U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

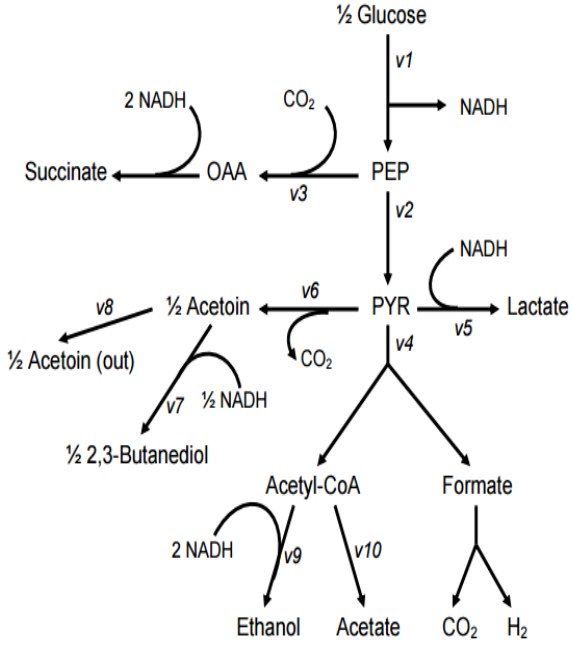
May 2023 Semester End Make-Up Examinations

Programme: B.E. **Semester: VII**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 19BT7DE5MTE **Max Marks: 100**
Course: Metabolic Engineering **Date: 17.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) **10**



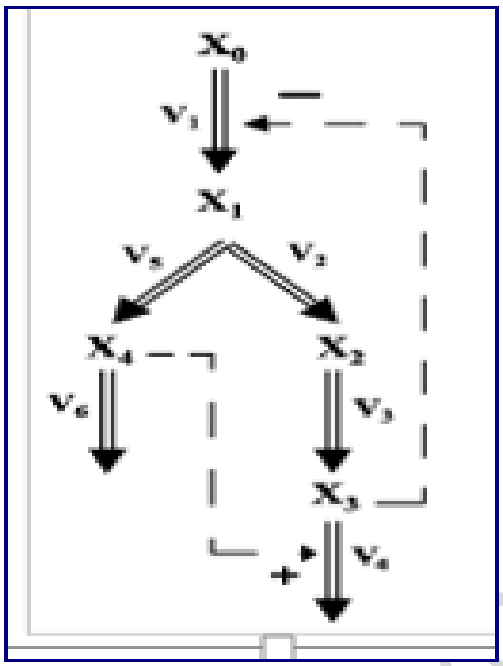
Shown above is the flux pattern for the anaerobic metabolism of E*nterobacter aerogenes*. Give the rate equation in matrix notation for the labelled reaction rates v1-v10.

b) Differentiate between metabolome, fluxome & proteome. **06**

c) Illustrate the mechanism of group translocation taking an example of PTS systems. **04**

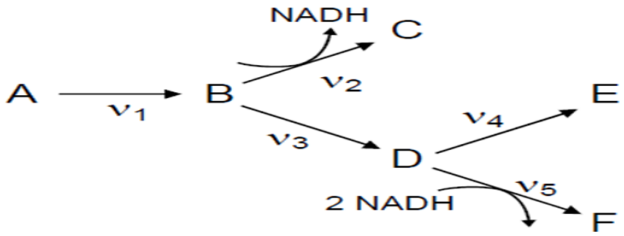
UNIT - II

2 a) What is branch point effect? Explain taking a suitable example. **06**

b)  **04**

In the given pathway, identify the mode of inhibition . Justify your answers.

c) In the following pathway, assuming pseudo steady state for metabolites B, D and NADH, calculate fluxes v2, v3, & v4, given that v1 is 8 mm/g/sec and v5 is 2 mm/g/sec. **04**



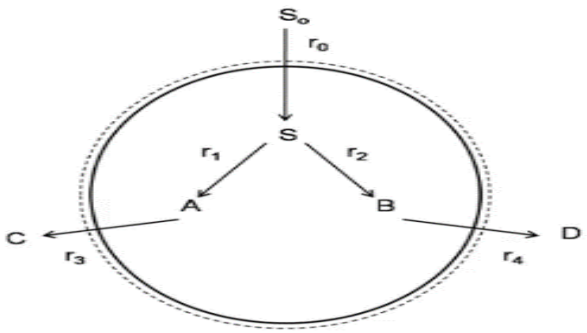
d) Cross regulation (cross talk) helps in control of pathways of central carbon metabolism. Justify this statement taking the example of Pho regulon. **06**

