Master of Science in Mathematics*
Program Prospectus

Institute of Mathematical Sciences and Physics
College of Arts and Sciences
Graduate School
University of the Philippines Los Baños

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I. INTRODUCTION

The Master of Science in Mathematics (MS Math) is designed for those who wanted to pursue advanced knowledge in mathematics and with the intent to go to the academe, industry research, college teaching, and related fields. Students of the program are trained to acquire the mastery of mathematics and intellectual independence.

The main feature of the revised MS Math program is the inclusion of three tracks: (1) Pure Mathematics, (2) Applied Mathematics, and (3) Mathematics Education. This gives opportunities for students to follow their diverse interests in theoretical mathematics, applied mathematics or mathematics teaching. Despite the delineation created by the tracks, students are provided with a common rigorous training in three foundational mathematics courses – Theory of Matrices, Topology, and Real Analysis; and provided with the right selection of elective courses.

The structure of the new program embodies the usefulness and ubiquity of mathematics to problems arising in various fields. These are, but not limited to, education, operations research, actuarial science, biology, chemistry, statistics, physics and engineering, finance and economics, computer science and information theory.

With the mathematical maturity honed by the MS Math program, graduates of the program are expected to perform exceptionally in their chosen professions and could pursue doctoral studies in theoretical mathematics, applied mathematics, mathematics education or other related fields.

II. PROGRAM GOALS

A. Program Outcomes

The MS Mathematics program aims to produce graduates who shall be

1. demonstrating sufficient mathematical mastery to pursue careers in academe, research, industry, business, civil society and government that require mathematical skills and perspectives;
2. competent to pursue doctoral studies in theoretical or applied mathematics, mathematics education, or related field;
3. prepared to conduct independent or collaborative research in mathematics;
4. proficient in teaching high school or undergraduate mathematics courses; and
5. upholding the University's values of honor and excellence.

B. Program Learning Outcomes

A graduate of the MS Mathematics program should have the ability to:

1. demonstrate advanced knowledge of mathematics and one of its major areas;
2. apply abstraction, logic, precision and rigor to solve problems in mathematics and other related disciplines;
3. demonstrate oral and written skills in communicating mathematical proofs and solutions;

4. implement research activities contributing to the advancement of the mathematical sciences; and
5. develop cognitive-behavioral schemas on the utility of mathematics as motivation for teaching and advanced learning of mathematics.

C. Specific Program Tracks Outcomes

1. Pure Mathematics

A graduate of the MS Mathematics program under the Pure Mathematics track should have the ability to:

a. construct rigorous proofs that are direct and readable in form;
b. analyze theoretical results to identify open problems in theoretical mathematics;
c. extend existing mathematical theories to novel areas of study in theoretical mathematics; and
d. integrate mathematical ideas to establish new concepts or results.

2. Applied Mathematics

A graduate of the MS Mathematics program under the Applied Mathematics track should have the ability to:

a. discuss critically the theories of deterministic and probabilistic mathematical methods;
b. model systems using mechanistic or phenomenological approaches;
c. solve mathematical problems analytically or numerically with the aid of technology; and
d. evaluate mathematical solutions to address problems in various disciplines.

3. Mathematics Education

A graduate of the MS Mathematics program under the Mathematics Education track should have the ability to:

a. integrate relationships among various mathematical ideas beyond their historical evolution;
b. evaluate pedagogical philosophies, principles and praxis in the science and art of teaching and learning mathematics;
c. effectively teach high school or undergraduate mathematics courses using various media; and
d. develop a school mathematics curriculum, specifically in the context of Philippine education system.

III. CURRICULUM DETAILS

A. Courses

The nine (9) units of core courses cover topics in linear algebra, real analysis and topology. These are subjects that every mathematics student should know before proceeding in the program. The nine (9) units of track courses intend to enhance their knowledge by focusing on more specific problems, applications and theories. Moreover, track courses complete the foundation for a graduate of MS Math program under a specific track. Electives will help students to broaden their intellectual horizon and supplement their preparation to do research in their chosen topic. The graduate seminar (MATH 299) helps students prepare and enhance their technical skills in conducting and managing research seminars.

