MATH 2731 Mathematical Problem Solving

Course Outline - Fall 2023

- Instructor: Dr. LI, Kin Yin Contact Details: Rm 3471; Phone 2358-7420; email: <u>makyli@ust.hk</u> Office Hour: By appointment
- 2. Teaching Assistant: Mr. ZHANG, Huai Gong Contact Details: email: <u>hzhangdg@connect.ust.hk</u>
- 3. Meeting Time and Venue Lectures: CYT G009B Tutorial: Room 2464

Date/Time: Tuesday, Thursday 09:00 – 10:20 Date/Time: Thursday 6:00pm – 6:50pm

4. Course Description

Credit Points: 3 Pre-requisite: Math 1003, 1012, 1014 or 1023 Exclusion: Nil Brief Information/Synopsis: The course aims to improve students' ability to solve challenging problems for math competitions such as the Simon Marais Math Competition

5. Intended Learning Outcomes (ILOs)

Upon the end of the course, the students should have opportunities to and be able to ILO A. Recognize the power of abstraction and generalization and apply logical reasoning to investigate mathematical work with independent judgement ILO B. Collaborate and communicate effectively for creative solutions ILO C. Apply rigorous deductive reasoning in conjunction with quantitative methods to analyse and solve problems related to the math profession.

All ILOs are for all assessment and class activities except for ILO B during examinations.

- 6. Assessment Scheme Homework 50%, Midterm 25% and Final exam 25% All marks will be posted on Canvas as soon as they are available.
- Student Learning Resources Lecture Notes, Readings (Mathematical Excalibur, IMO past papers, all kinds of mathematical competition (regional level or above)) Lecture notes will be posted on Canvas
- 8. Teaching and Learning Activities
 - a. 3 Hour Lectures: focus on techniques for solving advanced math problems in competition level
 - b. 1 Hour Tutorial: in class and assigned homework assignments and exams are used to measure the students' understanding and improvement

9. Course Schedule

Keyword Syllabus:

- Pairing Method, telescoping method, binomial sums, Fubini principle
- AM-HM-GM, Cauchy Schwarz, rearrangement, power mean inequalities
- Functional equations
- Modulo arithmetic, Fermat-Euler theorem, Chinese remainder theorem
- Divisibility problems and Diophantine equations
- Pigeonhole and inclusion-exclusion principles
- Recurrence relations and generating functions
- Mathematical games
- Geometry problems solved via coordinates, complex number, vector methods