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 III) (Token-required)
Instructor(s)	Dr Tsai Hin Tung Jonathan
Pre-requisites	Students should have the basic 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 All applicants **MUST** attend the **Screening Test** held on **15 May 2021**
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	**10 May 2021 12:00 n.n.**	Application Result Release Date	**28 May 2021**

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

Schedule

Session	Date	Time	Venue (HKAGE)
Screening Test	15 May	10:00 a.m. – 11:00 a.m.	Room 105
1	2 Aug	9:00 a.m. – 12:00 n.n.	Room 203
2	4 Aug		
3	6 Aug		
4	9 Aug		

Remarks:

For any assessment to be held in the programme, including the screening test, no make-up will be arranged.

Sample Notes

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 Academic Programme Development Division on 3940 0101 after language selection, press "1".