(1) Core Courses

- MATH 213. **Theory of Matrices** (3 units). Operations on matrices; canonical forms, determinants; characteristic equations; eigenvalues. 3 hrs (class). PR. MATH 120. *(1)*

- MATH 225. **Topology** (3 units). Topological spaces; bases and subbases; continuity; metric spaces; separation axioms; compactness; product spaces; connectedness. 3 hrs (class). PR. MATH 101 or its equivalent. *(2)*

- MATH 230. **Real Analysis** (3 units). The real number system; Lebesque measures; Riemann and Lebesque integrals; differentiation and integration. 3 hrs (class). PR. MATH 155 *(1)*

(2) Program Tracks Courses

Pure Mathematics Track

- MATH 211. **Abstract Algebra** (3 units). Binary operations, algebraic systems such as semi groups, rings integral domains, field, extensions. 3 hrs (class). PR. MATH 111. *(1)*

- MATH 222. **Finite Geometries** (3 units). The finite plane, projective plane, affine plane, hyperbolic plane; Galois geometries; combinatorial applications of finite geometries; finite inverse geometry and block design. 3 hrs (class). PR. MATH 211. *(2)*

- MATH 231. **Functions of a Complex Variable** (3units). Complex differentiation and integration; analytic continuation; residue theorem; conformal mapping; and some special functions. 3 hrs (class). PR. MATH 155 *(2)*

Applied Mathematics Track Courses

- AMAT 250. **Numerical Simulation** (3 units). Computational techniques for the simulation of a large variety of systems and processes. 3 hrs (class). PR. COI. (2)

- AMAT 255. **Mathematical Data Science** (3 units). Algebraic, geometric, fuzzy and probabilistic algorithms for discovering patterns in data sets. 3 hrs (class). PR. COI. (2)

- AMAT 266. **Deterministic Mathematical Decision Models** (3 units). Linear models; inventory models; integer programming and combinatorial models; elementary dynamic programming models; introduction to nonlinear programming. 3 hrs (class). PR. AMAT 160 or COI. (1)

Mathematics Education Track Courses

- MAED 201. **Mathematics Education** (3 units). Mathematical thoughts and ideas as bases of school mathematics. 3 hrs (class). PR. None. (1)

- MAED 202. **Mathematical Didactics** (3 units). Pedagogical philosophies, principles and praxis in mathematics education. 3 hrs (class). PR. None. (1)

- MAED 203. **Mathematics Curriculum** (3 units). Analysis, design, and evaluation of school mathematics curriculum. 3 hrs (class). PR. MAED 202. (2)

(3) Electives (See Annex A)

B. Master's Thesis

The six (6) units of MATH 300 – Master's Thesis can be officially conducted after completing the course work (core courses, track courses, and electives) and ideally after passing the general examination. The Master's thesis shall be an original and independent research in pure, applied mathematics or mathematics education. The student must be able to make a critical assessment of the previous works done in his/her chosen research topic and he/she should be able to present his research findings in a clear, systematic and scholarly manner. It must be of publishable quality and will be subjected to external review.

C. General Examination

The general examination is a written and/or oral examination that the student shall take after he/she has passed all the required courses. It is intended to determine whether the student has gained sufficient broad mathematical knowledge and to test the student's competence in integrating knowledge of the major areas.

D. Curriculum Summary

Courses	Units
Core Courses	9
Track Courses	9
Electives	6
MATH 299. Graduate Seminar	1
MATH 300. Master's Thesis	6
TOTAL	31

E. Program of Study

Below are the suggested programs of study for regular and non-regular students.

