Semester I

Subject 1

ME010101 Abstract Algebra

Text book : John B. Fraleigh, A first course in abstract algebra, 7th edition, Pearson Education, 2003

Week 1 Reading : §11.1-17

    Day 1 Introduction to Abstract Algebra.

    Day 2 Direct product of Groups. Reading : §11.1-11.
        Exercise : 11.1-20, 32-36, 45, 46-53

    Day 3 Finitely generated Abelian Groups. Reading : §11.12-17.
        Exercise : 11.21-31, 37-44, 54

    Day 4

    Day 5

      Jan 08, 2020 Assignment : Exercises 11

Week 2 Reading : §14.1-15

    Day 1 Cosets and Homomorphism. (Reading : §13.1-20)

    Day 2 Factor Groups. Reading : §14.1-8

    Day 3 Fundamental Homomorphism & Automorphism. Reading : §14.9-15

    Day 4

    Day 5

      Jan 15, 2020 Assignment : Exercises 14

Week 3 Reading : S16.1-17

    Day 1 Simple Groups. (Reading : §15)

    Day 2 Group Action. Reading : §16.1-8

    Day 3 Isotropy Subgroups. Reading : §16.9-17

    Day 4

    Day 5

Jan 22, 2020 Assignment : Exercises 16

Week 4 Reading : §17.1-7

Day 1 Burnside's forumula. Reading : §17.1-7

Day 2

Day 3

Day 4

Day 5

Jan 29, 2020 Assignment : Exercises 17
Feb 05, 2021 Module 1 Internal Examination

Week 5 Reading : §34.1-10

Day 1 First Isomorphism Theorem. Reading : §34.1-2

Day 2 Second Isomorphism Theorem. Reading : §34.3-5

Day 3 Third Isomorphism Theorem. Reading : §34.6-10

Day 4

Day 5

Feb 12, 2021 Assignment : Exercise 34

Week 6 Reading : §36.1-13

Day 1 Cauchy's Theorem. Reading : §36.1-4

Day 2 First Sylow's Theorem. Reading : §36.5-8

Day 3 Second Sylow's Theorem. Reading : §36.9-10

Day 4 Third Sylow's Theorem. Reading : §36.11-13

Day 5

Feb 19, 2021 Assignment : Exercise 36

Week 7 Reading : §37.1-15

Day 1 Applications. Reading : §37.1-6

Day 2 More Applications. Reading : §37.7-15

Day 3

Day 4

Day 5

Feb 26, 2021 Assignment : Exercise 37
Mar 05, 2021 Module 1 & 2 Internal Examination

Week 8 Reading : §20.1-15 & §21.1-9

Day 1 Rings, Fields & Integral Domains. (Reading : §18,19)

Day 2 Fermat, Euler Theorems. Reading : §20.1-15

Day 3 Field of Quotients. Reading : §21.1-9

Day 4

Day 5

Mar 12, 2021 Assignment : Exercise 20, 21

Week 9 Reading : §22.1-11

Day 1 Ring of Polynomials. Reading : §22.1-3

Day 2 Evaluation Homomorpism. Reading : §22.4-11

Day 3

Day 4

Day 5

Mar 19, 2021 Assignment : Exercise 22

Week 10 Reading : §23.1-21

Day 1 Factor Theorem. §23.1-6

Day 2 Irreducible Polynomials. §23.7-17

Day 3 Unique factorisation. §23.18-21

Day 4

Day 5

Mar 26, 2021 Assignment : Exercise 23
Apr 02, 2021 Module 3 Internal Examination

Week 11 Reading : §24.1-10

Day 1 Group Rings. Reading : §24.1-8

Day 2 Finite Division Ring. Reading : §24.9-10

Day 3

Day 4

Day 5

Apr 09, 2021 Assignment : Exercise 24

Week 12 Reading : §26.1-19

Day 1 Homomorphism. Reading : §26.1-6

Day 2 Factor Ring. Reading : §26.7-15

Day 3 Fundamental Homomorphism Theorem. Reading : §26-16-19

Day 4

Day 5

Apr 16, 2021 Assignment : Exercise 26

Week 13 Reading : §27.1-27

Day 1 Ideals. Reading : §27.1-6

Day 2 Maximal, Prime Ideals. Reading : §27.7-16

Day 3 Prime Fields. Reading : §27.17-27

Day 4

Day 5

Apr 23, 2021 Assignment : Exercise 27
Apr 30, 2021 Module 3 & 4 Internal Examination

