Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code:3160507 Date:30-05-2025

Subject Name: Advanced Separation Processes

Time: 10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Define the term "separation factor". Also describe the feasibility of separation based on the different values of separation factor.	**03**
	(b)	Describe the working of membrane bioreactor in brief.	**04**
	(c)	Explain working of gas chromatography with neat a figure in detail.	**07**
Q.2	**(a)**	Differentiate between equilibrium separation processes and rate-governed separation processes with appropriate examples.	**03**
	(b)	Describe the principle of thin-layer chromatography in brief.	**04**
	(c)	List the essential properties of a super critical solvent. Also describe their advantages and disadvantages over conventional liquid solvents.	**07**
		OR	
	(c)	Describe RO process with a schematic diagram and also explain its application in desalination.	**07**
Q.3	**(a)**	Explain the merits of reactive distillation over conventional technology (Reactor followed by distillation column).	**03**
	(b)	List at least four industrial applications of short path distillation.	**04**
	(c)	Explain the manufacturing of ETBE using reactive distillation. Also explain the effect of various parameters on the performance of reactive distillation unit.	**07**
		OR	
Q.3	**(a)**	Discuss about different materials used for membranes synthesis.	**03**
	(b)	List at least four industrial applications of reactive distillation technology.	**04**
	(c)	Explain design and working of shorth path distillation unit. Also explain sepearation of Vitamin-E from crude Vitamin-E acetate with the help of neat process flow diagram using short path distillation.	**07**
Q.4	**(a)**	Explain concept and working of nanofiltration.	**03**
	(b)	Classify different types of membrane process based on the driving force.	**04**
	(c)	With a flow sheet, explain the working of Kraft process for decaffeination of coffee.	**07**
		OR	
Q.4	**(a)**	Compare short-path distillation with molecular distillation.	**03**
	(b)	Explain the different problems associated with membranes and its possible solutions.	**04**
	(c)	Explain ROSE process with a neat flow diagram.	**07**
Q.5	**(a)**	Describe the factors affecting the efficiency of electrophoresis in brief.	**03**
	(b)	Compare ion exchange chromatography with gel filtration chromatography.	**04**
	(c)	Explain working principle of pervaporation and enlist its various industrial applications.	**07**
		OR	
Q.5	**(a)**	Discuss with a neat sketch: BALE and KATMAX packing for reactive and catalytic distillation.	**03**
	(b)	Compare gel electrophoresis with paper electrophoresis	**04**
	(c)	Enlist various membrane modules used for membrane separation processes and describe any two of them in detail.	**07**

****

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3160507 Date:24-05-2024

Subject Name:Advanced Separation Processes

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Write operating parameters of Ultrafiltration and Microfiltration membranes.	**03**
	(b)	Differentiate the Reverse osmosis and Dialysis.	**04**
	(c)	List out different working membrane modules and describe anyone in detail.	**07**
Q.2	**(a)**	Enlist different materials used for membranes synthesis.	**03**
	(b)	List out applications of membrane gas separation.	**04**
	(c)	Explain Hybrid distillation-pervaporation system.	**07**
		OR	
	(c)	Explain the Concept and working of the Membrane Reactor.	**07**
Q.3	**(a)**	Explain Separation factor.	**03**
	(b)	What are the factors affecting the Electrophoresis process?	**04**
	(c)	Discuss the Paper Electrophoresis.	**07**
		OR	
Q.3	**(a)**	List out the drawbacks of the conventional separation processes, and the need for advanced separation processes.	**03**
	(b)	List the advantages and disadvantages of chromatographic separation.	**04**
	(c)	Explain the Thin layer and paper chromatography.	**07**
Q.4	**(a)**	Discuss the properties of Supercritical fluid solvents.	**03**
	(b)	Discuss the Advantages of Supercritical fluid over Conventional Unit Operations.	**04**
	(c)	Explain the Decaffeination of the Coffee process in detail.	**07**
		OR	
Q.4	**(a)**	Why CO2 is considered the most preferred as a supercritical fluid solvent?	**03**
	(b)	List out the application of Supercritical Extraction.	**04**
	(c)	Discuss the Residuum Oil Supercritical Extraction (ROSE) process in detail.	**07**
Q.5	**(a)**	What is molecular distillation?	**03**
	(b)	Discuss the concept of Reactive and Catalytic distillation.	**04**
	(c)	Discuss the working mechanism of the Short Path Distillation Unit (SPDU).	**07**
		OR	
Q.5	**(a)**	List out the Advantages and Disadvantages of Reactive and catalytic distillation.	**03**
	(b)	Discuss the BALE and KATMAX packing.	**04**
	(c)	Describe the manufacturing of MTBE by reactive distillation process.	**07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3160507 Date:14-07-2023

