

# 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 : §16.1-17

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 formula. 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 Homomorphism. 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  $\alpha$  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 polynomial
- 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



## Subject 10

# ME010205 Measure & Integration

Week 1 Jun 14-18, 2021

- Day 1 Introduction Lebesgue Outer Measure  
The  $\sigma$ -algebra of Lebesgue Measurable Sets
- Day 2 Outer and Inner Approximation of Lebesgue Measurable Sets  
Countable Additivity
- Day 3 Continuity and Borel-Cantelli Lemma
- Day 4 Non measurable Sets  
The Cantor Set and Cantor Lebesgue Function
- Day 5 Lebesgue Measurable Functions and Lebesgue Integration Sums  
Products and Compositions

Week 2 Jun 21-25, 2021

- Day 1 Sequential Pointwise Limits and Simple Approximation
- Day 2 The Riemann Integral
- Day 3 The Lebesgue Integral of a bounded measurable function over a set of finite measure
- Day 4 The Lebesgue Integral of a measurable non-negative function
- Day 5 The General Lebesgue Integral

Week 3 Jun 28-July 2, 2021

- Day 1
- Day 2
- Day 3
- Day 4
- Day 5 First Internal Examination  
Module 1 & 2

Week 4 July 5-9, 2021

Day 1 General Measure Space and Measurable Function and Signed Measures

Day 2 Measures and Measurable Sets

Day 3 The Hanh and Jordan decompositions

Day 4 The Caratheodory Measure induced by an outer measure

Day 5 Measurable Functions

Week 5 July 12-16, 2021

Day 1 Integration over General Measure Space and Product Measure

Day 2 Integration of non-negative measurable functions

Day 3 Integration of General Measurable Functions

Day 4 The Radon Nikodym Theorem

Day 5 The Theorems of Fubini and Tonelli

Week 6 July 19-23, 2021

Day 1

Day 2

Day 3

Day 4

Day 5 Second Internal Examination  
Module 3 & 4

## 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<sup>1</sup>

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  $J_f(\bar{x})$ , Jacobian determinant of complex-valued functions §13.1

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

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

Day 4 Inverse function theorem. Reading : §13.3

Day 5 Implicit function theorem. Reading : §13.4

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<sup>1</sup>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 representation 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

**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