For Regular Student

First Year - First Semester	
MATH 213. Theory of Matrices PR: MATH 120	3
MATH 230. Real Analysis PR: MATH 155	3
MATH 225. Topology PR: MATH 101	3
Track course I	3
	12
First Year - Second Semester	
Track course II	3
Track course III	3
Elective I	3
Elective II	3
	12
Second Year - First Semester	
MATH 299. Graduate Seminar	1
MATH 300. Master's Thesis	3
	4
Second Year - Second Semester	
MATH 300. Master's Thesis	3
	3
Total number of units = 31	

For Non-regular Students

First Year - First Semester	
MATH 213. Theory of Matrices PR: MATH 120	3
MATH 230. Real Analysis PR: MATH 155	3
	6
First Year - Second Semester	
MATH 225. Topology PR: MATH 155	3
Track course I	3
	6
Second Year - First Semester	
Track course II	3
Elective I	3
	6
Second Year - Second Semester	
Track course III	3
Elective II	3
	6
Third Year - First Semester	
MATH 299. Graduate Seminar	1
MATH 300. Master's Thesis	3
	4
Third Year - Second Semester	
MATH 300. Master's Thesis	3
	3
Total number of units = 31	

IV. ADMISSION REQUIREMENT

Prospective students of the program must have finished a baccalaureate degree in pure or applied mathematics or related fields including but not limited to engineering, mathematics education, statistics, computer science, physics, accounting and economics. They must have a general weighted average of 2.50 or its equivalent, in all mathematics courses taken in the undergraduate level.

Applicants must possess sufficient knowledge of the foundational concepts in undergraduate mathematics such as Logic and Set Theory (MATH 101 or its equivalent), Advanced Calculus (MATH 155 or its equivalent), and Linear Algebra (MATH 120, AMAT 105 or its equivalent). This will be determined through a written diagnostic exam and/or a panel interview by the IMSP Graduate Admissions Committee.

a. If the applicant has demonstrated sufficient knowledge in two of these courses, the applicant may be recommended for regular status, and the remaining foundation course will have to be included in the student's plan of study.

b. If the applicant has demonstrated sufficient knowledge in only one or none of these courses, he/she will be given the following options:

   i. complete and pass an enrichment program in Mathematics covering the three topics to be administered the midyear before his/her enrolment; or

   ii. be admitted under probationary status or for the non-degree program.

V. ADMINISTRATION OF THE PROGRAM

The Institute of Mathematical Sciences and Physics (IMSP), through the UPLB Graduate School, appoints a Graduate Admissions Committee (IMSP-GAC) and a Graduate Curriculum Committee (IMSP-GCC) that are responsible for the administration of the program. These committees are responsible for crafting and implementing rules on admissions, overseeing the admission procedure, evaluating proposals for new and revised graduate programs and courses, and appraising the equivalency of graduate courses offered in other institutes and universities.

The thesis adviser chairs the student's Guidance Committee that is responsible in guiding the student's research work and in monitoring the overall performance of the student in the program. The Guidance Committee is elected by the student concurrently with the accomplishment of the student's plan of study.

VI. ANNEXES

A. IMSP Graduate Faculty Profile

Name	Highest Educational Attainment	Specialization/ Research Interests
Dr. Ariel L. Babierra	Ph.D.	Approximation of inverse operators, combinatorial pattern avoidance, hamiltonian graph theory
Prof. Genaro A. Cuaresma	M.Sc.	Optimization, combinatorics, modeling
Dr. Crisanto A. Dorado	Ph.D.	Applied problems, stochastic modeling, actuarial Science
Prof. Lynie B. Dimasuay	M.Sc.	Mathematics education

