Printed Page:- 04 **Subject Code**:- **ABT0602**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VI - THEORY EXAMINATION (2023 - 2024)

Subject: Metabolic Engineering

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-a. Which of the following best defines metabolic engineering? (CO1) 1

(a) The study of metabolic pathways in cells

(b) The manipulation of cellular metabolism to produce desired products

(c) The optimization of enzymatic reactions in the human body

(d) The analysis of metabolic diseases in organisms

1-b. What is the primary advantage of using microbial hosts in metabolic engineering? (CO1) 1

(a) They are easy to genetically manipulate

(b) They have a faster growth rate compared to other organisms

(c) They have a larger genome size

(d) They can produce complex secondary metabolites

1-c. _____ is used for balancing chemical reactions (CO2) 1

(a) Electron balancing

(b) Elemental balancing

(c) Stoichiometry balancing

(d) All of the above

1-d. Constraint based Reconstruction and Analysis involves _____(CO2). 1

(a) Flux variability analysis

(b) Linear programming

(c) Quadratic programming

(d) All of the above

1-e. _____ is used for balancing chemical reactions (CO3) 1

(a) Electron balancing

(b) Elemental balancing

(c) Stoichiometry balancing

(d) All of the above

1-f. Constraint based Reconstruction and Analysis involves ----------(CO3). 1

(a) Flux variability analysis

(b) Linear programming

(c) Quadratic programming

(d) All of the above

1-g. These circuits use Boolean logic gates to control the expression of metabolic enzymes based on the presence or absence of specific inputs (CO4). 1

(a) feedforward circuits

(b) feedback circuits

(c) boolean circuits

(d) toggle switches

1-h. These circuits use external signals such as inducers or light to activate the expression of metabolic enzymes (CO4). 1

(a) feedforward circuits

(b) toggle switches

(c) feedback circuits

(d) boolean circuits

1-i. Which enzyme is involved in the conversion of ethanol to acetaldehyde during fermentation? (CO5) 1

(a) Alcohol dehydrogenase

(b) Ethanol oxidase

(c) Acetaldehyde dehydrogenase

(d) Ethanol dehydrogenase

1-j. Which of the following organisms is commonly used for ethanol fermentation in industrial processes? (CO5) 1

(a) Escherichia coli

(b) Saccharomyces cerevisiae

(c) Aspergillus niger

(d) Pseudomonas aeruginosa

2. Attempt all parts:-

2.a. Define differential regulation by isoenzymes. (CO1) 2

2.b. What do you mean by metabolic flux analysis? (CO2) 2

2.c. Differentiate between isotopomers and isotopologes. (CO3) 2

2.d. Give the expression and circuit diagram for OR gate. (CO4) 2

2.e. How can metabolic engineering contribute to the sustainability of biofuel and amino acid production? (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. Write short note on all four basic reactions. (CO1) 6

3-b. State four basic types of reactions involved in our body. (CO1) 6

3-c. What is the partitioning of flux vectors? (CO2) 6

3-d. What do you understand by thermodynamics based MFA? (CO2) 6

3.e. What are the various attributes of stoichiometric matrix? (CO3) 6

3.f. Describe the commands used for plotting a circle in 2D. (CO4) 6

3.g. What are the few metabolic engineering applications?(CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. Discuss in detail the methods by which branched pathways are regulated. (CO1) 10

4-b. Elaborate the permeability and transport of the molecules. (CO1) 10

5. Answer any <u>one</u> of the following:-

5-a. With the help of an example, prepare a flowchart and explain how the network reconstruction is performed in applied in metabolic engineering. (CO2) 10

5-b. Discuss various characteristics of Stoichiometric matrix. How can you construct 10

a stoichiometric matrix employing internal and external reactions? (CO2)

6. Answer any <u>one</u> of the following:-

6-a.	Differentiate between Purge and trap GC-MS and analyze the detection of different elements in GC-MS is performed. (CO3)	10
6-b.	What are the components of an NMR instrument? How does NMR work? (CO3)	10

7. Answer any <u>one</u> of the following:-

7-a.	Discuss in detail the capailities of MATLAB. (CO4)	10
7-b.	Elaborate how integrated and dynamic flux balance analysis can be performed.(CO4)	10

8. Answer any <u>one</u> of the following:-

8-a.	Discuss the concept of bioconversions. Describe the concept of mixed or sequential bioconversions with example. (CO5)	10
8-b.	How lignocelluclosic residues are promising substrates for biofuel production? Describe the conversion of lignocellulosic residues to biofuels.(CO5)	10