Iligan Institute of Technology
of the Mindanao State University
Quality Education for a better Mindanao

DOCTOR OF MATHEMATICS

Introduction

The D. Math (Doctor of Mathematics) Program, an option of the existing Ph.D. in Mathematics Program of the Department of Mathematics , is designed to cater to the needs of a broader clientele, encompassing MS degree holders in mathematics and other related fields, who are competent to undergo the rigors of learning mathematics but are more inclined into the art of teaching mathematics rather than in mathematics research.

Whereas the Ph.D. Math Program, which is directed towards mathematics research, requires 60 academic units in math courses in various fields, a comprehensive exam and a dissertation with original contribution in a chosen field of specialization, which is publishable in refereed journals, the D. Math Program requires 72 units of academic requirement, a comprehensive exam and a doctoral thesis , which may be expository in nature but with sufficient degree of originality and does not require publication. A student can be awarded either a Ph.D. Math or D. Math degree but not both. However, a student who has successfully defended his doctoral thesis may opt to write a dissertation to obtain a Ph.D. Math degree.

Objectives

1. Develop more experts in teaching mathematics courses in all levels;
2. Increase the number of doctoral students at no additional cost; and
3. Keep at pace with the trend of in graduate mathematics programs worldwide.

Admission Requirements

In addition to the requirements of the University for admission to the Graduate School, the following must be met by the applicant:

1. He (or She) must have completed at least 30 units of MS Math courses , which includes Algebra, Analysis and Topology, from any recognized and acceptable institution;
2. His weighted average grade (GPA) must be 1.75 or better in all graduate math courses;
3. He must submit two letters of recommendation from former graduate professors;
4. He must submit a copy of his transcript of records;
5. In case of deficiencies of the above requirements, the Mathematics Graduate Committee may in addition require the applicant to undergo an interview and have a GPA of 1.55 or better to determine his admissibility to the program.

DOCTOR OF MATHERMATICS (D. Math)

(LIST OF COURSES BY SEMESTER)

First Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Math 412	Real analysis I	3	3	0	3	Math 213
Math 425	Abstract Algebra I	3	3	0	3	Math 225
	Math Elective	3	3	0	3	
	Total	9	9	0	9	

First Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Math 413	Real analysis II	3	3	0	3	Math 412
Math 426	Abstract Algebra II	3	3	0	3	Math 425
	Math Elective	3	3	0	3	
	Total	9	9	0	9	

First Year, Summer

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	Math Elective	3	3	0	3	
	Math Elective	3	3	0	3	
	Total	6	6	0	6	

Second Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Math 416	Complex Analysis	3	3	0	3	Math 212
Math 421	Linear Algebra	3	3	0	3	Math 221
Math 461	General Topology	3	3	0	3	Math 261
	Math Elective	3	3	0	3	
	Total	12	12	0	12	

Second Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Math 431	Probability Theory	3	3	0	3	Math 212
	Math Elective	3	3	0	3	
	Math Elective	3	3	0	3	
	Total	9	9	0	9	

Second Year, Summer

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	Math Elective	3	3	0	3	
	Total	3	3	0	3	

Third Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	Math Elective	3	3	0	3	
	Math Elective	3	3	0	3	
	Math Elective	3	3	0	3	
	Math Elective	3	3	0	3	
	Total	12	12	0	12	

Third Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	Doctoral Thesis	12	0	0	12	
	Total	12	0	0	12	

Fourth Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	Doctoral Thesis					
	(Continuation)					

Fourth Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	Doctoral Thesis					
	(Continuation)					

TOTAL NUMBER OF UNITS: 72

CATALOGUE OF COURSES

MATH 406 NUMBER THEORY

Congruences, the function Φ(n), congruences of degree two, power residues, quadratic residues, legendre symbol, quadratic reciprocity, Jacobi symbol, numerical functions, Moebius inversion formula, recurrence functions, some Diophantine equations, theory of primitive roots

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 407 ALGEBRAIC NUMBER THEORY