Subject Name:Advanced Separation Processes

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	What are the essential properties of a good supercritical solvent?	**03**
	(b)	Discuss why CO_2 is used as the most preferred supercritical fluid solvent.	**04**
	(c)	With the help of a detailed flow diagram explain the ROSE process for deasphalting.	**07**
Q.2	**(a)**	Write operating parameters of Ultrafiltration and Microfiltration membranes.	**03**
	(b)	List out four applications of membrane gas separation.	**04**
	(c)	Discuss the drawbacks of the conventional separation processes and need for advanced separation processes.	**07**
		OR	
	(c)	Explain the Separation factor, equilibrium, and rate governed separation.	**07**
Q.3	**(a)**	Discuss various membrane materials.	**03**
	(b)	List out different working membrane modules.	**04**
	(c)	Discuss the working principle of Reverse osmosis and Dialysis with its industrial applications.	**07**
		OR	
Q.3	**(a)**	Discuss the principle of pervaporation.	**03**
	(b)	Discuss Gas separation membranes.	**04**
	(c)	Explain the Concept & working of the Membrane Reactor.	**07**
Q.4	**(a)**	Compare short-path distillation with molecular distillation.	**03**
	(b)	List the advantages and disadvantages of reactive catalytic distillation.	**04**
	(c)	Describe the manufacturing of ETBE by reactive distillation process and compare it with the conventional process.	**07**
		OR	
Q.4	**(a)**	Explain the concept of Reactive and Catalytic Distillation.	**03**
	(b)	Discuss with a neat sketch: BALE and KATMAX packing for reactive and catalytic distillation.	**04**
	(c)	Draw a neat sketch of the Short Path Distillation Unit (SPDU) and discuss the concept and working of SPDU.	**07**
Q.5	**(a)**	Write the principle of the electrophoresis process.	**03**
	(b)	List out the uses of Electrophoresis.	**04**
	(c)	Explain thin layer and paper chromatography.	**07**
		OR	
Q.5	**(a)**	With a neat diagram explain the principle of electrophoresis separation.	**03**
	(b)	Explain Liquid chromatography.	**04**
	(c)	List the advantages and disadvantages of chromatographic separation.	**07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3160507 Date:10/06/2022

Subject Name:Advanced Separation Processes

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Write two examples of materials used as organic membrane and inorganic membrane.	**03**
	(b)	What are unique properties and solubility behaviour of supercritical fluids?	**04**
	(c)	With suitable examples discuss importance of advanced separation processes over conventional separation processes in chemical industry.	**07**
Q.2	**(a)**	List out three names of membrane modules used in membrane separation processes.	**03**
	(b)	Discuss working principle of nanofiltration and its industrial applications.	**04**
	(c)	Explain with neat flow sheet Residuum Oil Supercritical Extraction (ROSE) process.	**07**
		OR	
	(c)	Explain with neat flow sheet MTBE manufacturing by catalytic distillation.	**07**
Q.3	**(a)**	Define: Membrane fouling. If the pressure drop (ΔP) is 1000 units, the flux (J) is 50 units, what is the hydraulic membrane permeability?	**03**
	(b)	Define: supercritical fluid. Explain important properties of super critical fluid. CO_2 is most widely used super critical fluid for extraction-justify.	**04**
	(c)	Discuss in detail about different types of membrane reactors.	**07**
		OR	
Q.3	**(a)**	Draw labeled diagram of: (i) dead-end membrane filtration and (ii) cross-flow membrane filtration	**03**
	(b)	State four advantages of reverse osmosis.	**04**
	(c)	List out five advantages and five limitations of reactive/catalytic distillation over conventional distillation.	**07**
Q.4	**(a)**	Define: (i) equilibrium governed separation and (ii) rate governed separation.	**03**
	(b)	State four applications of microfiltration.	**04**
	(c)	Draw a labeled diagram of short path distillation unit (SPDU).	**07**
		OR	
Q.4	**(a)**	Write three examples of concentration driven membrane process.	**03**
	(b)	What are the essential properties of a good supercritical solvent?	**04**
	(c)	Discuss membrane gas separator principal using complete mixing model.	**07**
Q.5	**(a)**	Answer the followings:	**03**
	(i)	What is the membrane that selectively allows certain species to pass through called?	
	(ii)	What is the value of standard design temperature of reverse osmosis systems?	

	(iii)	Calculate the recovery for the following data: Product Flow: 535 m^3/h. Feed flow : 635 m^3/h.	
	(b)	What is principal and working of thin layer chromatography?	**04**
	(c)	Explain in detail about pervaporation separation.	**07**

OR

Q.5	**(a)**	List out three industrial applications of membrane gas separation.	**03**
	(b)	With neat diagram explain principle of electrophoresis separation.	**04**
	(c)	Explain principal and working of gel filtration and affinity chromatography.	**07**

****