BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

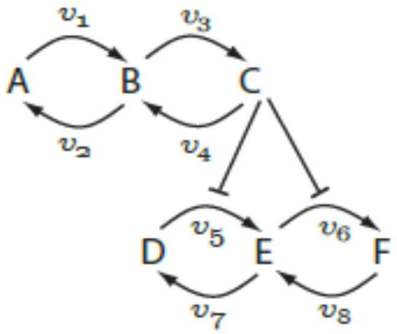
CLASS: BTECH **SEMESTER : VII**
BRANCH: BIOTECHNOLOGY **SESSION : MO/2025**

SUBJECT: BE313 METABOLIC ENGINEERING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	With a neat flow chart, explain metabolic and biosynthetic pathways for amino acid production from glucose?	[5]	1	Understanding
Q.1(b)	(i) Discuss about the regulation of metabolic pathways. (ii) Write in detail about the fundamental requirements for metabolic engineering?	[5]	1	Applying
Q.2(a)	Discuss how enzyme kinetics and regulation can be incorporated into a metabolic network model.	[5]	2	Evaluating
Q.2(b)	The figure illustrates a simple protein signalling network, comprising two double phosphorylation cycles coupled by inhibition by protein C on the lower double cycle (D,E and F) . Write the stoichiometric matrix for the system?	[5]	2	Evaluating



Q.3(a)	Using linear programming, outline how one can determine the maximal theoretical yield of a target metabolite in a genome-scale model. What constraints are typically considered?	[5]	2	Remembering
Q.3(b)	Explain how isotope-labelled substrates are used to measure intracellular metabolic fluxes. What are the key assumptions and limitations of this approach?	[5]	2	Applying
Q.4(a)	Define the flux control coefficient and concentration control coefficient. For a simple branched pathway, how would you interpret a high flux control coefficient for a particular enzyme?	[5]	3	Analyze
Q.4(b)	Discuss how metabolic control analysis (MCA) can guide engineering interventions in a biosynthetic pathway. Provide a hypothetical example.	[5]	3	Remember
Q.5(a)	Write in detail about a case study of metabolic engineering in the Environmental bioremediation	[5]	4	Create
Q.5(b)	Write in detail about a case study of metabolic engineering in the pharmaceutical industry.	[5]	4	Evaluate

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