

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS-2022

B.Tech-VIII Semester (BT)

COURSE CODE (CREDITS): 21B1WBT832 (3)

MAX. MARKS: 35

COURSE NAME: Bioprocess Modelling and Simulation

COURSE INSTRUCTOR: Dr.Garlapati Vijay Kumar

MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. What are the different items need to consider as a part of “Capital Cost Estimation” of a bioprocess project? What do you know about the scaling law/ 0.6 rule and which aspect it will be used as a part of bioprocess design? What are the various measures utilized for “Profitability analysis” under bioprocess economics and express them with the utilized formulas?

(CO I & CO II & CO III) (7 M)

Q2. Differentiate “RSM” with “OFAT/OVAT” utilized for bioprocess optimization studies? Write in detail about the steps utilized in “RSM” study with emphasizing the main points of each step?

(CO IV) (7 M)

Q3. What are the different steps utilized in execution of “Bioprocess Process Design”? How the “SuperPro Designer” helps n better execution of bioprocess modeling and simulation by explaining the different tasks carried out and their importance in Bioprocess process design?

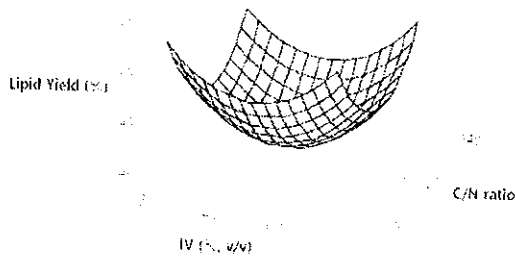
(CO V) (7 M)

Q4. What is “Response Surface Methodology” and mention the advantages and disadvantages? Write the equation which is considered as a heart of RSM approach? Under which aspects we have to utilize the “placket-burman design” and “central-composite design” of RSM and give an example? What are advantages and disadvantages of “Central-composite Design” over “Box-Benkhein Design” of RSM?

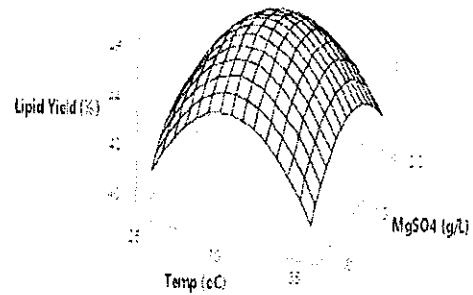
(CO IV) (7 M)

(P.T.O)

Q5. (a) Explain the following RSM plots obtained as a part of modeling and optimization of lipid production from waste glycerol? **(CO IV) (3.5 M)**



(a)



(b)

(b) Discuss in detail about the different scenarios of Hyaluronic acid production obtained through the capital cost estimation through SuperPro Designer? **(CO V) (3.5 M)**

Table . Total capital investment, unit production cost, and profitability metrics for all evaluated scenarios of hyaluronic acid production.

	S1	S2	S3	S4
Total Capital Investment (million US\$)	53.5	44.3	107.0	89.6
Unit Production Cost (US\$/kg)	1115	946	1691	1449
Return on Investment (ROI)	32.6%	43.5%	42.5%	53.1%
Payback Time (years)	3.07	2.30	2.35	1.88
Net Present Value ¹ (NPV) (million US\$)	92.4	115.3	276.5	308.7
Product for Topical Use (kg)	20,000	20,000	19,067	19,067
Product for Injectable Use (kg)	0	0	871	871

¹ Considering an annual interest rate of 3%.

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