Prof. Alleli Ester C. Domingo	M.Sc.	Operations research, mathematics education, Innovations in mathematics
Prof. Lauro L. Fontanil	M.Sc.	Graph theory, Chemical Reaction Network Theory
Dr. Maica Krizna A. Gavina	D.Sc.	Population dynamics, optimization
Dr. Marvin U. Herrera	Ph.D.	Surfaces, interfaces, functionalization
Dr. Editha C. Jose	Ph.D.	Homogenization and Controllability of Partial Differential Equations, Chemical Reaction Network Theory, Biomathematics
Prof. John Mark T. Lampos	M.Sc.	Algebraic coding theory, codes over fields and rings
Prof. Vernel M. Lawas	M.Sc.	Graph theory, mathematics education
Dr. Jean O. Loyola	Ph.D.	Graceful trees, semigroup theory
Dr. Herbert S. Palines	Ph.D.	Algebraic structures, algebraic coding theory
Prof. Rolando G. Panopio*	M.Sc.	Operations research, graph theory, mathematics education
Dr. Chrysline Margus N. Piñol	Ph.D.	Population dynamics, modeling and simulation
Dr. Darwin B. Putungan	Ph.D.	Computational materials physics, first-principles calculations, energy conversion and storage
Dr. Jomar F. Rabajante	D.Sc.	Mathematical modeling of complex biological and social systems
Dr. Virgilio P. Sison	Ph.D.	Coding theory, convolutional codes and codes over rings, cryptology, algebra, geometry
Dr. Alvin Karlo G. Tapia	D.Sc.	Disordered materials, low frequency spectroscopy, ultrafast physics
Dr. Jerrold M. Tubay	D.Sc.	Mathematical Biology (diversity modeling and simulation), Operations Research
Dr. Ranzivelle Marianne L. Roxas-Villanueva	Ph.D	Social and language networks, machine learning applications

*Adjunct Professor/Professorial Lecturer

B. Non-exhaustive List of Possible Elective Courses

Courses offered by IMSP

AMAT 215. Mathematical Theory of Choice and Games (3). Mathematical modeling and analysis of games and rational choice. 3 hrs (class). PR. AMAT 105 or MATH 120 or COI. (2)

AMAT 250. Numerical Simulation (3). Computational techniques for the simulation of a large variety of systems and processes. 3 hrs (class). PR. COI. (2)

AMAT 255. Mathematical Data Science (3). Algebraic, geometric, fuzzy and probabilistic algorithms for discovering patterns in data sets. 3 hrs (class). PR. COI. (2)

AMAT 266. Deterministic Mathematical Decision Models (3). Linear models; inventory models; integer programming and combinatorial models; elementary dynamic programming models; introduction to nonlinear programming. 3 hrs (class). PR. AMAT 160 or COI. (1)

AMAT 267. Probabilistic Mathematical Decision Models (3). Basic concepts and application of probabilistic mathematical decision models such as queuing, inventory, dynamic programming and simulation, inventory, dynamic programming and simulation models. 3 hrs (class). PR. AMAT 160 or COI. (2)

AMAT 277. Mathematical Finance (3). Mathematical concepts and techniques used in the pricing of financial derivatives. 3 hrs (class). PR. COI. (2)

AMAT 280. Biomathematics (3). Mathematical modeling of biological systems. 3 hrs (class). PR. None. (1)

MAED 201. Mathematics Education (3). Mathematical thoughts and ideas as bases of school mathematics. 3 hrs (class). PR. None. (1)

MAED 202. Mathematical Didactics (3). Pedagogical philosophies, principles and praxis in mathematics education. 3 hrs (class). PR. None. (1)

MAED 203. Mathematics Curriculum (3). Analysis, design, and evaluation of school mathematics curriculum. 3 hrs (class). PR. MAED 202. (2)

MATH 211. Abstract Algebra (3). Binary operations, algebraic systems such as semigroups, rings integral domains, field, extensions. 3 hrs (class). PR. MATH 111. (1)

MATH 215. Coding Theory and Cryptography (3). Concepts and mathematical theory of error-correcting codes, encryption and decryption schemes. 3 hrs (class). PR. MATH 111. (1)

MATH 217. Algebraic Combinatorics (3). Discrete structures from an algebraic perspective. 3 hrs (class). PR. MATH 211. (2)

MATH 220. Algebraic Geometry (3). Concepts and theorems of algebraic geometry. 3 hrs (class). PR. MATH 211. (1)

MATH 222. Finite Geometries (3). The finite plane, projective plane, affine plane, hyperbolic plane; Galois
geometries; combinatorial applications of finite geometries; finite inversive geometry and block design. 3 hrs (class). PR. MATH 211. (2)

MATH 231. Functions of a Complex Variable (3). Complex differentiation and integration; analytic continuation; residue theorem; conformal mapping; and some special functions. 3 hrs (class). MATH 155. (2)