Free abelian groups, algebraic numbers and integers, conjugate and determinants, integral bases, norms and traces, quadratic and cyclotomic fields, factorization into irreducibles, prime factorization, Euclidean quadratic fields, the Ramanujan-Nagell Theorem, prime factorization of ideal, norm of an ideal.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 206 and Math 226

MATH 412 REAL ANALYSIS I

Abstract measure spaces, lebesgue measure and integration, comparison of Lévesque and Reimann integrals, Lévesque dominated convergence theorem, Vitali covering lemma, fundamental theorem of calculus, Riesz representation theorems.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 213

MATH 413 REAL ANALYSIS II

Lp spaces, Banack spaces, Hahn-Banach, open mapping, closed graph and Banach-Steinhaus theorems, Absolutely continuous functions and functions of bounded variation, Radon-Nikodym theorem, Jordan decomposition, product measures, Fubini theorem.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 412 or equivalent.

MATH 414 NUMERICAL ANALYSIS

Interactive methods for solutions of linear equations, linear least squares problems, theory of difference equations and numerical methods for ordinary differential equations, systems of nonlinear equations, numerical quadrature, polynomial and rational approximation theory.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 212 and Instructor's consent

MATH 416 COMPLEX ANALYSIS I

Complex Numbers, infinite series, analytic functions, theorems of Mittag-Leffler, Weierstrass and Runge, conformal mapping.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 212

MATH 417 COMPLEX ANALYSIS II

Analytic continuation, the Riemann mapping theorem, special functions, introduction to Riemann surfaces.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 416 (Complex Analysis I)

MATH 421 LINEAR ALGEBRA I

Decomposition of a single linear transformation; the characteristic polynomial; determinants; matrices and maps; rank and equivalence; right modules and duality; bilinear forms; alternating bilinear forms; sesquilinear duality; structure bilinear forms; symmetric forms; orthogonal basis; hyperbolic spaces; quadratic maps; symmetric forms over ordered fields; hermitian forms; spectral theorem; alternating forms; lemma of Schur; Euclidean and unitary spaces; orthogonal complete reducibility; Euclidean geometry reducibility; Euclidean geometry; semi-definite transformations; polar factorization of an arbitrary linear transformation; unitary space.

Credit : 3 units
Prerequisite(s) : Math 221

MATH 422 LINEAR ALGEBRA II

Selected applications of linear algebra on topics such as vector geometry; finite conic and linear inequalities; linear programming communication theory; vector calculus; spectral decomposition and linear transformations; systems of linear differential equations; small oscillations of mechanical systems; representations of finite groups by matrices.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 421 (Linear algebra)

MATH 423 LINEAR PROGRAMMING

Introduction to classical LP models; definition, the assumptions or limitations of LP models; the geometry and LP solutions; the art of LP formulation; algorithms used in LP models: simplex algorithm, revised simplex and the penalty methods; duality and sensitivity analysis; parametric analysis; goal programming; the transportation models; network models, e.g. shortest-route, maximal flow.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 421 (Linear Algebra)

MATH 424 DYNAMIC PROGRAMMING

Definition of dynamic programming; (DP); elements of the DP models; some classical DP problems, e.g. resource allocation, equipment replacement, traveling salesman, inventory models, cargo-loading and capital budgeting; the recursive equations; dimensionality in DP; solutions of some linear programming models by DP methods; stochastic processes.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 423

MATH 425 ABSTRACT ALGEBRA I

The structure of groups which includes topics on the action of a group on a set; the Sylow theorems; classification of finite groups; nilpotent and solvable groups; normal and subnormal series; free abelian groups; finitely generated abelian groups. Finally, this course also deals with modules which includes topics on modules, homomorphisms and exact sequences; free modules and vector spaces; projective and injective modules; homomorphism and duality; modules over a principal ideal domain.

Credit : 3 units
Prerequisite(s) : Math 225

MATH 426 ABSTRACT ALGEBRA II

This course deals with fields and Galois theory which includes topics on field extensions; the fundamental theorem; splitting fields; algebraic closure and normality; the Galois group of a polynomial; finite fields; cyclic extensions; cyclotomic extensions; radical extensions.