OR

3 a) Differentiate between stimulon, regulon and modulon. **06**

b) Give the equation which represents coordinated control of flux by energy charge & reduction charge. **06**

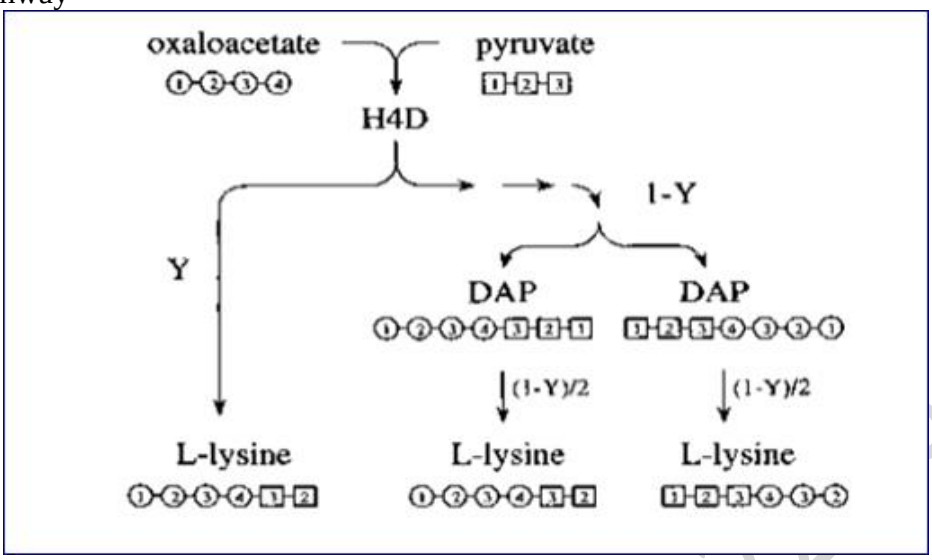
c) Determine the intracellular metabolite flux assuming that the extracellular metabolite rates for the given pathway are known **08**



UNIT - III

4 a) Determine the theroteical yield of lysine biosynthesis by stochiometric balancing and by considering the cofactor requirements. **08**

b) Construct the atom mapping matrices for the synthesis of lysine in the below pathway **08**



c) What is endogenous metabolism? Give the relationship between specific substrate uptake rate and specific growth rate taking into consideration endogenous metabolism. **04**

UNIT - IV

5 a) In an experiment w.r.t tryptophan metabolism, the effects of various levels of tryptophan 2,3, dioxygenase was measured. The enzyme activities (v_{max}) were found to be 30µM /hr & 58 µM/hr and the corresponding fluxes were 4.6 and 6.7 µM. Given that pathway flux was 2.6 µM under basal conditions with a measured activity of 13.7µM for the enzyme and an FCC of 0.77. Are the results predicted above consistent? **05**

b) Define the theories of MCA. **04**

c) Consider the pathway $X_0 \rightarrow Y \rightarrow Z \rightarrow X$. Xase, Zase and Yase are the enzymes respectively. Predict the changes in overall flux if additional amount of emzyme Yase is added. **06**

d) What is Pathway Shortening? What are its drawbacks. **05**

OR

6 a) With an example explain the approach "double modulation" for determination of the elasticity coefficients? List any four limitations of this method. **08**

b) What is elasticity co-efficient? How is it measured graphically? Why is it an important parameter in MCA? **06**

c) What is response coefficient? What are the factors that affect the response co-efficient? Consider the pathway, $x \rightarrow y \rightarrow z$, where an external metabolite "p" acts as a regulator for an enzyme "e1" which catalyzes the conversion of $x \rightarrow z$. what is the response co-efficient of "p". **06**

UNIT - V

7 a) "Multivariate-modular pathway engineering" is a strategy used for overproduction of complex natural products. Justify the statement with a suitable example. **10**

b) Explain how metabolic engineering of *Escherichia coli* can be done to increase NADH availability. **10**

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