

Department of Mathematics
Indian Institute of Technology Delhi
 MTL 145: NUMBER THEORY

COURSE OUTLINE FOR 2026–27, SEMESTER I

July 24, 2026

• **CONTENTS**

- **Divisibility.** Basic properties and basic results; GCD & LCM, properties and results; Prime numbers, proofs on the infinitude of primes, theorems of Gandhi and Chebyshev, rate of growth of $\pi(x)$
- **Congruences.** Elementary properties, theorems of Fermat–Euler, Wilson & Wolstenholme; Solutions of linear and systems of linear congruences; Chinese Remainder Theorem & Hensel’s Lemma; Solutions of quadratic congruences, Gauss’s Lemma & Quadratic Reciprocity Law; Existence of primitive root.
- **Arithmetical functions.** Study of ϕ , μ , σ_k , λ , Λ ; the group structure of arithmetical functions; Möbius Inversion Formula; Abel’s Summation Formula; average orders of ϕ , μ , d .
- **Theory of Partitions.** Basic definitions, Ferrar’s graphs and consequences; generating functions of partitions and related functions; theorems of Euler & Jacobi; Congruence properties of $p(n)$; Rogers–Ramanujan Identities.
- **Diophantine Approximations.** Simple continued fractions; representations of real numbers by continued fractions, Equivalent numbers; Approximations by convergents; Measure of approximation of real numbers by rationals & Markoff constants; Orders of Approximation; Theorems of Dirichlet & Liouville; Algebraic & Transcendental numbers; transcendence of e and π .
- **Binary Quadratic Forms.** Definite & Indefinite Binary Quadratic Forms; Equivalence of Quadratic Forms; Sums of two and four squares; Reduction of Indefinite Binary Quadratic Forms; The Pell equations; The Class Group.
- **Diophantine Equations.** Review of the linear Diophantine equation; Cases $p = 2$ and $p = 3$ of Fermat’s “Last” Theorem; Rational points on Curves; Elliptic Curves and the Group Law; Theorems of Mordell–Weil, Lutz–Nagell, Mazur, and the “abc” conjecture; the equations $y^2 = x^3 + k$; Waring’s Problem, bounds for $g(k)$ and $G(k)$.

• **REFERENCES**

- Tom M. Apostol, Introduction to Analytic Number Theory, Narosa Publishing House, New Delhi, Third reprint, 1991.
- G. H. Hardy & E. M. Wright, An Introduction to the Theory of Numbers, Oxford University Press, Fourth Edition, 1959.
- Kenneth Ireland & Michael Rosen, A Classical Introduction to Modern Number Theory, Graduate Texts in Mathematics, Springer-Verlag, New York, Second Edition, 1993.
- Ivan Niven, Herbert S. Zuckerman & Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Wiley & Sons, New York, Fifth Edition, 1991.

• **EXAM DATES & SYLLABUS**

	DATES	PROPOSED SYLLABUS
Quiz 1	24 August	Divisibility & Congruences
Minor	12 – 17 September	Divisibility, Congruences, Arithmetical Functions & Partitions
Quiz 2	2 November	Binary Quadratic Forms & Diophantine Approximations
Major	19 – 25 November	Entire Syllabus, with emphasis on portions covered after Minor

- **GRADING POLICY**

Grades will be assigned based on performance in Minor (30%) and Major (40%), and two quizzes (15% each). An 'A' will be assigned for scores of 80% and over. You need 30% to get a 'D' or 'NP' grade.

- **ATTENDANCE & MAKEUP POLICY**

Students are expected to regularly attend classes, although no attendance will be taken. No re-Minor or re-Major will be conducted without valid medical certificate.

- **TUTORIAL POLICY**

There are no regular tutorials in this course, but we will discuss problems at the end of each chapter. Problem sheets may be downloaded from my homepage.

- **INSTRUCTOR & LECTURE SCHEDULE**

NAME	VENUE	E-MAIL
Amitabha Tripathi	LHC 603	atripath@maths.iitd.ac.in

Lectures will be held from 2:00 to 3:30 on Tuesdays & Fridays.

- **WEB PAGE**

All updated information on this course may be found at: web.iitd.ac.in/~atripath.

TUE	FRI	TUE	FRI
	July 24 DIVISIBILITY	Sept 22 BINARY QFs	Sept 25 NO CLASS
July 28 DIVISIBILITY	July 31 DIVISIBILITY	Sept 29 MID-SEMESTER BREAK.	Oct 2 GANDHI JAYANTI
Aug 4 CONGRUENCES	Aug 7 CONGRUENCES	Oct 6 BINARY QFs	Oct 9 BINARY QFs
Aug 11 CONGRUENCES	Aug 14 CONGRUENCES	Oct 13 DIOPHANTINE APP.	Oct 16 DIOPHANTINE APP.
Aug 18 CONGRUENCES	Aug 21 ARITHMETICAL FNS.	Oct 20 DUSSEHRA	Oct 23 DIOPHANTINE APP.
Aug 25 ARITHMETICAL FNS.	Aug 28 ARITHMETICAL FNS.	Oct 27 DIOPHANTINE APP.	Oct 30 DIOPHANTINE APP.
Sept 1 PARTITIONS	Sept 4 JANMASHTAMI	Nov 3 DIOPHANTINE EQNS.	Nov 6 DIOPHANTINE EQNS.
Sept 8 PARTITIONS	Sept 11 PARTITIONS	Nov 10 DIOPHANTINE EQNS.	Nov 13 DIOPHANTINE EQNS.
Sept 15 MINOR EXAM	Sept 18 BUFFER DAY	Nov 17 DIOPHANTINE EQNS.	Nov 21 MAJOR EXAM

- **Thur, Sep 3 works as a Fri: PARTITIONS**

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