Course Handout Part II

17-08-2020

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: Debopam Chakraborty

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

3. Course Plan:

Lecture	Learning objectives	Topics to be covered	Chapter in

No.			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 correctness of a division problem	The division algorithm	2.1
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, the Pollard Rho factoring method	4.1 – 4.3
17 – 18	To explain the applications of congruence	Divisibility tests, check digits, round - robin tournaments	5.1 – 5.3, 5.5
19 – 24	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
25 – 28	To define the	Euler's phi function, the tau and	8.1 – 8.2,

	multiplicative functions and to explain their properties	sigma functions, the Mobius function	8.5
29 – 31	To explain perfect numbers	Perfect numbers, Mersenne primes	8.3 – 8.4
32 – 35	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
36 – 40	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
41 – 42	To explain the continued fractions	Finite continued fractions, infinite continued fractions	12.1 – 12.2

4. **Evaluation Scheme:**

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Test – 1	30 minutes	15	September 10 – September 20 (During scheduled class hour)	Open Book
Test – 2	30 minutes	15	October 09 –October 20 (During scheduled class hour)	Open Book
Test – 3	30 minutes	15	November 10 –	Open Book

			November 20 (During scheduled class hour)	
Assignment – 1	-	15		Open Book
Assignment – 2	-	15		Open Book
Comprehensive Examination	120 minutes	25	TBA	Open 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 only.

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