[A-3]COURSE SYLLABUS

1. Course Description (Approximately 100 words)

This course introduces students to the theory and practice of modeling biological systems from the molecular to the organism level with an emphasis on intracellular processes. Topics covered include kinetic and equilibrium descriptions of biological processes, systematic approaches to model building and parameter estimation, analysis of biochemical circuits modeled as differential equations, modeling the effects of noise using stochastic methods, modeling spatial effects, and modeling at higher levels of abstraction or scale using logical or agent-based approaches. A range of biological models and applications will be considered including gene regulatory networks, cell signaling, and cell cycle regulation. Weekly lab sessions will provide students hands-on experience with methods and models presented in class

2. Course Goals and Objectives (Approximately 100 words)

This course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialised knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project. The general goals and objectives include but not limited to an understanding in the:

structural and chemical biology including nucleic acid structure and interactions, signaling proteins and membrane proteins, enzyme kinetics and drug discovery and protein design.

From genome to proteome, including all steps in eukaryotic gene expression from chromatin accessibility to translation and mRNA turnover.

3. Textbook (Title, Author, Publisher, Year of Publication, etc.)

The Analysis of Biological Data 1st Edition by Michael C. Whitlock (Author), Dolph Schluter (Author)

Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids 1st Edition by Richard Durbin (Author), Sean R. Eddy (Author), Anders Krogh (Author)

Biological Science, 2017 by Scott Freeman (Author), Kim Quillin (Author), Lizabeth Allison (Author), Michael Black (Author)

4. Reference

Biology of Sensory Systems 2nd Edition by C. U. M. Smith (Author)

5. Course Requirements and Grades

EXAMINATION = 70%
QUIZ = 20%
C.A.T. = 10%

6. Course Calendar

Week	Main Content
1	INTRODUCTION
2	INTRACELLULAR PROCESSES
3	GENE NETWORKS
4	Mechanisms of Gene Regulation
5	metabolic control analysis
6	metaTIGER
7	C.A.T.
8	Modeling the dynamics of cellular networks
9	Why network?
10	REVERSE ENGINEERING OF BIOLOGICAL NETWORKS
11	Biological networks – Boolean networks, Bayesian networks
12	Network flexibility and robustness:
13	Measurement of centrality and importance in bio-molecular networks
14	EXAMINATION