Subject 2

ME010102 Linear Algebra

Week 1

Subject 3

ME010103 Basic Topology

Week 1

Subject 4

ME010103 Real Analysis

Week 1

Subject 5

Graph Theory

Week 1

Semester II

Subject 6

ME010201 Advanced Abstract Algebra

Text book : John B. Fraleigh, A first course in abstract algebra, 7th edition, Pearson Education, 2003

Week 1 June 14-18, 2021

Day 1 Reading : §29.1-12
Introduction to Extension Fields
Algebraic and Transcendental Elements

Day 2 Reading : §29.13-19
The Irreducible Polynomial for α over F
Simple Extensions

Day 3 Reading Assignment : §31.1-11
Finite Extensions

Day 4 Reading : §31.12-18
Algebraically Closed Fields and Algebraic Closures

Day 5 Reading : §32.1-11
Constructible Numbers
The Impossibility of Certain Constructions

Week 2 June 21-25, 2021

Day 1 Reading : §33.1-7
The Structure of Finite Field

Day 2 Reading : §33.8-12
The Existence of $GF(p^n)$

Day 3 Reading : §45.1-7
Unique Factorization Domains

Day 4 Reading : §45.8-18
Every PID is a UFD

Day 5 Reading : §45.19-31
If D is a UFD, then $D[x]$ is a UFD

Week 3 June 28-July 2, 2021

> Day 1 Reading : §46.1-5
> Euclidean Domains

> Day 2 Reading : §46.6-11
> Arithmetic in Euclidean Domains

> Day 3 Reading : §47.1-5
> Gaussian Integers

> Day 4 Reading : §47.6-10
> Multiplicative Norms

> Day 5 First Internal Examination
> Module 1 & 2

Week 4 July 5-9, 2021

> Day 1 Reading : §48.1-7
> Automorphism of Fields

> Day 2 Reading : §48.8-19
> Automorphism and Fixed Fields, Frobenius Automorphism

> Day 3 Reading : §49.1-5
> The Extension Theorem

> Day 4 Reading : §49.6-11
> The index of a Field Extension

> Day 5 Reading : §50.1-9
> Splitting Fields

Week 5 July 12-16, 2021

> Day 1 Reading : §51.1-6
> Multiplicity of zeros of a polynominal

> Day 2 Reading : §51.7-10
> Separable Extensions

> Day 3 Reading : §51.11-16
> Perfect Fields
> The Primitive Element Theorem

> Day 4 Reading : §53.1-2
> Galois Theory
> Normal Extension

> Day 5 Reading : §53.3-6
> The Main Theorem

Week 6 July 19-23, 2021

> Day 1 Reading : §53.7-8
> Galois Groups over Finite Fields
> Proof of the Main Theorem Completed

> Day 2 Reading : §54.1-7
> Illustrations of Galois Theory
> Examples

Day 3 Reading : §55.1-6
        Cyclotomic Extensions

Day 4 Second Internal Examination
        Module 3 & 4

Day 5 Survey : §56.1-6
        Insolvability of the Quintic

Subject 7

ME010202 Advanced Topology

Week 1

Subject 8

Numerical Analysis with Python3

Revision Plan

Day 1 Gauss elimination - Elimination phase('Pivot Equation', n^3 operations), Back substitution phase. §2.2(Kiusalaas pages 37-44) **Oct 8, 2020**

Day 2 Doolittle LU decomposition - ('LU' factorisation, Comparison), Modifications to Gauss Elimination, combined matrix, Forward + Back substitution §2.3(Kiusalaas pages 44-47) **Oct 9, 2020**

Day 3 Numerical Integration - Lagrange's interpolant, Newton-Cotes formula **Oct 12, 2020**

Subject 9

ME010204 Complex Analysis

Week 1 Jun 02-03, 2022

> **Day 1** §1.1 *The Algebra of Complex Numbers : Arithmetic Operations, Square Roots, Justificaiton, Conjugation, Absolute Value, Inequalities*
>
> **Day 2** §1.2 *The Geometric Representation of Complex Numbers : Geometric Addition and Multiplication, The Binomial equation, Analytic Geometry*