MATH 235. Functional Analysis (3). Concepts, principles, methods, and applications of functional analysis; normed and Banach spaces; Hilbert space theory. 3 hrs (class). PR. MATH 213. (2)

MATH 243. Graph Theory and Applications (3). Concepts and theorems involving graphs and networks and their applications. 3 hrs (class). PR. None. (2)

MATH 252. Theory of Partial Differential Equations (3). Concepts and advanced techniques in solving partial differential equations arising from applications. 3 hrs (class). PR. MATH 151 or COI. (1)

MATH 281. Measure-theoretic Probability and Stochastic Processes (3). Theories and techniques in probability and stochastic processes. 3 hrs (class). PR. MATH 182 or COI. (1)

MATH 291. Special Topics (1-3). May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. May be taken twice. PR. COI.

Courses offered by other UPLB units

AECO 210. Advanced Agricultural Production Economics. PR. COI. (1)
AECO 240. Natural Resource Economics. PR. ECON 101 or COI. (1)
AECO 241. Economic Analysis and Planning of Agricultural Projects. PR. ECON 101 and ECON 102 or COI. (2)

AECO 250. Agriculture and Economic Development (3). Factors that accelerate or inhibit the growth of agriculture; survey of existing growth theories and establishment of their relevance to Philippine experience. PR. ECON 101 and ECON 102 or COI. (2)

AECO 261. Food and Nutrition Economics (3). World food problems and the economic consequences of malnutrition; review of food and nutrition policies and programs. (1)

AGME 250. Micrometeorology (3). Radiation, energy and water balances over land surfaces, radiation, temperature, humidity and wind profiles in the atmospheric boundary; microclimate modifications; and instrumentation. PR. PHYS 13 or its equivalent. (1)

AGME 260. Tropical Agrometeorology (3). Climatic controls; agrometeorological observation network and practices; crop and animal weather-relations; research methods in agrometeorology; agrometeorological forecasts and advisories. PR. AGME 250. (2)

AGR 255/BIO 255. Population Genetics (3). Genetics of population undergoing random mating and inbreeding; effects of selection, mutation, migration and other forces on the genetic composition of natural and artificial biological population. PR. BIO 130b and MATH 26. (1)

AGR 256. Quantitative Genetics (3). Genetics of quantitative characters in random and nonrandom mating population. Application of quantitative genetic theories in breeding work. PR. AGR 255. (2)

AGRI 211. Design and Assessment of Farming Systems (3). Critical analysis, designing and evaluating farming systems. PR. AGRI III or COI. (2)

BIO 201/MBB 201. Advanced Molecular Biology (3). Advances in molecular biology with emphasis on the structures, properties, functions, and interactions of biomolecules in basic cellular processes and manipulation of DNA. PR. BIO 101. (2)

BIO 235. Evolutionary Genetics (3). Analysis of genetic mechanisms affecting evolutionary change. PR. BIO 30 or its equivalent. (1)

BIO 236. Developmental Genetics (3). Genetic control of development in plants and animals. PR. BIO 130a. (2)

ChE 240. Advanced Control Theory (3). Theories for analysis and design of advanced control systems. PR. EE 130 or COI. (2)

CED 201. Philosophy of Education (3). Significant theories and principles of education and their implications for development education in the Philippines. PR. COI. (1,2)

CED 202. Theory and Practice of Community Education (3). Theoretical underpinnings and strategies in community education. PR. COI. (1,2)

CED 210. Managing Education for Community Welfare (3). Management principles and tools for productivity and quality improvement in education within the community. PR. COI. (1,2)

CED 211. Advanced Educational Psychology (3). Psychological theories and principles underlying the learning processes. PR. COI. (1)

CED 213. Instructional Systems Design and Management (3). Principles, approaches, and processes in designing and managing instructional systems. PR. COI (2)

CED 215. Leadership for Educational and Community Productivity (3). Leadership behavior, theories, qualities, approaches, skills and techniques. PR. COI. (2)

CED 217. Educational Planning (3). Concepts, procedures and tools in developing plans at various levels and types of educational systems. PR. COI. (2)

