<u>Course Outline</u>

Course Code: **MATH6041A**

Course Title: **Topics in Differential Equations I**

<u>Fall 2023</u>
3:30pm-6:15pm, Every Tuesday (September 5, 2023 – December 5, 2023)

<u>Venue</u>: Room G03, G/F, Academic Building No. 1, CUHK

<u>Mode</u>: Face-to-Face

<u>Assessment Scheme</u>:
Each student will be asked to write a report on a topic assigned by the teacher.

<u>Course Contents</u>:
Some topics on Multi-Dimensional Systems of Hyperbolic Conservation Laws:
- Introduction;
- Cauchy problem and Friedrich's theory on Symmetric hyperbolic systems;
- Blow-up of Smooth Solutions and formation of shocks:
    - Scalar equations;
    - Plane waves and formation of shocks for 1D systems;
    - Sideris theory of blow-up of smooth solutions to the compressible Euler systems.
- IBVP;
- Weak solutions:
    - Shock front solutions;
    - Rarefaction waves;
    - Contact discontinuities;
    - Some physical wave patterns;
    - Transonic flows
    - Non-uniqueness of weak solutions.
- Other related topics……

<u>References</u>:
1. Tai Ping Liu, Shock Waves, 215 AMS
2. J. A. Smoller: Shock Waves and Reaction-Diffusion Equations, Spring-Verlag
3. C. M. Dafermos: Hyperbolic Conservation Laws in Continuous Mechanics
4. A. Majda: Compressible Fluid Flows and System of Conservation Laws in Several Space Variables
5. D. Serre: Systems of Conservation Laws: Vol. 1 & 2, 1999.