Week 2 Jun 06-10, 2022

> **Day 1** §1.2.4 The Sperical Representation
>
> **Day 2** §2.1 *Introduction to the Concept of Analytic Function : Limits and Continuity, Analytic Functions, Polynomials, Rational Functions*
>
> **Day 3** §2.2 Elementary Theory Power Series : Sequences, Series, Uniform Convergence, Power Series
>
> **Day 4** §2.2.5 Abel's Limit Theorem
>
> **Day 5** §3.2 Conformality

Week 3 Jun 13-17, 2022

> **Day 1** §3.3 Linear Transformations : Linear Group, Cross Ratio,
>
> **Day 2** §3.3.3 Symmetry
>
> **Day 3** §3.3.4-5 Oriented Circles, Families of Circles
>
> **Day 4** §4.1 Fundamental Theorems : Line Integrals, Rectifiable Arcs, Line integrals as funtions of arcs
>
> **Day 5** §4.1.4 Cauchy's theorem for a Rectangle

Week 4 Jun 20-June 24, 2022

> **Day 1** §4.1.5 Cauchy's theorem in a Disk
>
> **Day 2** §4.2 Cauchy's Integral Formula : The index of a point with respect to a closed curve

Day 3 §4.2.2 The integral formula

Day 4

Day 5 First Internal Examination
Module 1 & 2

Week 5 June 27-July 01, 2022

Day 1 §4.2.3 Higher Derivatives

Day 2 §4.3 Local Properties of Analytic Functions : Removable Singularities, Zeros and Poles

Day 3 §4.3.3 The Local Mapping

Day 4 §4.3.4 The maximum principle

Day 5 §4.4 The general form of Cauchy's theorem : Chains and Cycles, Simple Connectivity, Homology, The general statement of Cauchy's theorem, Proof of Cauchy's theorem, Locally exact differentials, Multiply Connected Regions

Week 6 July 04-08, 2022

Day 1 §4.5 The Calculus of Residues : The Residue theorem, The Argument Principle

Day 2 §4.5.3 Evaluation of Definite integrals

Day 3

Day 4

Day 5

Week 7 July 11-15, 2022

Day 1

Day 2

Day 3

Day 4

Day 5 Second Internal Examination
Module 3 & 4

Week 8 July 18-22, 2022

Day 1

Day 2

Day 3

Day 4

Day 5

Week 9 July 25-29, 2022

Day 1

Day 2

Day 3

Day 4

Day 5

Subject 10

ME010205 Measure & Integration

Week 1 Jun 02-03, 2022

    Day 1 Evolution of Integral

    Day 2 §1 *The Real Numbers : Sets, Sequences, and Functions*

Week 2 Jun 06-10, 2022

    Day 1 §2.1 Introduction

    Day 2 §2.2 Lebesgue Outer Measure

    Day 3 §2.3 The σ-algebra of Lebesgue Measurable Sets

    Day 4 §2.4 Outer and Inner Approximation of Lebesgue Measuareable Sets

    Day 5 §2.5 Countable Additivity, Continuity and Borel-Cantelli Lemma

Week 3 Jun 13-17, 2022

    Day 1 §2.6 Non measurable Sets

    Day 2 §2.7 The Cantor Set and Cantor Lebesgue Function

    Day 3 §3 Lebesgue Measurable Functions : Sums, Products and Compositions

    Day 4 §3.2 Sequential Pointwise Limits and Simple Approximation

    Day 5 §4 Lebesgue Integral : The Riemann Integral

Week 4 Jun 20-June 24, 2022

    Day 1 §4.2 The Lebesgue Integral of a bounded measurable function over a set of finite measure

