Kyaw Shin Thant

Transcript of Mathematics Coursework *Last updated December 18, 2024.*

Year 4 Term 2

MATH5022, *Theory of PDE II*, Prof. Yong YU.
Graduate course on elliptic partial differential equations.
Textbook: None.

MATH3260, *Graph Theory*, Prof. Wai See SHIU.
Definitions and applications of graphs and digraphs, Eulerian graphs, Hamiltonian graphs, path algorithm, connectivity, trees, planarity and coloring graphs.
Textbook: TBA.

Year 4 Term 1

MATH5070, *Topology of Manifolds*, Prof. Zhongtao WU.
Graduate course on differential geometry. Smooth manifolds, immersions, submersions, Sard's theorem, partitions of unity, vector fields, integral curves, flows, Lie derivatives, Lie groups and Lie algebras, vector bundles, differential forms, orientations, integration on smooth manifolds, Stokes' theorem, de Rham cohomology, homotopy invariance and Mayer-Vietoris sequence, cohomology with compact support, degree theory, Poincare duality.
Textbook: Warner, *Foundations of Differentiable Manifolds and Lie Groups*.

MATH5011, *Real Analysis I*, Prof. De-Jun FENG.
Graduate course on measure theory, covering chapters 1, 2, 3 and 6 of Rudin. Measure spaces, simple functions, integration, dominated convergence theorem, outer measures, Riesz representation theorem, Lebesgue and Hausdorff measures, Cantor and Vitali sets, L^p-spaces and their duals, signed measures, Radon-Nikodym theorem.
Textbook: Rudin, *Real and Complex Analysis*.

MATH4010, *Functional Analysis*, Prof. Chi Wai LEUNG.
A standard course in functional analysis. Normed spaces, Banach spaces, bounded linear operators, dual and quotient spaces, sequence spaces, Hahn-Banach theorem, reflexive spaces, weak and weak* convergence, open mapping theorem, closed graph theorem, uniform boundedness theorem, Hilbert spaces, self-adjoint operators, compact operators, spectral decomposition theorem, unbounded operators.
Textbook: Bowers and Kalton, *An Introductory Course in Functional Analysis*.

MATH3020, *Axiomatic Set Theory*, Prof. Michael MCBREEN.
A course covering some axiomatic set theory and a bit of computability theory at the end. Sets, first order logic, ZFC axioms, orderings, construction of $\mathbb{N}$, recursion theorem, operations on $\mathbb{N}$, well-ordered sets, ordinals, transfinite induction, alephs, models, completeness and incompleteness theorems, computability, Turing machines.
Textbook: Hrbacek and Jech, *Introduction to Set Theory*.

Year 3 Term 2

A **MATH4080**, *Modules and Representation Theory*, Prof. Jiu-Kang YU.

Representation theory of finite groups and a little bit of module theory. semisimple algebras, Artin-Wedderburn theorem, Maschke's theorem, characters, orthogonality relations, Noetherian modules, Hilbert basis theorem, Hilbert's nullstallensatz, structure theorem for modules over PID, primary decomposition, Euler-Poincaré characteristic.

Textbook: Artin, *Algebra*.

A- **MATH3093**, *Fourier Analysis*, Prof. De-Jun FENG.

Undergrad Fourier analysis course covering everything in the first 5 chapters of the textbook. Convolutions, good kernels, Dirichlet's problem, Fourier series convergence, isoperimetric inequality, Weyl's equidistribution theorem, heat equation on the circle, Fourier transform, Parseval, Plancherel, Poisson summation formula.

Textbook: Stein and Shakarchi, *Fourier Analysis: An Introduction*.

A **MATH3070**, *Topology*, Prof. Thomas Kwok Keung AU.

A course on mostly point set topology and a little bit of algebraic topology at the end. Topological spaces, bases/local bases, product/quotient topologies, connectedness, compactness/local compactness, Tychonoff's theorem, separation axioms, Tietze extension theorem, Urysohn's lemma, path-connectedness, homotopy, fundamental group.

Textbook: Munkres, *Topology*, Chapter 1-9.

A **MATH2230**, *Complex Variables and Applications*, Prof. Zhongtao WU.

Holomorphic functions, Cauchy-Riemann equations, branch cuts, elementary functions, contour integrals, Cauchy-Goursat theorem, Cauchy integral formula, Liouville's theorem, maximum modulus principle, Taylor and Laurent series, residue theorem, argument principle, Rouché's theorem.

