香 港 資 優 教 育 學 苑
The Hong Kong Academy for Gifted Education

Dynamical Systems in Medicine (MATS2960)

Introduction	Many things change over time. Turn on a heater and the heat spreads through the room – at each point in the room, we can measure the temperature at that point and observe how it changes with time. Take a pill when you are sick and the molecules of the drug spread around your body over time – understanding this is crucial to ensure that the medicine is doing its job. The study of how things change over time is called "Dynamical Systems". In this course, we will learn the basics of dynamical systems and the tools used to study them. Through this, we will learn about pharmacokinetics - the study of how a drug moves around the body and the considerations that must be taken when creating medicines. Dynamical systems are also used to study how diseases spread in a population. In light of the global COVID-19 pandemic, we will also study aspects of epidemic modelling in this course. In particular, we will learn about the celebrated SIR model and understand what implications the various parameters have on the spread of a disease. The instructor, Dr Jonathan Tsai, obtained his PhD in Mathematics from the University of Cambridge in 2008. Since then he has worked at all levels of mathematics including cutting-edge research and high school mathematics education.
Programme Type / Level	Across Domains and Interdisciplinary Course (Level 3) (Token-required)
Instructor(s)	Dr Tsai Hin Tung Jonathan
Pre-requisites	Knowledge in: 1. differentiation (techniques, rates and stationary points) and integration (antidifferentiation, techniques) is required; 2. human biology is useful.
Target Participants	➢ S1 – S6 HKAGE student members ➢ Class size: 30 For students applied on or before 4 May, they MUST submit the Screening Test answers **no later than 11 May 2020** (Mon) at **12 noon** For students applied after 4 May, they MUST submit the Screening Test answers **no later than 25 May 2020** (Mon) at **12 noon**
Medium of Instruction	English with English handouts

Certificate

E-Certificate will be awarded to participants who have:

- Attended **at least 3 sessions AND**
- Completed all assignments with **satisfactory performance** in the course tests

Intended Learning Outcomes

Upon completion of the programme, participants should be able to:

1. apply the theory of dynamical systems to a wide range of fields;
2. solve simple problems by dynamical system and compartment modelling in real-life situations;
3. solve simple problems related to pharmacokinetics.

Application Deadline

18 May 2020
12:00 n.n.

Application Result Release Date

29 May 2020

If student members withdraw from the programme after the Application Deadline, the token will be deducted.

Schedule

Session	Date	Time	Venue (HKAGE)
~~Submission Deadline of Screening Test~~	~~11 May or 25 May~~ **[Cancelled]**	~~12:00 n.n.~~	---
~~1~~	~~13 Jun~~ **[Cancelled]**	~~9:00 a.m. – 12:00 n.n.~~	~~Room 403~~
~~2~~	~~20 Jun~~ **[Cancelled]**		
~~3~~	~~27 Jun~~ **[Cancelled]**		
~~4~~	~~4 Jul~~ **[Cancelled]**		~~TBC~~

Remarks:

1. For students **applied on or before 4 May**, Screening Test paper will be **sent on 8 May (Fri)** through email. Students must return their answers through email **no later than 11 May (Mon) at 12 noon**.

   For students applied **after 4 May**, Screening Test paper will be **sent on 22 May (Fri)** through email. Students must return their answers through email **no later than 25 May (Mon) at 12 noon.**

   Late submission will not be considered.

2. For any assessment to be held in the programme, no make-up will be arranged, including Screening Test.

Sample Examples for the Programme	1) Under the SIR model, define the basic reproduction number of an epidemic and discuss how the values represent different phases of an epidemic. 2) The plasma concentration of a drug after a bolus dose is assumed to be an exponential function C(t)=0.38exp(-1.7t). Compute the mean residence time and distribution volume of the dose. 3) Describe the two-compartment model of drug distribution in the body. Demonstrate how the basic pharmacokinetic parameters can be deduced from the rate constants in this model.
Enquiries	For enquiries, please contact us at 3940 0101 after language selection, press “1”.