STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI –600 086
(For candidates admitted from the academic year 2023 – 2024 & thereafter)

M. Sc. DEGREE EXAMINATION, APRIL 2026
BIOINFORMATICS
FOURTH SEMESTER

COURSE : CORE
PAPER : SYSTEMS BIOLOGY
SUBJECT CODE : 23BI/PC/SM44
TIME : 3 HOURS MAX. MARKS: 100

Q. No.	SECTION A (10 x 1=10 marks) All questions to be answered	CO	KL
1	Systems biology primarily focuses on ____ a. Studying individual genes in isolation b. Systematic study of complex interactions in biological systems. c. Traditional wet-lab experiments only d. Classification of organisms.	CO1	K1
2	Which of the following is not a characteristics of systems biology? a. Holistic b. Predictive c. Isolated d. Integrative	CO1	K1
3	Which of the following is a limitation of static models? a. Include real-time execution events b. Consider long time processes c. Ignore events during execution d. Model system dynamics	CO1	K1
4	Biological food chain is an example of ___ type of network	CO1	K1
5	_____ represents biological relationships in a Boolean network.	CO1	K1
6	The holistic approach in systems biology means: a. Studying each gene separately b. Studying the system as a whole c. Ignoring interactions d. Studying only proteins	CO2	K2
7	Mathematical models in systems biology are mainly used to a. Store biological samples b. Predict behavior of biological systems c. Identify bacteria d. Sequence DNA	CO2	K2
8	A metabolic network mainly shows _____.	CO2	K2
9	Which of the following is not a metabolic network database? a. KEGG b. Reactome c. EMP d. STRING	CO2	K2
10	Euler's group theory consisted of ___ bridges.	CO2	K2
Q. No.	**SECTION B (10 x 2= 20 marks) Answers in about 50 words**	**CO**	**KL**
11	Why is systems biology called an integrative science?	CO3	K3
12	Explain any two properties of a good biological model.	CO3	K3
13	What is model behavior? Why is it important?	CO3	K3
14	Describe the general structure of a promoter.	CO3	K3
15	Write a short note on gene expression modeling.	CO3	K3
16	What is whole-cell simulation?	CO4	K4
17	Mention the applications of ECELL or VCELL.	CO4	K4
18	How are metabolic networks represented in systems biology?	CO4	K4
19	What is the role of EMP database?	CO4	K4
20	Mention any two challenges in systems biology modeling.	CO4	K4

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Q. No.	SECTION C (4 x 10= 40 marks) **Answer in about 600 words**	CO	KL
21	a) Explain systems biology as a living science and discuss the importance of data integration. **(OR)** b) Explain enzyme kinetics and thermodynamics in metabolic network modeling.	CO4	K4
22	a) Describe different approaches used for promoter identification. **(OR)** b) Explain promoter identification and sequence-based prediction of promoters.	CO4	K4
23	a) Explain whole-cell modeling using the human erythrocyte model and its applications. **(OR)** b) Describe simulation of cellular subsystems involving metabolites and enzymes.	CO5	K5
24	a) Explain the concepts and enabling technologies of synthetic biology in genome editing. **(OR)** b) Describe biological databases used in systems biology such as KEGG, MetaCyc, and AraCyc.	CO5	K5
Q. No.	**SECTION D (2x 15=30 marks)** **Answer any TWO questions in about 1200 words**	**CO**	**KL**
25	Explain the principles of systems biology modeling and discuss how different biological networks are integrated.	CO5	K6
26	Describe in detail the methods used to model gene expression and regulatory networks.	CO5	K6
27	Explain signal transduction networks and gene regulatory networks with examples.	CO5	K6
28	Discuss applications of synthetic biology in gene therapy, microbiome engineering, and optogenetics.	CO5	K6

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