ABOUT THE PROGRAM

York University has an active part-time M.A. Program especially designed for teachers who would like to improve their mathematics expertise. We welcome in particular students who have been away from formal schooling for some years. We recognize that teachers interested in this program may have completed their university studies some time ago, and our courses have been designed to take this into account.

This Program has been in existence since 1975. Ada Chan, Peter Gibson, Hanna Jankowski, Stan Kochman, Neal Madras, Georges Monette, Tom Salisbury, Paul Szeptycki, Steven Wang, Asia Weiss, Walter Whiteley, Michael Zabrocki and Hongmei Zhu are among its recent teaching staff.

The Program focuses on giving the students an overview of various mathematical fields and discusses mathematical issues of relevance to teachers. It will thus provide the teachers with a broader perspective on mathematics. It does not prepare students for study at the Ph.D. level in mathematics.

Courses in the Program will be scheduled in the evenings, usually with a three-hour session once a week for a course in the Fall-Winter term, and two three-hour sessions per course in the Summer term. Ordinarily, two courses are offered in the Fall-Winter session and one course in the Summer session.

In summer 2017, we will be offering MATH 5370 *Financial Mathematics for Teachers* and MATH 5430 *Statistics for Teachers*. In Fall/Winter 2017-18, we will be offering MATH 5020 *Fundamentals of Mathematics for Teachers*, MATH 5510 *Topics in Mathematics for Teachers (Combinatorics)*, and Math 5421 *Algebra for Teachers.*

ADMISSION

Graduates with a four-year degree in mathematics (or equivalent background) may be admitted as "Candidates" for the M.A. degree--that is, they will undertake a normal program of studies. Teachers with a three-year degree in mathematics and additional qualifications (e.g., a B.Ed.) or a four-year degree in a related discipline (science, engineering, etc) are also encouraged to enquire. An interview with the program coordinator may be required.

The application deadline for students wishing to apply either for the Fall/Winter or Summer terms is March 8, 2017.

The Graduate Admissions on-application website is:
http://futurestudents.yorku.ca/graduate/

COURSE REQUIREMENTS

The normal program of studies requires satisfactory completion of 36 credits, which must include Mathematics 5020 6.0 *Fundamentals of Mathematics for Teachers*, and Mathematics 5400 6.0 *History of Mathematics*. The remaining 24 credits will be chosen from among the Mathematics courses listed below.

The M.A. Program in Mathematics for Teachers, like all graduate programs at York, permits you to take some courses outside the program, including the Graduate Program in Education. These courses can be either additional courses or substitutes and can involve no extra fees. Contact the program coordinator for more information.

Students may complete their M.A. degree in two years, although study at a slower pace is also possible. For details on fees for this program, contact the Graduate Program in Mathematics & Statistics.

FURTHER INFORMATION

Each year, in late February/early March, we offer an information session for prospective applicants to the Teachers' Program. For details or further information, please call the Assistant of the Graduate Program in Mathematics and Statistics at 736-5250, ext. 33974 or visit:
http://mathstats.info.yorku.ca/gradprogram/

COURSE DESCRIPTIONS

MATH 5020 6.0 Fundamentals of Mathematics for Teachers
Number theory and combinatorics are branches of mathematics in which theorems and problems are usually easy to state but often difficult to prove or resolve. This course deals with topics in these two fundamental mathematical fields, including modular arithmetic, linear and quadratic diophantine equations, permutations and combinations, distributions and partitions, recurrence relations, generating functions, formal power series. Stress is placed on solving challenging problems.

MATH 5400 6.0 History of Mathematics
The course deals with the historical development of the main currents of mathematical thought from ancient to modern times, with emphasis on ideas of particular relevance to high school teachers. It is intended that this course give students an overview of mathematics and its relation to other disciplines. Presentation of various topics by students with ensuing discussions is an integral part of the course.

MATH 5100 3.0 Mathematical Literature Seminar for Teachers
The course deals with a variety of mathematical issues, and is intended to convince the students that mathematics is meaningful, that some of its problems are profound, and that the evolution of some of its ideas is an exciting chapter of intellectual history. Students are encouraged to present material in class, and one of the key objectives of the course is to develop in students the ability to read independently and critically in the relevant mathematical literature.

