SRM UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF BIOINFORMATICS

BI0308- SYSTEMS BIOLOGY

LECTURE PLAN

SEMESTER: VI **Course: Systems Biology**
CODE: BI0308 **Staff Handling: Dr. N. Rathankar**
Total Hours: 45

LECTURE	TOPIC	LEARNING OUTCOME
1	**UNIT I-INTRODUCTION** Basic principles of Systems Biology.	o **Introduction to Systems Biology** o **Types of methods to study Systems Biology** o **Review of Experimental methods, their uses in biology**
2	Approaches used in Systems Biology	
3	Uses of Systems Biology and introduction to modeling	
4	Examples in systems Biology and differences between SB and Bioinformatics	
5	Restriction enzymes and gel electrophoresis	
6	Cloning vectors and DNA libraries	
7	1D and 2D protein gels, overview of separation techniques.	
8	Hybridization and Blotting techniques	
9	**UNIT II- STANDARD MODELS AND APPROACHES** Introduction to Metabolism, glycolysis pathway modeling	o **Mathematical modeling techniques** o **Compartment models** o **Sensitivity analysis**
10	Enzyme kinetics introduction with modeling studies	
11	Reaction kinetics, Thermodynamics	
12	Parameter estimation	
13	Metabolic networks, Stoichiometric matrix	
14	Elementary flux modes and extreme pathways	
15	Flux balance analysis, conservation principles, types of approximations	
16	Metabolic control analysis, determining coefficients	
17	Elasticity and response sensitivity	
18	Applications	
19	**UNIT III- BIOLOGICAL PROCESSES** Introduction to signal transduction	o **Understanding Signal**

20	Functions and structure of inter cellular signal transduction	**transduction process** o **Understanding pathways, and motifs**
21	Modeling receptor-ligand interactions	
22	Structural components of signaling pathway	
23	G-proteins, ras proteins	
24	Phosphorelay systems, MAP Kinase cascades	
25	JAK-STAT pathways, motifs, adaptation motifs	
26	Biological oscillations	
27	Cell cycle	
28	Aging	
29	**UNIT IV-EVOLUTION** Introduction to evolution and self organization	o **Understanding evolution** o **Deriving mathematical models to understand evolution** o **Genetic algorithms** o **Data integration** o **Applications of data integration in biology**
30	Quasispecies and hypercycles	
31	Self replication without interactions, selection and the quasispecies models	
32	Genetic algorithm	
33	Hypercycles	
34	Spin glass model	
35	Neutral theory of molecular evolution	
36	Data integration, Database networks	
37	SRS, ENSMART, DISCOVER LINK	
38	**UNIT V-APPLICATIONS** Systems biology in medical research	o **Applications of Systems Biology in other related fields** o **Limitations of Systems Biology** o **Databases used in systems Biology** o **Modeling tools used in systems biology** o **Usage of SIMBIOLOGY toolbox in Systems Biology.**
39	Experimental planning and publications	
40	Systems Biology in text mining and drug development	
41	Computational limits and potential dangers of systems biology	
42	Databases needed for systems biology: Gene ontology, KEGG, BRENDA, NCBI, EBI	
43	REACTOME, TRANSFAC	
44	Modeling tools: Mathematica and MATLAB	
45	SIMBIOLOGY Toolbox in Matlab	

TEXT BOOK

1. Edda Klipp, Ralf Herwig, *Systems Biology in Practice-Concepts, Implementation and Application*, Wiley VCH, I Edition, 2005.
2. Lilia Alberghina, Hans V. Westerhoff, *Systems Biology: Definitions and Perspectives*, Springer, 2005.

REFERENCE BOOK

1. Andrzej K. Konopka, Systems Biology: Principles, Methods, and Concepts, CRC Press, 2006.
2. Darren James Wilkinson, *Stochastic Modelling for Systems Biology*, CRC Press, 2006.

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