CED 220. Sociology of Education (3). Analysis of education as a factor in social change; the sociological significance of schools and other social institutions in rural development; social factors in the learning process. PR. COI. (2)

CED 224. Economics of Education (3). Application of the economics in the analysis of problems and issues in financing education, both formal and nonformal, particularly in low-income countries. PR. COI. (1)

CED 226. Educational Evaluation (3). Measurement approaches, evaluation techniques, models and processes in determining the effectiveness of formal education training programs. PR. COI. (1)

CED 227. Administrative Theory (3). Management theories and concepts as they relate to organizations with emphasis on educational institutions; forces in the organization and the external environment and their influence on managerial roles, functions, and management policies. PR. COI. (2)

CMSC 244. Algorithms and Advanced Data Structures I (3). Design, analysis, and implementation of algorithms; use of advanced data structure in algorithm design. PR. CMSC 142 or COI. (1)

CMSC 245. Algorithms and Advanced Data Structures II (3). Advanced topics in algorithmic graph theory, efficient polynomial and matrix algorithms; number theoretic algorithms, string processing and computational geometry; design and analysis of parallel algorithms; the theory of NP completeness and approximation algorithms. PR. CMSC 244. (2)

CMSC 250. Scientific Computing (3). Principles, methodology, and tools of scientific computing. PR. MATH 28 or 38 or COI. (1)

DM 221. Fiscal Administration in Development (3). Theories and methods of fiscal administration and their application in the financial planning and analysis of development programs. PR. COI. (1,2)

DM 223. Project Development and Management (3). Design, implementation, and evaluation of development projects. PR. COI. (1,2)

DMG 224. Governance Framework for Disaster Risk Reduction and Climate Change Adaptation (3). Governance theories, concepts and issues, and their application in disaster risk reduction and climate change adaptation policy, plans and projects. PR. COI. (1,2)

DMG 225. Governance of Food Systems (3). Theories, perspectives and approaches to governance of food systems for food and nutrition security. PR. COI. (1,2)

DMG 230. Microfinance, Microinsurance and Development (3). Concepts, models, and management of microfinance and microinsurance institutions and their role in development. PR. COI. (1.2)

DMG 231. Governance of Microfinance Institutions (3). Concepts, approaches, and tools in the governance of microfinance institutions. PR. DM 230 or COI. (1,2)

DMG 232. Governance of Microinsurance Institutions (3). Concepts, approaches, and tools in the governance of microinsurance institutions. PR. DMG 230 or COI. (1,2)

ECON 201. Macroeconomic Theory I (3). Theories of income and employment determination and the business cycle; theories of inflation and unemployment; the macroeconomy and the fiscal, monetary, and external sectors; open economy macroeconomics; stabilization policies. PR. ECON 101 or COI. (1)

ECON 202. Microeconomic Theory I (3). Preference and choice; consumer choice and demand; production costs, profits, and supply; competitive markets; market structure; externalities, public goods, and market failure; general equilibrium and welfare. PR. ECON 102 or COI. (1)

ENS 242/ECON 275. Economic Valuation of Environmental and Natural Resource System (3). Approaches and techniques for economic measurements and valuation of natural resources and environmental impacts of development. PR. COI. (2)

ENS 201. Ecosystem Structure and Dynamics (3). Ecosystem structure, function, energetics, nutrient cycles, population dynamics, ecosystem models. PR. BOT 150 or BIO 150 or COI. (1,2).

ENS 211. Systems Analysis and Quantitative Methods in Natural Resources Management (3). Statistical concepts and data analysis; optimization techniques; stochastic modeling; application of the systems approach to resource-based problems. PR. MGT 211 or COI. (1).

ENS 270. Dynamics of Population, Resources and Environment (3). Interactions of human populations with resources and environment in different ecosystems; local, national, and global in scope. PR. HUME 2 or COI. (1).

ENS 296. Environmental Impact Assessment: Perspectives from the Natural and Social Sciences (4). Framework and methodology for environmental impact assessment of the biophysical and socioeconomic systems; ecological, social and ethical bases of EIA; risk assessment and management; mitigation of negative impacts and enhancement of positive impacts; case studies. PR. COI. (2,S).

