GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2024

Subject Code:3150406   **Date:02-12-2024**
Subject Name: Metabolic Engineering
Time:10:30 AM TO 01:00 PM   **Total Marks:70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Define metabolic engineering. How does it differ from traditional genetic engineering?	**03**
	(b)	What are the key metabolic pathways involved in energy production in cells?	**04**
	(c)	Explain how cells regulate their metabolic pathways to respond to changes in environmental conditions and cellular needs.	**07**
Q.2	**(a)**	Briefly explain the role of transport processes in cellular metabolism. How do they contribute to metabolic efficiency?	**03**
	(b)	Explain the importance of regulating enzyme concentration in metabolic pathways	**04**
	(c)	Comprehensively discuss cellular metabolism, covering Biosynthetic pathways (amino acid, nucleotide, and lipid biosynthesis)	**07**
		OR	
	(c)	What are the primary goals of metabolic engineering in industrial applications? Give one example of its application.	**07**
Q.3	**(a)**	Describe the different types of cellular reactions. How do these reactions support cellular function?	**03**
	(b)	What are the key mechanisms for regulating enzymatic activity in metabolic pathways? Provide two examples.	**04**
	(c)	Distinguish between overdetermined and underdetermined systems in metabolic flux analysis.	**07**
		OR	
Q.3	**(a)**	Enlist limitations and potentials of metabolic engineering	**03**
	(b)	Explain how growth energetics influences the overall metabolic rate of a cell	**04**
	(c)	What are the unique challenges in studying branched pathways using Metabolic Control Analysis?	**07**
Q.4	**(a)**	Explain the concept of stoichiometry in cellular reactions and its importance in metabolic modeling	**03**
	(b)	Discuss the concept of global control in metabolic networks and does it differ from local control?	**04**
	(c)	Provide an overview of metabolic pathway synthesis algorithms. Describe how these algorithms support the design and regulation of metabolic pathways, and discuss their applications in metabolic engineering.	**07**
		OR	
Q.4	**(a)**	Define the concept of elasticity coefficients in Metabolic Control Analysis	**03**
	(b)	Explain the core principles behind metabolic flux analysis and its significance in understanding cellular metabolism.	**04**
	(c)	Discuss how reaction rates, dynamic mass balances, yield coefficients, and linear rate equations are applied in creating comprehensive models of cellular metabolism.	**07**

Q.5	**(a)**	Explain the fundamental principles of Metabolic Control Analysis	**03**
	(b)	Define flux control coefficient in MCA. How is it used to measure control within a metabolic pathway?	**04**
	(c)	Provide specific examples of how metabolic flux analysis has been used to improve strain engineering	**07**

OR

Q.5	**(a)**	Describe random mutagenesis	**03**
	(b)	How are flux control coefficients determined experimentally? Discuss the challenges and limitations of these methods.	**04**
	(c)	Provide case studies of how metabolic flux analysis is used for drug development and disease diagnosis	**07**

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