# DEPARTMENT OF MATHEMATICS
# CENTRAL UNIVERSITY OF JAMMU

| TEACHING PLAN | |
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| **Course Title: Finite Fields &Coding theory** | **Duration of Examination: 3 hours** |
| **Course Code: MAMT- 303** | **Maximum Marks: 100** |
| **Course Instructor : Dr. Deep Singh** | |
| Lecture 1 | Field extension: Field, prime field and their examples |
| Lecture 2 | Algebraic extension, simple extension of finite fields |
| Tutorial | Assignment/discussion/exercises |
| Lecture 3 | Algebraic element and its Minimal polynomial |
| Lecture 4 | Finite extension, Transitivity of Finite extensions |
| Tutorial | Assignment/discussion/exercises |
| Lecture 5 | Simple algebraic extension, splitting field |
| Lecture 6 | Characterization of finite Fields : Finite field and no. of elements in a finite field |
| Tutorial | Assignment/discussion/exercises |
| Lecture 7 | Existence and uniqueness of finite fields |
| Lecture 8 | Subfield of a finite field and examples |
| Tutorial | Assignment/discussion/exercises |
| Lecture 9 | Roots of an irreducible polynomials over finite fields: nature of roots |
| Lecture 10 | Relation between splitting fields of two irreducible polynomials of same degree |
| Tutorial | Assignment/discussion/exercises |
| Lecture 11 | Automorphism of a finite field |
| Lecture 12 | Trace: Definition and its basic properties |
| Tutorial | Assignment/discussion/exercises |
| Lecture 13 | Relation between trace and linear transformations, transitivity of trace |
| Lecture 14 | Norm: Definition and its basic properties, Transitivity of norm |
| Tutorial | Assignment/discussion/exercises |
| Lecture 15 | Bases: Dual bases, normal basis |
| Lecture 16 | Artin lemma, normal basis theorem |
| Tutorial | Assignment/discussion/exercises |
| Lecture 17 | Roots of unity and cyclotomic polynomials: Cyclotomic field, primitive *n*th root of unity |
| Lecture 18 | Cyclotomic polynomials, Cyclotomic field as simple algebraic extension |
| Tutorial | Assignment/discussion/exercises |
| Lecture 19 | Finite fields as cyclotomic fields |
| Lecture 20 | Representation of elements of finite fields: Some different ways of writing the elements of a finite field |
| Tutorial | Assignment/discussion/exercises |
| Lecture 21 | Irreducible polynomials, Moebius function |
| Lecture 22 | Moebius inversion formula |
| Tutorial | Assignment/discussion/exercises |
| Lecture 23 | Number of monic irreducible polynomials of a given degree over a finite field |

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| Lecture 24 | Product of all monic irreducible polynomials of a given degree over a finite field |
| Tutorial | Assignment/discussion/exercises |
| Lecture 25 | Linear codes: Definition of code and examples |
| Lecture 26 | Coding scheme and decoding scheme |
| Tutorial | Assignment/discussion/exercises |
| Lecture 27 | Linear codes, Hamming distance, Hamming weight and examples |
| Lecture 28 | t-error-correcting codes |
| Tutorial | Assignment/discussion/exercises |
| Lecture 29 | Decoding of linear codes |
| Lecture 30 | Hamming bound, Plotkin bound |
| Tutorial | Assignment/discussion/exercises |
| Lecture 31 | Gilbert-Varshamov bound |
| Lecture 32 | Dual codes: Definition and examples |
| Tutorial | Assignment/discussion/exercises |
| Lecture 33 | Cyclic codes: Definition and examples |
| Lecture 34 | Characterization of cyclic code in terms of an ideal |
| Tutorial | Assignment/discussion/exercises |
| Lecture 35 | Generator polynomial of cyclic code |
| Lecture 36 | Parity-check polynomial of cyclic code |
| Tutorial | Assignment/discussion/exercises |
| Lecture 37 | Relation between code polynomial and the roots of generator polynomial |
| Lecture 38 | BCH codes: Definition and examples |
| Tutorial | Assignment/discussion/exercises |
| Lecture 39 | Minimum distance of BCH codes |
| Lecture 40 | Decoding algorithm for BCH codes |
| Tutorial | Assignment/discussion/exercises |
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