ENTR 201. Theory and Practice of Entrepreneurship (3). Theories, principles, perspectives, practices, and trends in entrepreneurship. (1, 2)

ENTR 271. Technology Commercialization and Technopreneurship (3). Technology commercialization; technology-based enterprise identification and business plan development. PR. ENTR 201 or COI. (1,2)

FRM 204. Geospatial Methods in Natural Resources Management (3). Application of geographic information systems (GIS) technology in natural resources management; GIS operations and spatial analysis. PR. FRM 104 or COI. (1)

FRM 287. Economic Analysis in Forest Management (3). Forest management unit as a bioeconomic system, decision-making in timber management; economic sustained yield theory; current forest management practices. PR. COI. (2)

FST 220. Microbiological Aspects of Food Processing (3). Introduction to the microbiological problems in food preservation. PR. COI. (1)

HFDS 232. Consumer Behavior (3). Consumer motivation and behavior in relation to various factors. PR. COI. (2)

MBB 211. Biocomputing in Molecular Biology and Biotechnology (2). Principles and applications of computational sciences in molecular biology and biotechnology. PR. COI. (1)

MBB 251/PPTH 251. Molecular Plant-Pathogen Interactions (3). Molecular mechanisms of plant-pathogen interactions and application of molecular diagnostics and markers in plant pathology. PR. PPTH 101 and BIO 101. (2)

MCB 285. Predictive Microbiology and Modeling Applications in Food Safety (4). Assessment and control of microbiological risks in foods, process calculations on growth, survival, and inactivation of microorganisms in foods. PR. MCB 180 and Math 26 or COI. (1)

MGT 201. Organization and Management (3). Organization and management theories, concepts and processes; organization changes and managerial systems. (1,2)

MGT 203. Environment of Management (3). Survey of socio-cultural, economic, politico-legal, technological and natural forces in local and international environment, their interactions/interrelationships, and their influence and effects on management of public and private organizations. PR. COI. (2,S)

MGT 207. Managerial Problem Solving and Decision-Making (3). Quantitative and non-quantitative concepts, tools, and dynamics in problem solving and decision-making processes at the national, firm, and individual levels. PR. COI. (1,2)

MGT 209. Economic Analysis (3). Economic theory and policy with reference to the Philippine development program. (2)

MGT 213. Management Accounting and Control I (3). Financial accounting policy in private and public organizations within the framework of accounting conventions. (1)

MGT 215. Financial Management (3). Short and long-range financial planning. Management of working capital and long-term financial position of a business organization. (2)

MGT 221. Quantitative Methods in Administration (3). Various techniques of determining optimization involving univariate and multivariate functions. Includes differential and integral calculus, linear systems, and matrices and an introduction to linear programming. PR. COI. (1)

MGT 231. Human Behavior in Organization (3). Individual and group behavior as these are influenced by cultural and technological factors: organizational change. (1,2)

MGT 251. Marketing Management (3). The nature and dynamics of demand, the major marketing problems confronting the management in adapting to demand conditions; the development of pricing strategies for new and existing products. The types of distribution patterns and promotional programs employed to obtain sales and profits under a variety of operating conditions; the management of existing product lines, the development, testing, and introduction of new products; and the dynamics of export markets. (2)

MGT 273. Management of Small Business (3). Characteristics, opportunities and hazards of small business; entrepreneurship and the formation of small business; problems of survival; problems created by growth and ways to deal with them. (1)

NRC 201. Perspectives and Approaches to Natural Resources Conservation (3). Biological, geological and social dimensions of natural resources conservation. PR. COI. (1)

NRC 241. Coastal Ecosystem Dynamics (3). Structures, functions, processes and interactions in coastal ecosystems. PR. FBS 36 or BIO 150 or COI. (2)

PAf 201. Political Economy of Public Affairs (3). PR. COI. (1)

PAf 203. Data Analysis and Modelling of Public Affairs (3). PR. COI. (1)

SOC 242. Population Studies (3). Population concepts, methods and issues related to society. PR. COI. (1)