Credit : 3 units
Prerequisite(s) : Math 425

MATH 431 PROBABILTY THEORY I

Treatment of abstract probability theory as a branch of measure theory, probability spaces, random variables, general theory of distribution functions and their characteristic functions.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 212 (Real Analysis I)

MATH 432 PROBABILITY THEORY II

Conditional probability, independent random variables and the central limit problem, dependent random variable, Markov processes, stationary processes and theory of linear predictions.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 431

MATH 436 STOCHASTIC PROCESSES

Markov Chains, transition and absolute probabilities, irreducible Markov Chains, stationary stochastic sequences, Markov processes, discontinuous and continuous transitions, non-Markovian processes, stationary and stochastic processes.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 431 (Probability Theory I)

MATH 451 ORDINARY DIFFERENTIAL EQUATIONS

Some special classes of differential equations; systems of differential equations; stability of differential equations; Liapunov's second method (stability theory continue); Volterra integral equations; Fredholm theory of linear integral equations; self adjoint integral equations; some applications.

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 452 PARTIAL DIFFERENTIAL EQUATIONS

Fourier series and Fourier transforms, distribution, elliptic equations, initial value problems (Cauchy problems), evolution equations, hyperbolic equations, Green's functions and spectra.

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 461 TOPOLOGY I

Topological spaces, homeomorphisms, subspaces, Hausdorff spaces, regular and normal spaces, connectedness, product and quotient spaces, separability, metric spaces and compactness, Urysohn and Tietze's theorems, completely regular spaces, covering of spaces, metrization of topological spaces, uniform spaces, sequence and nets, filterbases, countable and local compactness, Baire spaces, category, function spaces, the spaces C(Y), and complete spaces.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 261

MATH 462 GENERAL TOPOLOGY II

Homotopy and applications, maps into spheres, topology of En, homotopy type, path spaces, H-spaces, fiber spaces.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 461 (General Topology I)

MATH 470 COMBINATORICS

Fundamentals of combinatorial mathematics, principles of inclusion and exclusion, recurrence relations, theorem of Ramsey, systems of distinct representatives, matrices of zeros and ones, orthogonal latin squares, combinatorial designs, perfect difference sets, and other topics

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Consent of Instructor

MATH 475 GRAPH THEORY

Graphs and associated matrices; connectivity; traversability; factorization; planarity; and colorability of graphs, groups and graphs; spectrum of graphs; digraphs.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Consent of Instructor

MATH 476 THEORY OF HYPERGRAPHS

Hypergraphs and their duals; transversals; chromatic number of a hypergraph; balanced hypergraphs and unimodular hypergraphs; matroids.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 475 (Graph Theory)

MATH 481 FUNCTIONAL ANALYSIS I

Topological vector spaces, Banach spaces, Hilbert spaces and their duals, bounded linear transformations, Banach-Steinhaus and Banach Alaoglu theorems, Krein-Milman theorem.

Credit : 3 units (3 hours lec, 0 hours lab)
Prerequisite(s) : Math 413 (Real Analysis II)

MATH 482 FUNCTIONAL ANALYSIS II

Linear operators on a Banach space, the spectrum and resolvent of a linear operator, compact operators, spectral theorem for compact Hermitian operators on a Hilbert space, integral equations.

Credit : 3 units
Prerequisite(s) : Math 481

MATH 490 SEMINAR: ANALYSIS

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 491 SEMINAR: FUNCTIONAL ANALYSIS

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 492 SEMINAR: ALGEBRA

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 493 SEMINAR: PROBABILITY THEORY & MATHEMATICAL STATISTICS

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 494 SEMINAR: GRAPH THEORY/ COMBINATORICS

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 495 SEMINAR: APPLIED MATHEMATICS

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 496 SEMINAR: TOPOLOGY

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 497 SEMINAR: SELECTED TOPICS

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 498 INDEPENDENT STUDY

Credit : 3 units
Prerequisite : Consent of Instructor

MATH 499 SPECIAL PROJECT

Credit : 3 units
Prerequisite(s) : Consent of Instructor

MATH 500 DOCTORAL DISSERTATION

Credit : 12 units