    Day 2 §4.3 The Lebesgue Integral of a measurable non-negative function

    Day 3 §4.4 The General Lebesgue Integral

    Day 4

    Day 5 First Internal Examination
           Module 1 & 2

Week 5 June 27-July 01, 2022

    Day 1 §17 General Measure Spaces : Their Properties and Construction

    Day 2 §17.1 Measures and Measurable Sets

    Day 3 §17.2 Signed Measures : The Hanh and Jordan decompositions

    Day 4 §17.3 The Caratheodory Measure induced by an outer measure

    Day 5 §18 Integration over general Measure Spaces : Measurable Functions

Week 6 July 04-08, 2022

    Day 1 §18.2 Integration of non-negative measurable functions

    Day 2 §18.3 Integration of General Measurable Functions

    Day 3 §18.4 The Radon Nikodym Theorem

    Day 4 §20.1 Product Measures : The Theorems of Fubini and Tonelli

    Day 5

Week 7 July 11-15, 2022

    Day 1

    Day 2

    Day 3

    Day 4

    Day 5 Second Internal Examination
          Module 3 & 4

Week 8 July 18-22, 2022

    Day 1

    Day 2

    Day 3

    Day 4

    Day 5

Week 9 July 25-29, 2022

    Day 1

    Day 2

    Day 3

    Day 4

    Day 5

Semester III

Subject 11

ME010301 Advanced Complex Analysis

Week 1

Subject 12

ME010302 Partial Differential Equations

Week 1

Subject 13

ME010303 Multivariate Calculus & Integral Transforms

Textbooks : Tom M. Apostol, Mathematical Analysis, 2nd Edition, Addison-Wesley, 1974
Walter Rudin, Principles of mathematical analysis, 3rd Edition

Week 1 Weierstrass approximation theorem, other forms of Fourier series, Fourier integral theorem, exponential form of Fourier integral theorem, integral transforms. Reading : §11.15-20

Week 2 Directional derivatives, Total Derivative, Complex valued functions, matrix of linear functions, Jacobian matrix. Reading: §12.1-8

Week 3 chain rule, matrix form of chain rule, mean-value theorem. Reading : §12.9-11[1]

Week 4 Reading : §12.12-13

    Day 1 Sufficient condition for differentiability. Reading : §12.12

    Day 2 Sufficient condition for equality of partial derivatives. Reading : §12.13

    Jan 08, 2020 Internal Examination Module 2

Week 5 Reading : §13.1-4

    Day 1 Implicit function, Jacobian determinant $J_f(\overline{x})$, Jacobian determinant of complex-valued functions §13.1

    Day 2 Continuity of f with $J_f(\overline{x}) \neq 0$. Reading : §13.2 Theorem 13.2

    Day 3 Function f with $J_f(\overline{x}) \neq 0$ is an open mapping. §13.2 Theorem 13.3

    Day 4 Inverse function therorem. Reading : §13.3

    Day 5 Implicit function theorem. Reading : §13.4

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[1]Semester 2, University Examinations

Jan 15, 2020

Week 6 Reading : §13:5-6

    Day 1 Extrema of function on one variable. Reading : §13.5

    Day 2 Extrema of functions on several variables. Reading : §13.6

Jan 22, 2020

Week 7 Convolution theorem for Fourier transforms. Reading : §11.21 (pending)
Jan 29, 2020

Week 8 Reading : §10.1-9

    Day 1 k-cell I_k, integration over k-cell, support, primitive mappings, flip, local represenation as composition of primitives and flips, partitions of unity, change of variables on continuous functions with compact support.

Feb 05, 2020

Week 9 Reading : §10.10-14

    Day 1 k-surface, k-form (differential form of order k), properties of k-forms, basic k-forms.

Feb 12, 2020

Subject 14

ME010304 Functional Analysis

Week 1

Subject 15

ME010305 Optimization Technique

Week 1

Semester IV

Subject 16

ME010401 Spectral Theory

Week 1 Jun 02-03, 2022

> Day 1
>
> Day 2

Week 2 Jun 06-10, 2022

> Day 1 §4.6 Reflexive Spaces
>
> Day 2 §4.7 Category Theory, Uniform Boundedness Theorem
>
> Day 3 §4.8 Strong and Weak Convergence
>
> Day 4 §4.9 Convergence of Seqeunce of Operators and Functionals
>
> Day 5 §4.12 Open Mapping Theorem

Week 3 Jun 13-17, 2022

> Day 1 §4.13 Closed Linear Operator, Closed Graph Theorem
>
> Day 2 §5.1 Banach Fixed Point Theorem
>
> Day 3 §7.1 Spectral Theory in Finite dimensional Normed Spaces
>
> Day 4 §7.2 Basic Concepts
>
> Day 5