SPPS 201. Strategic Planning: Theory and Methods (3). Theoretical perspectives and techniques in strategic planning. PR. COI. (1,2)

SPPS 232. Science and Technology Policy Analysis (3). Applications of S & T policy analysis on contemporary societal concerns. PR. COI. (1,2)

SPPS 272/ENS 272. Science, Technology and Development (3). Interactions of science, technology and development in society and the nation's economy, and their implications on nation-building and human wellbeing. (1,2)

STAT 250. Multivariate Statistical Methods (3). Multivariate normal populations; tests of hypotheses on means, multivariate analysis of variance; classification by linear discriminant function; inferences from covariance matrices; principal components; and factor analysis. PR. STAT 162 and MATH 120 or COI. (1,2)

STAT 251. Linear Models I (3). Multidimensional normal distribution; distributions of quadratic forms; full rank models; estimation and tests of hypotheses. PR. STAT 142 and STAT 235 or COI. (1)

STAT 252. Linear Models II (3). Linear models not of full rank; experimental design models and components of variance models; distributional properties of point estimators; test of hypotheses. PR. STAT 251.

STAT 263. Sampling and Sample Surveys (3). Simple random, stratified, systematic, multistage and multiphase sampling; ratio and regression estimation; sampling with varying probabilities. PR. STAT 141 or COI.

STAT 264. Statistics for Epidemiology (3). Statistical methods in the collection, organization and analysis of epidemiologic data and subsequent interpretation. PR. STAT 1 or COI (1).

STAT 266. Time Series Analysis I (3). Stationary stochastic processes; covariance and autocorrelation functions; autoregressive and moving average processes. PR. COI. (1,2)

TM 232. Science and Technology Policy (3). The analysis of science and technology as "public goods", the evolution of government policies on science and technology (S&T), contemporary government policies on S&T and their interrelations with trade and industrial development protection of intellectual property, research and development, development of S&T, human resources, issues on the role of government in the management of S&T policies on the economy and society. (1,2)

VEPI 221. Veterinary Epidemiological Methods (3). Application of epidemiological concepts and methods for systematic inquiry into disease status of animal populations. PR. COI. (1)

VEPI 222. Veterinary Surveillance (3). Epidemiologic concepts and methods for surveillance of animal and zoonotic diseases. PR. COI. (1,S)

VEPI 225. Veterinary Risk Analysis (3). Introduction to Animal Health Risk Analysis. PR. COI. (1,2)

VEPI 226. Veterinary Informatics (3). Application of computer technology in veterinary epidemiology. PR. COI. (1,2)

VEPI 227. Environmental Animal Health (3). Factors that may have adverse effects on the health of animal and human populations, and the wider environment, and their management. PR. None. (1,2)

WLDL 258. Wildlife Population Dynamics (3). Analysis and prediction of changes in wildlife population. PR. STAT 162 or STAT 164 and WLDL 155 or its equivalent. (1)

ZOO 253. Ecology of Animal Parasites (3). Basic concepts and recent advances in the ecology of parasites affecting man and other vertebrates. PR. ZOO 173 or its equivalent.

ZOO 273. Advanced Animal Parasitology (3). Biology and control of parasite commonly affecting farm animals in the Philippines. PR. COI. (1,2)

Courses offered by UP Diliman

MATH 260. Actuarial Theory and Practice (3). Multiple life theory, multiple decrement theory, applications of multiple decrement theory, risk theory and introduction to credibility theory. PR. MATH 164 or equivalent.

MATH 261. Survival and Loss Models (3). Hazard rate function, analysis of various survival and loss models, credibility theory. PR. MATH 164 or equivalent.

MATH 262.1. Actuarial Science I (3). Gross premiums and asset shares, non forfeiture values, expense analysis, distribution of surplus, valuation of liabilities, product development process, introduction to life insurance accounting. PR. MATH 261 or COI.

MATH 262.2. Actuarial Science II (3). Selection of risks, reinsurance, introduction to investments analysis and finance management, insurance code, actuarial principles in special lines of insurance. PR. MATH 262.1 or COI.