JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- MAY 2023

B.Tech- VIII Semester (BT)

COURSE CODE (CREDITS): 21BIWBT832 (03) **MAX. MARKS**: 35

COURSE NAME: Bioprocess Modelling and Simulation

COURSE INSTRUCTORS: Dr.Garlapati Vijay Kumar **MAX. TIME**: 2 Hours

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

1. Differentiate RSM with OVAT approaches? Mention the equation which considered being heart of the RSM? Explain briefly about the certain criteria need to met to execute the RSM? (CO I & CO II & CO III) **(5 M)**
2. What are the advantages & disadvantages of RSM? Explain in detail about the advantages "Maximum Information from Experiments" & "Forces one to Plan"? What do you know about the statistical term "Correlation Coefficient"? (CO IV) **(5 M)**
3. Depict the steps utilized in RSM study through a neat sketch? What types of DOE need to choose for "Screening of Variables" and "Process Optimization? Differentiate the CCD with BBD, the DOE approaches of RSM ? (CO IV & CO V) **(5 M)**
4. What are the three activities utilized to minimize the error in RSM study? Explain briefly about the each activity by mention its purpose and benefits? What do you know about "T value", "P value" and "F value" of RSM? (CO V) **(5 M)**
5. What do you know about the "SuperPro Designer" and write about the functionalities carried out by "SuperPro Designer"? As a part of Techno-economic analysis of Hyaluronic Acid Production, the user obtained the following information from"SuperPro Design" software, related to four scheme approaches (S1, S2, S3 and S4), discuss about the economic evaluation by comparing the four schemes (CO V) **(7.5 M)**

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

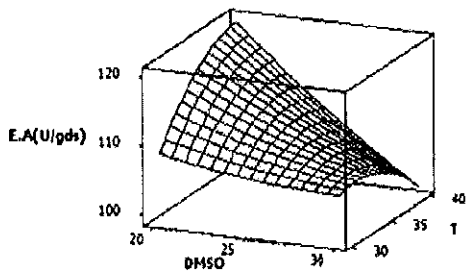
	S1	S2	S3	S4
Total Capital Investment (million US$)	53.5	44.3	107.0	89.6
Unit Production Cost (US$/kg)	1115	946	1691	1449
Return on Investment (ROI)	32.6%	43.5%	42.5%	53.1%
Payback Time (years)	3.07	2.30	2.35	1.88
Net Present Value [1] (NPV) (million US$)	92.4	115.3	276.5	308.7
Product for Topical Use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

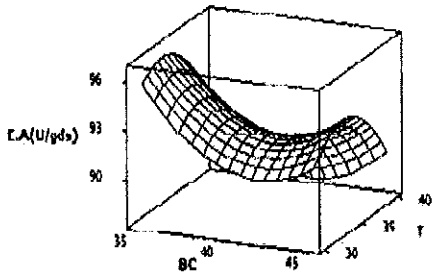
[1] Considering an annual interest rate of 5%.

6. As a part of the lipase extraction, the user utilized the RSM for modeling and optimization purpose and obtained the following significance Test and 3D surface plots. Explain the significance test results along with explanation of interaction behavior of 3D surface plots? (CO IV) **(7.5 M)**

Table - Results of significance test on the non-linear model – coefficients, standard errors, T statistics and P-values for Lipase activity (E.A (U/gds) (coded form).

Sl.no	*Terms*	*Coeff.*	*SE coeff.*	*T*	*P*
1	Const	111.941	1.0021	111.709	0.000
2	X_1	-9.452	0.6409	-14.748	0.000
3	X_2	0.041	0.6409	0.064	0.950
4	X_3	-4.271	0.6409	-6.664	0.000
5	X_4	4.217	0.6409	6.580	0.000
6	X_1^2	0.699	1.6957	0.412	0.688
7	X_2^2	2.699	1.6957	1.591	0.138
8	X_3^2	-7.071	1.6957	-4.170	0.001
9	X_4^2	-2.656	1.6957	-1.567	0.143
10	X_1X_2	-2.773	0.6798	-4.078	0.002
11	X_1X_3	-2.280	0.6798	-3.354	0.006
12	X_1X_4	-4.448	0.6798	-6.542	0.000
13	X_2X_3	1.725	0.6798	2.537	0.026
14	X_2X_4	0.665	0.6879	0.978	0.347
15	X_3X_4	-1.770	0.6798	-2.604	0.023
	SS = 2.719		R-Sq = 97.3%		R-Sq (adj) = 94.1%





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