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Printed Page:-3 **Subject Code:- BBT0413**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: IV - THEORY EXAMINATION (2025 - 2026)
Subject: System Biology

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*
1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. *Maximum marks for each question are indicated on right -hand side of each question.*
3. *Illustrate your answers with neat sketches wherever necessary.*
4. *Assume suitable data if necessary.*
5. *Preferably, write the answers in sequential order.*
6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

(1.1) Gene control helps a cell to: (CO1,K1) 1

(a) Express all genes continuously
(b) Express genes randomly
(c) Express required genes at the right time
(d) Stop DNA replication

(1.2) The biochemical paradigm mainly focuses on:(CO1,K1) 1

(a) Gene networks
(b) Enzyme reactions and pathways
(c) Computer models
(d) Population genetics

(1.3) Gene regulation helps cells to: (CO2,K1) 1

(a) Express all genes
(b) Express randomly
(c) Express required genes
(d) Stop division

(1.4) Lac repressor binds to:(CO2,K1) 1

(a) Promoter
(b) Gene
(c) Ribosome
(d) Operator

(1.5) Quorum sensing activates genes when: (CO3,K2) 1

(a) Low density
(b) No AI
(c) AI threshold reached
(d) Cells die

(1.6) Gram-negative AI enters cells by: (CO3,K1) 1

(a) Active transport
(b) Endocytosis
(c) Passive diffusion
(d) Pump

(1.7) Peptide autoinducers in Gram-positive bacteria are transported by: (CO4,K2) 1

(a) Passive diffusion
(b) Osmosis
(c) ABC transporters
(d) Endocytosis

(1.8) LuxI protein is responsible for: (CO4,K2) 1

(a) DNA replication
(b) Autoinducer synthesis
(c) Cell division
(d) Protein digestion

(1.9) Enzyme inhibition means: (CO5,K1) 1

(a) Increasing enzyme activity
(b) Reducing enzyme activity
(c) Making DNA
(d) Producing light

(1.10) Non-competitive inhibition mainly decreases:(CO5,K1) 1

(a) Km only
(b) Vmax
(c) Temperature
(d) pH

2. Attempt all parts:-

(2.1) What is meant by gene control in a cell? (CO1,K2) 2

(2.2) What is induction in gene regulation? (CO2,K2) 2

(2.3) Name one signaling molecule used by Gram-negative bacteria. (CO3,K1) 2

(2.4) How does systems biology differ from traditional biology? (CO4,K2) 2

(2.5) What is the function of the promoter region? (CO5,K2) 2

SECTION-B 30

Answer any one of the following:-

(3.1) Explain gene regulation and its importance in cellular functioning. (CO1,K2) 6

(3.2) Explain the mechanism of transcription in prokaryotes. (CO1,K2) 6

Answer any one of the following:-

(3.3)	Explain gene regulation and its importance in cellular processes. (CO2,K2)	6
(3.4)	Explain enzyme kinetics and its importance. (CO2,K2)	6

Answer any one of the following:-

(3.5)	Discuss the differences between Gram-positive and Gram-negative quorum sensing systems. (CO3,K2)	6
(3.6)	Discuss the role of quorum sensing in virulence factor production. (CO3,K2)	6

Answer any one of the following:-

(3.7)	Explain the concept of systems biology and its importance in modern biological research. (CO4,K2)	6
(3.8)	Explain regulatory networks and their significance in maintaining cellular functions. (CO4,K2)	6

Answer any one of the following:-

(3.9)	Compare systems biology with the traditional reductionist approach in biology. (CO5,K4)	6
(3.10)	Explain how allosteric regulation influences enzyme function in metabolic pathways. (CO5,K2)	6

SECTION-C 50

4. Answer any one of the following:-

(4.1)	Explain the fundamentals of gene control and its importance in cellular function. Discuss negative and positive control of gene expression. (CO1,K2)	10
(4.2)	Describe the mechanisms involved in gene regulation in prokaryotes and eukaryotes. (CO1,K2)	10

5. Answer any one of the following:-

(5.1)	Differentiate between allosteric inhibition and competitive inhibition. (CO2,K2)	10
(5.2)	Describe the importance of lac operon and allosteric regulation in biotechnology and medicine. (CO2,K2)	10

6. Answer any one of the following:-

(6.1)	Describe the quorum sensing mechanism in Gram-negative bacteria with reference to the LuxI/LuxR system. (CO3,K2)	10
(6.2)	Explain feedback inhibition and feedback activation with suitable examples. (CO3,K2)	10

7. Answer any one of the following:-

(7.1)	Critically compare systems biology with reductionist biology, highlighting their advantages and limitations. (CO4,K2)	10
(7.2)	Compare competitive, non-competitive, and allosteric inhibition in terms of mechanism and biological significance. (CO4,K2)	10

8. Answer any one of the following:-

(8.1)	Discuss how systems biology offers a holistic framework for studying complex biological systems compared to conventional approaches. (CO5,K2)	10
(8.2)	Describe the interaction of multiple signaling pathways in maintaining effective cellular communication. (CO5,K2)	10