UPES

End Semester Examination, December 2023

Course: Downstream Processing   Semester : V

Program: B. Tech. Biotechnology   Duration : 3 Hours

Course Code: HSBT3003   Max. Marks: 100

Instructions:

1. The question paper consists of four sections (A, B, C & D).

2. For MCQ in Section A, write the correct options as well as correct answers.

3. For True/False type questions in Section A, write either 'True' or 'False', whichever applicable.

4. For short answer type questions in Section A, answers must be written to the point.

5. Section C is based on case studies.

6. Draw diagrams/flow diagrams wherever necessary.

7. Attempt all questions.

8. One question from section D has an internal choice.

S. No.	Section A Short answer questions/ MCQ/T or F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	Downstream processing is also called ---------------. a) Bioseparations b) Synthesis of products c) Air pollution control d) None of these	1.5	CO1
Q 2	Biotechnology without downstream processing would be incomplete – State whether true or false	1.5	CO1
Q 3	For the recovery of products from modern biotechnology, a number of steps involving high-resolution techniques such as ------------- are required. a) Chromatography b) Filtration c) Centrifugation d) None of these	1.5	CO1
Q 4	Besides fermenters or bioreactors, other special reactors such as air lift, membrane and immobilized cell reactors are also used in the manufacture of bioproducts. – State whether true or false	1.5	CO1
Q 5	Define the term, 'cell disruption'.	1.5	CO2
Q 6	The outer layer of the Gram-positive bacteria is called …… a) Murein layer b) Plasma c) Glucan layer d) None of these	1.5	CO2
Q 7	Remember and write the condition for using thermolysis for cell disruption.	1.5	CO2

Q 8	Recall and write the merits and demerits of alkali treatment used for cell disruption.	1.5	CO2
Q 9	The thickness of the cake increases from an initial value of zero to a final thickness at the end of filtration. – State whether true or false	1.5	CO3
Q 10	Remember and write the methods of pretreatment of fermentation broth for enhancing its filterability.	1.5	CO3
Q 11	Centrifugation is used to separate materials of different densities when gravitational force is insufficient for separation. – State whether true or false	1.5	CO3
Q 12	High molecular weight substances such as antibodies, proteins and enzymes are not amenable to conventional solvent extraction. – State whether true or false	1.5	CO3
Q 13	Addition of chemicals such as acids, bases, simple electrolytes or polyelectrolytes promote ----------------- of the broth. a)Fermentation b) Adsorption c) Coagulation and Flocculation d) None of these	1.5	CO4
Q 14	Protein precipitation of a fermentation broth reduces its volume by a factor of 10-50 times.- State whether true or false	1.5	CO4
Q 15	List any two methods of protein precipitation based on solvent property modification.	1.5	CO4
Q 16	Precipitation of proteins by the addition of salt known as ------. a) Salting-in b) Salting-out c) Leaching d) None of these	1.5	CO4
Q 17	------- is a process where solid particles of specified size and shape are formed from a homogeneous phase. a) Drying b) Pervaporation c) Crystallization d) None of these	1.5	CO5
Q 18	A crystalline product has always a better appearance and consumer acceptance. – State whether true or false	1.5	CO5
Q 19	Define the term, 'drying'.	1.5	CO5
Q 20	Most of the biological products which are hygroscopic will have a residual moisture content depending on the relative humidity of the surrounding atmosphere. – State whether true or false.	1.5	CO5

Section B
(4Qx5M=20 Marks)

Q 21	List the characteristics of fermentation broths that influence the downstream processing of biomolecules.	5	CO1
Q 22	Explain 'constant pressure filtration' and 'constant volume filtration'.	5	CO3
Q 23	List the advantages and disadvantages of isoelectric protein precipitation.	5	CO4
Q 24	Describe crystallization theory with regard to crystal growth.	5	CO5

Section C
(2Qx15M=30 Marks)

Q 25	**a)** Identify and write the most suitable raw material for the manufacture of baker's yeast. List the objectives behind optimizing baker's yeast manufacturing process. Also, highlight the major issue that baker's yeast producing companies are facing.	7	CO2
	b) Draw the flow diagram for the conventional baker's yeast manufacturing process.	8	CO2
Q 26	**a)** Recall and write the share of downstream process, in the total production cost of citric acid, in an industrial process. Also, analyze the traditional method of separation of citric acid from fermentation broths.	7	CO2
	b) Differentiate between the two citric acid recovery methods, precipitation and adsorption, with regard to chemical products, advantages, disadvantages and environmental impact.	8	CO2

	Section D **(2Qx10M=20 Marks)**		
Q 27	**a)** Explain 'liquid-liquid extraction'. Draw the diagram showing single stage extraction.	**5**	**CO3**
	b) List the quantities to be given consideration in making a choice of solvent, for liquid-liquid extraction.	**5**	**CO3**
Q 28	**a)** Discuss the finishing step in relation with final purification and consumer acceptance of pharmaceuticals and organic fine chemicals.	**5**	**CO5**
	b) Analyze the equipment for crystallization. Diagram is not necessary.	**5**	**CO5**
	OR		
	a) Analyze crystallization with regard to nucleation.	**5**	**CO5**
	b) Explain the principle of working of hot air dryers. Also, list at least three hot air dryers for drying solid products.	**5**	**CO5**