Week 4 Jun 20-June 24, 2022

> Day 1 §7.3 Spectral Properties of Bounded Linear Operator
>
> Day 2 §7.4 Futher Properties of Resolvent and Spectrum
>
> Day 3 §7.5 Use of Complex Analysis in Spectral Theory
>
> Day 4
>
> Day 5 First Internal Examination
>   Module 1 & 2

Week 5 June 27-July 01, 2022

> Day 1 §7.6 Banach Algebras
>
> Day 2 §7.7 Further Properties of Banach Algebras

Day 3 §8.1 Compact Linear Operators on Normed Spaces

Day 4 §8.2 Further Properties of Compact Linear Operators

Day 5 §8.3 Spectral Properties of Compact Linear Operators

Week 6 July 04-08, 2022

Day 1 §8.4 Further Spectral Properties of Compact Linear Operators

Day 2 §9.1 Spectral Properties of Bounded Self-Adjoint Linear Operators

Day 3 §9.2 Further Spectral Properties of Bounded Self-Adjoint Linear Operators

Day 4 §9.3 Positive Operators

Day 5 §9.5 Projection Operators

Week 7 July 11-15, 2022

Day 1 §9.6 Further Properties of Projections

Day 2

Day 3

Day 4

Day 5 Second Internal Examination
        Module 3 & 4

Week 8 July 18-22, 2022

Day 1

Day 2

Day 3

Day 4

Day 5

Week 9 July 25-29, 2022

Day 1

Day 2

Day 3

Day 4

Day 5

Subject 17

ME010402 Analytic Number Theory

Week 1

Subject 18

ME800401 Differential Geometry

Text book : J. A. Thorpe, Elementary topics in Differential Geometry, Springer, 1979

Week 1 Reading : §1, §2, §3

> Day 1 Graphs and Level Sets. Reading : §1
>
> Day 2 Vector Fields. Reading : §2
>
> Day 3 Maximal Integral Curve. Reading : §2
>
> Day 4 Tangent Space. Reading : §3
>
> Day 5

Week 2 Reading : §4, §5

> Day 1 Surface. Reading : §4
>
> Day 2 Vector Fields on Surfaces. Reading : §5
>
> Day 3 Maximal Integral Curve. Reading : §5
>
> Day 4 Orientation. Reading : §5
>
> Day 5

Week 3 Reading : §6, §7

> Day 1 Gauss Map. Reading : §6
>
> Day 2 Gauss map is onto. Reading : §6
>
> Day 3 Geodesics. Reading : §7
>
> Day 4 Maximal Geodesic. Reading : §7
>
> Day 5

Week 4 Reading : §8

> Day 1 Covariant Differentiation. Reading : §8
>
> Day 2 Levi-Civita Parallel. Reading : §8

Day 3 Parallel Transport. Reading : §8

Day 4 Properties of Parallel Transport. Reading : §8

Day 5

Week 5 Reading : §9,§10

Day 1 Directional Derivatives. Reading : §9

Day 2 Weingarten map. Reading : §9

Day 3 Properties of Weingarten Map. Reading : §9

Day 4 Curvature of Plan Curves. Reading : §10

Day 5

Week 6 Reading : §11

Day 1 Length of parameterised Curve. Reading : §11

Day 2 Existence of global parameterisation. Reading : §11

Day 3 Unit speed global parameterisation. Reading : §11

Day 4 Differential Forms. Reading : §11

Day 5

Week 7 Reading : §12

Day 1 Normal Curvature of Surfaces. Reading : §12

Day 2

Day 3

Day 4

Day 5

Week 8 Reading : §14

Day 1

Day 2

Day 3

Day 4

Day 5

Subject 19

ME800402 Algorithmic Graph Theory

Week 1

Subject 20

ME800403 Combinatorics

Week 1

Subject 21

Probability Theory

Week 1

Subject 22

Operational Research

Week 1

Subject 23

Operational Research

Week 1

Subject 24

Commutative Algebra

Week 1

Subject 25

Ordinary Differential Equations

Week 1

Subject 26

Classical Mechanics

Week 1

Bibliography