Printed Page:- 03 **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. Which of the following is an example of passive transport?(CO1) 1

(a) Sodium-potassium pump
(b) Endocytosis
(c) Facilitated diffusion
(d) Exocytosis

1-c. Challenges in 13C MFA. (CO2) 1

(a) Steady state assumption (the use of bioreactor instead of shaking flasks)
(b) Central metabolic network (Genome scale levels, more applications)
(c) Computational bottlenecks
(d) All of the above

1-d. Isotopologues refers to ---(CO2) 1

(a) same no. of labelled carbons
(b) different no. of labelled carbons
(c) same labelled carbons

(d) All of the above

1-e. Which of the following is not a feature of carrier gas used in gas chromatography?(CO3) 1

(a) It must be chemically inert
(b) It should be suitable for the detector employed
(c) It should not be completely pure
(d) It should be cheap

1-f. Which of the following is the disadvantage of hydrogen, which can be used as carrier gas in gas chromatography?(CO3) 1

(a) Dangerous to use
(b) Expensive
(c) Reduced sensitivity
(d) High density

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. Which command is used to clear a command window? (CO4) 1

(a) clear
(b) close all
(c) clc
(d) clear all

1-i. What is the primary microorganism responsible for the bioconversion of ethanol?(CO5) 1

(a) Bacteria
(b) Yeast
(c) Fungi
(d) Algae

1-j. Which metabolic process produces ethanol as a byproduct?(CO5) 1

(a) Glycolysis
(b) Krebs cycle
(c) Electron transport chain
(d) Fermentation

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 Boolean expression and circuit diagram for AND gate.(CO4)	2
2.e.	How can metabolic engineering be used to improve the yield of biofuels or amino acids? (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Explain and elaborate the term DBTL. (CO1)	6
3-b.	Write a short note on stochiometry of cellular reactions. (CO1)	6
3-c.	Write various characteristics of Stoichiometric matrix?(CO2)	6
3-d.	How can the partitioning of flux vectors be used to identify key reactions in a metabolic pathway?(CO2)	6
3.e.	Discuss the applications of C13 mass balance analysis.(CO3)	6
3.f.	Describe the commands used for plotting a circle in 2D. (CO4)	6
3.g.	How does metabolic engineering contribute to improving amino acids yields?(CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Explain the concept of permeability and transport of metabolites?(CO1)	10
4-b.	What do you understand by Jacob Monod model? How it is used for lactose metabolism?(CO1)	10

5. Answer any one of the following:-

5-a.	What do you understand by flux balance analysis? How can experimental data be used to impose constraints on a flux distribution?(CO2)	10
5-b.	How can a flux cone be used to analyze the feasibility of metabolic pathways? What are some common software tools used for FBA analysis? (CO2)	10

6. Answer any one of the following:-

6-a.	Elaborate the method of C13 MFA labelling experiment and GC-MS analysis ?(CO3)	10
6-b.	Comment on the techniques of purge, trap and GC-tamdem-MS. (CO3)	10

7. Answer any one of the following:-

7-a.	Discuss in detail the capailities of MATLAB. (CO4)	10
7-b.	How ROOM is different from MOMA? (CO4)	10

8. Answer any one of the following:-

8-a.	Explain the systems metabolic approach and the categorize various strategies to alter amino acids production pathway. (CO5)	10
8-b.	Describe the rational intuitive approaches for metabolic engineering of amino acid production. (CO5)	10