**THE EDUCATION UNIVERSITY OF HONG KONG**

**Course Outline**

**Part I**

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**Programme Title :** Master of Arts in Mathematics and Pedagogy

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| **Programme QF Level :** | 6 |

**Course Title :** Calculus and Mathematical Modelling

**Course Code :** MTH6131

**Department :** Mathematics and Information Technology

**Credit Points :** 3

**Contact Hours :** 39

**Pre-requisite(s) :** Nil

**Medium of Instruction :** English supplemented with Chinese

**Course Level :** 6

**Part II**

The University’s Graduate Attributes and seven Generic Intended Learning Outcomes (GILOs) represent the attributes of ideal EdUHK graduates and their expected qualities respectively. Learning outcomes work coherently at the University (GILOs), programme (Programme Intended Learning Outcomes) and course (Course Intended Learning Outcomes) levels to achieve the goal of nurturing students with important graduate attributes.

In gist, the Graduate Attributes for Undergraduate, Taught Postgraduate and Research Postgraduate students consist of the following three domains (i.e. in short “PEER & I”):

* **P**rofessional **E**xcellence;
* **E**thical **R**esponsibility; **&**
* **I**nnovation.

The descriptors under these three domains are different for the three groups of students in order to reflect the respective level of Graduate Attributes.

The seven GILOs are:

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| 1. Problem Solving Skills |
| 2. Critical Thinking Skills |
| 3. Creative Thinking Skills |
| 4a. Oral Communication Skills |
| 4b. Written Communication Skills |
| 5. Social Interaction Skills |
| 6. Ethical Decision Making |
| 7. Global Perspectives |

1. **Course Synopsis**

We aim to let students learn practical and modelling skills, beyond elementary calculus, in solving various daily life problems that are originally raised from different dynamical situations. This course will enable students to experience the different kinds of modelling techniques to solve real life problems in various situations. Practical applications and approaches will be employed with the aids of problem solving techniques in differential equations and difference equations while optimization and numerical techniques will also be introduced.

1. **Course Intended Learning Outcomes** (CILOs)

*Upon completion of this course, students will be able to:*

CILO1 Demonstrate an ability to apply calculus techniques to solve practical problems

* + - * 1. Show understanding and demonstrate basic knowledge of differential and integral calculus
        2. Demonstrate the understanding of the properties of multivariable functions and basic skills of partial differentiation
        3. Demonstrate the techniques of solving practical problems using elementary calculus

CILO2 Demonstrate an understanding of various types of differential equations and their solutions, and difference equations

1. Show understanding of classification of differential and difference equations
2. Show comprehensive knowledge of initial values, solutions, existence and uniqueness, and properties of solutions

CILO3 Demonstrate skills and standard techniques of solving differential equations and difference equations

1. Show various analytic techniques in solving linear first order equations, system of linear first order equations
2. Show ability to solve system of equations by linear algebra techniques
3. Show ability to solve practical problems
4. Show understanding of basic numerical techniques and other methods by using scientific computational tools

CILO4 Demonstrate an understanding of mathematical modeling

1. Show understanding of Elementary modelling techniques in dealing with a real life problems
2. Show ability to interpret solutions and analyze the dynamical characteristics of the solutions of modelling equations
3. **Content, CILOs and Teaching & Learning Activities**

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| **Course Content** | **CILOs** | **Suggested Teaching & Learning Activities** |
| Revision on differential and integral calculus | *CILO1* |  |
| Introduction to ordinary differential equations and difference equations. Techniques of solving linear, ordinary differential equations and difference equations | *CILO1,2,3,4* | Group activity in classroom; demo on the formation of an ODE |
| Numerical techniques and other methods, with scientific computational tools, of solving equations | *CILO3,4* | Lab visit;  experience on using computational tools |

1. **Assessment**

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| **Assessment Tasks** | | **Weighting (%)** | **CILO** |
| (a) | Two assignments | 20 | *CILO1,2,3,4* |
| (b) | Written midterm examination on the content materials | 20 | *CILO1,2,3,4* |
| (c) | Written examination on the content materials | 60 | *CILO2,3,4* |

1. **Required Text(s)**

Nil

1. **Recommended Readings**

Barnes, B. & Fulford, G. (2002). *Mathematical Modelling with case studies: a differential equation approach*. Taylor & Francis, London.

Boyce, W. E. & DiPrima, R.C. (2012). *Elementary Differential Equations and Boundary* *Value Problems*. (10th ed.). John Wiley & Sons.

Fulford, G., Forrester, P. & Jones, A. (1997). *Modelling with Differential and Difference Equations.* Cambridge University Press, New York.

Jordan, D.W. & Smith, P. (2008). *Mathematical Techniques – An Introduction for the engineering, physical, and mathematical sciences*. (4th ed.). Oxford University Press.

Nagle, R.K, & Snider, A.D. (2012). *Fundamentals of Differential Equations*. (8th ed.). Pearson.

Rosenblatt, J. & Bell, S. (1999). *Mathematical Analysis for Modeling.* CRC Press LLC.

Spiegel, M.R. (1988), *Schaum’s Outline of the Theory and Problems of Probability* and *Statistics*, McGraw-Hill.

1. **Related Web Resources**

<http://www.sosmath.com/diffeq/modeling/modeling.html>

<http://tutorial.math.lamar.edu/Classes/DE/Modeling.aspx>

<http://www.math.cmu.edu/~handron/21_124/>

1. **Related Journals**

Nil

1. **Academic Honesty**

The University adopts a zero tolerance policy to plagiarism. For the University’s policy on plagiarism, please refer to the *Policy on Academic Honesty, Responsibility and Integrity with Specific Reference to the Avoidance of Plagiarism by Students* (<https://www.eduhk.hk/re/modules/downloads/visit.php?cid=9&lid=89>). Students should familiarize themselves with the Policy.

1. **Others**

Nil

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