MATH 5210 3.0 Problem Solving I
This course aims to develop the student's problem solving ability by examining a variety of challenging problems from famous collections. Emphasis will be placed on problem solving techniques of wide applicability, such as recursion and iteration methods, generating functions and power series, transformation methods, vector methods (both geometric and algebraic), and congruences.

MATH 5220 3.0 Problem Solving II
This course continues with problem solving techniques begun in MATH 5210. Emphasis will be placed on problem solving techniques such as symmetry, pigeonhole principle, series summations, applications of calculus, and estimation.

MATH 5300 6.0 Computation and Mathematics for Teachers
This course will concentrate on the role of computation in mathematics relying on popular software designed for this purpose. The examples to be discussed will be chosen from applied mathematics using high school calculus, elementary number theory, probability, numerical approximation of familiar constants and discrete mathematics. The intention will be that any one of the topics could serve as the basis for supplementary material or a project for highly motivated students in the final years of high school. Students taking this course will be evaluated on the basis of reports written on each of the topics discussed.

Math 5350 3.0 An Introduction to Mathematical Modeling - Discrete-Time and Probability
This course provides an introduction to discrete-time and probabilistic mathematical models. The course focuses on the mathematical methods underlying scientific inquiry and discovery. Through hands-on exploration and reflection, students will examine topics such as historical connections between mathematics and science, empirical modeling, model validation, proportionality, and simulation. The course starts with an overview of the modeling process and a review of relevant technology - Texas Instrument TI-92, the Internet and the World Wide Web, Java applets and computer algebra systems. Strategies to initiate modeling in the secondary classroom and classroom assessment of modeling activities are introduced and discussed. Topics include difference equations, Markov chains, and leslie matrices, applied to problems in biology, the environment, and finance i.e. modeling infectious disease spread, species extinction, power delivery. Particular attention is given to topics in the intermediate and senior Ontario curriculum.

Math 5360 3.0 An Introduction to Mathematical Modeling – Continuous-Time and Probability
This course provides an introduction to continuous-time and probabilistic mathematical models. The course focuses on the mathematical methods underlying scientific inquiry and discovery. Through hands-on exploration and reflection, students will examine topics such as historical connections between mathematics and science, empirical modeling, model validation, proportionality, and simulation. The course starts with an overview of the modeling process and a review of relevant technology - Texas Instrument TI-92, the Internet and the World Wide Web, Java applets and computer algebra systems. Strategies to initiate modeling in the secondary classroom and classroom assessment of modeling activities are introduced and discussed. Particular attention is given to topics in the intermediate and senior Ontario curriculum.

Math 5370 3.0 Financial Mathematics for Teachers
The course will examine a broad range of financial applications of mathematics, focusing particularly on those that involve probability. These include insurance, annuities, mortgages, stocks, bonds, options, futures, and derivative securities. The uses of derivatives will be discussed and also their misuses. The mathematization of finance is a consequence of relatively recent discoveries about how to hedge financial risks. The course will study both hedging, and the mathematics that underlies it.

MATH 5411 3.0 Analysis for Teachers
Real Analysis is the formal study of the mathematics that surrounds calculus. Complex Analysis adds a geometric layer to this study. Both developed greatly in the nineteenth century, which in turn changed the way calculus is taught. To understand where the modern approach to calculus comes from, and how analytic ideas are used, the course explore topics and problems from real and complex analysis that involve objects that are less smooth than those assumed in Calculus classes. These may include fractals, the Cantor function, recursion, bifurcation and chaos, iteration and the Mandelbrot set, and the Fourier series for Brownian motion. Techniques drawn on may include estimation and inequalities, polynomial approximation and splines, proofs, and also computer experiments. A good knowledge of calculus is assumed, but no prior course in real or complex analysis is required.

MATH 5420 6.0 Algebra for Teachers
The intent of this course is to give the student an appreciation of mathematical structure through the study of fields, rings and groups, with examples from,

and applications to, number theory and geometry. Emphasis is placed on how modern algebra unifies diverse results, and how it sheds light on classical algebraic problems. For example, field extensions will be applied to problems of construction with ruler and compass; factorization theory in integral domains will be applied to solutions of diophantine equations.