Textbook: Brown and Churchill, *Complex Variables and Applications*.

A **MATH2070**, *Algebraic Structures*, Prof. Charles Chun Che LI.

Basic group and ring theory.

Textbook: Gallian, *Contemporary Abstract Algebra*.

Year 3 Term 1

A **MATH5051**, *Abstract Algebra I*, Prof. Jiu-Kang YU.

Graduate course on Galois theory of algebras. Categories and functors, Yoneda lemma, tensor products of algebras and base change, separable extensions, etale algebras, Galois theory of etale algebras, Galois algebras, Hilbert's Theorem 90, Galois descent and twists, simple/semisimple modules, central simple algebras, Brauer group.

Textbook: None.

A- **MATH4030**, *Differential Geometry*, Prof. Man Chun LEE.

An introductory course on the differential geometry of curves and surfaces. curvature and torsion of curves, Frenet formulas, regular surfaces, shape operator, 1st and 2nd fundamental form, Gaussian curvature and mean curvature, Christoffel symbols, Gauss' theorema egregium, covariant derivative, geodesics, Gauss-Bonnet theorem.

Textbook: Do Carmo, *Differential Geometry of Curves and Surfaces*.

A **MATH3060**, *Mathematical Analysis III*, Prof. Kai Seng CHOU.

Introductory Fourier analysis, metric spaces and their topology, Banach fixed point theorem and applications: inverse function theorem, Picard-Lindelöf theorem, Arzelà-Ascoli theorem, Baire category theorem.

Textbook: None.

A **MATH3030**, *Abstract Algebra*, Prof. Kwok Wai CHAN.

Normal subgroups, quotient groups, free groups, presentations of groups, isomorphism theorems, subgroup series, group actions, Sylow theorems and their applications, prime and maximal ideals, factorization in rings, PIDs and UFDs.

Textbook: Dummit and Foote, *Abstract Algebra*.

A **MATH2048**, *Honours Linear Algebra II*, Prof. Ronald Lok Min LUI.

Direct sums, products and quotient spaces, Zorn's lemma, linear transformations, dual spaces, diagonalizability, inner product spaces, adjoint, normal and self-adjoint operators, spectral theorem and Jordan canonical form.

Textbook: Friedberg, Insel and Spence, *Linear Algebra*.

Year 2 Term 2

A **MATH3040**, *Fields and Galois Theory*, Prof. Michael MCBREEN.

Finite and algebraic extensions, algebraic closures, straightedge and compass constructions, finite fields, automorphism groups, splitting fields, separable and normal extensions, Galois correspondence, cyclotomic extensions, solvability by radicals.

Textbook: Fraleigh, *A First Course in Abstract Algebra*.

A **MATH2060**, *Mathematical Analysis II*, Prof. Leung Fu CHEUNG.

Derivatives, Taylor's theorem, Riemann integration and Darboux integration, pointwise and uniform convergence of functions, absolute convergence, series of functions.

Textbook: Bartle and Sherbert, *Introduction to Real Analysis*, Chapter 6-9.

A **MATH2020**, *Advanced Calculus II*, Prof. Kai Seng CHOU.

Double and triple integrals, change of coordinates, line integrals, vector fields, Green's theorem, surface integrals, Stokes' theorem.

Textbook: *Thomas' Calculus*, Chapter 15-16.

Year 2 Term 1

A **MATH2050**, *Mathematical Analysis I*, Prof. Man Chun LEE.

A first course on real analysis. Construction of real numbers, least upper bound property, sequences and limits, Cauchy sequences, infinite series, limits of functions, continuity and uniform continuity.

Textbook: Bartle and Sherbert, *Introduction to Real Analysis*, Chapter 1-5.

A **ESTR2004**, *Discrete Mathematics for Engineers*, Prof. Hoi To WAI.

Mathematical induction, summation, recurrences and generating functions, asymptotics, counting, introductory graph theory and probability.

Textbook: None.

Year 1 Term 2

A **MATH1050**, *Foundations of Modern Mathematics*, Dr. Wing Chun FONG.

A course on introduction to proof writing through various topics, and basic set theory and logic.

Textbook: None.

Year 1 Term 1

A **MATH1510**, *Calculus for Engineers*, Dr. Kelvin Chun Lung LIU.

Standard first course on calculus. Functions, limits, continuity, differentiation and applications, integration, Taylor series.

Textbook: None.