MATH 5430 3.0 Statistics for Teachers
This course includes a review of the concepts underlying the Ontario high school course: MDM4U: Mathematics of Data Management. Use of public data to address social issues, data analysis and visualization using the Fathom statistical package, fundamental issues, controversies and paradoxes in statistical inference, association and causation, Simpsons Paradox, ecological correlation, conditional association and stratification. Topics of this course shall include applications of statistics to analyzing data such as polls, medical results and news reporting.

MATH 5440 3.0 Probability for Teachers
The course covers an overview of probability that is appropriate for teachers responsible for a course on Data Management. Random variables, expected value, probability paradoxes, and applications to gambling and cryptography.

MATH 5450 6.0 Geometry for Teachers
This course will expose students to the richness and variety of geometrical methods. Various geometries including euclidean, affine, projective, inversive, noneuclidean, and finite geometries, and the transformations associated with these geometries, will be studies from the unifying point of view of affine and metric affine geometry. Many applications to euclidean geometry will be given.

MATH 5451 3.0 Topics in Geometry for Teachers
Topics will be chosen from among areas of geometry of interest to teachers. Potential topics include: polyhedra; symmetry in 2-D and 3-D with applications to tilings and classification of plane polygons using symmetry; geometric transformations and Klein's Hierarchy of Geometries; conic sections; problem solving in plane geometry, including proofs of theorems. The course will use physical manipulatives and dynamic geometry programs (e.g. GSP).

MATH 5510 3.0 Topics in Mathematics for Teachers
Topics in mathematics chosen according to the interests of students. Typical subject material might include set theory and logic, cryptography, symmetry and group actions, mathematical finance or applications of mathematics in the physical and social sciences.

Math 5840 3.0 Mathematics Learning Environments
This course explores issues in mathematics education in light of new developments in cognitive theory, in order to characterize environments for learning mathematics that are both learner centered and knowledge centered. Topics include mathematics learning as a social/cultural experience, mathematics as sense making, the impact of technology on mathematics learning environments.

MATH 5900 3.0 Thinking about Teaching Mathematics
This course invites participants to reflect on the practice of teaching mathematics in light of research and their own experiences. It examines how teachers draw on mathematical and pedagogical knowledge in their work. A specialized mathematics background is not a prerequisite.

Mathematics 5910 3.0 Quantitative Research Methods
This course deals with the principles of scientific reasoning and how they inform the research process. The theoretical and practical problems involved in data collection are examined (questionnaire construction, interview procedures, sample design). The second part of the course concentrates on the logic of analysis used in assessing and interpreting data. No formal knowledge of statistics is required.

Math 5920 3.0 Research in Mathematics Education
This course involves participants in the analysis of a diverse range of theoretical and methodological approaches to mathematics education research. Through an evaluation of the literature participants develop an understanding of contemporary issues and debates within the mathematics education community.

Math 5848 3.0 Technology & Math Education
This course will involve participants in critically examining the role of technology in the teaching and learning of mathematics. Readings and experiences with technological applications will provide the basis for analysis of central themes and issues. A specialized mathematics background is not a prerequisite.

GRADUATE DIPLOMA IN MATHEMATICS EDUCATION

The Graduate Diploma in Mathematics Education focuses on mathematics education as an area of study grounded in critical examination of teaching practice, learning theories, and curriculum, and supported by analyses of socio-cultural, equity, and gender issues in the teaching and learning of mathematics. It is designed to provide opportunities for graduate level study of theories and research in Mathematics Education, as well as enriched mathematical experiences and reflection on the practice of mathematics, to practicing teachers and administrators and to people in the community whose work involves developing mathematical literacies.

The Graduate Diploma in Mathematics Education is jointly offered by the Graduate Program in Education and the Graduate Program in Mathematics and Statistics. For students in the MA in Mathematics for Teachers, the diploma will provide a recommended pathway towards future Ph.D. studies in Mathematics Education.

If you need further information, please contact Walter Whiteley (whiteley@mathstat.yorku.ca).

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Master of Arts in Mathematics for Teachers