SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF AGRICULTURAL ENGINEERING

QUESTION BANK

V SEMESTER

AG3564 - UNIT OPERATIONS IN AGRICULTURAL PROCESSING

B.TECH. AGRICULTURAL ENGINEERING

Regulation – 2023

Academic Year: 2025– 2026 (ODD SEM)

R. KARTHICK

ASSISTANT PROFESSOR (O.G)

DEPARTMENT OF AGRICULTURAL ENGINEERING

SRM VALLIAMMAI ENGINEERING COLLEGE

B.TECH. AGRICULTURAL ENGINEERING

AG3564 - UNIT OPERATIONS IN AGRICULTURAL PROCESSING

Question Bank

SEMESTER: 05 **REGULATION-2023** **YEAR: B.TECH /V**

UNIT – I: EVAPORATION AND CONCENTRATION
Unit operations in food processing - Conservation of mass and energy - Overall view of an engineering process - Dimensions and units - Dimensional and unit consistency - Dimensionless ratios - Evaporation - Definition - Liquid characteristics - Single and multiple effect evaporation - Performance of evaporators and boiling point elevation - Capacity - Economy and heat balance - Types of evaporators - Once through and circulation evaporators - Short tube evaporators and long tube evaporators - Agitated film evaporator.

PART - A

Q. No	Questions	BT Level	Competence
1.	Define food processing.	BT-1	Remember
2.	Define conservation of mass.	BT-1	Remember
3.	Define evaporation.	BT-1	Remember
4.	Give the examples of evaporation.	BT-1	Remember
5.	List the advantages of horizontal tube evaporator.	BT-2	understand
6.	List the types of evaporator.	BT-1	Remember
7.	List the advantages of short tube evaporator.	BT-2	Understand
8.	Write about the mixed feed evaporator	BT-3	Apply
9.	Write the difference between short tube and long tube evaporators.	BT-3	Apply
10.	What are the two chambers available in the evaporation chamber?	BT-1	Remember
11.	List the disadvantages of long tube evaporator.	BT-2	Understand
12.	Give the examples of dimensions and units.	BT-1	Remember
13.	Define forward feed.	BT-1	Remember
14.	Write the difference between the forward and backward feed.	BT-3	Apply
15.	Define natural circular evaporation.	BT-1	Remember
16.	List out the types of natural circular evaporation.	BT-2	Understand
17.	Write about open pan evaporator.	BT-2	Understand
18.	List out the types of forced circular evaporator.	BT-2	Understand
19.	List the overall view of engineering process.	BT-2	Understand
20.	What is agitated film evaporator?	BT-1	Remember
21.	What is short tube evaporator?	BT-1	Remember
22.	What is boiling point evaluation?	BT-1	Remember
23.	Write the difference between the single and multiple effect in evaporation.	BT-1	Remember
24.	Define parallel feed.	BT-1	Remember

PART – B

Q. No	Questions	BT Level	Competence
1.	Explain with the help of the flow chart Discontinuous, continuous and Semi-continuous operation in the food processing.	BT-2	Understand
2.	A single - effect evaporator is to concentrate 20000 kg/hr of a	BT-5	Evaluate

	solution containing 5% salt to a concentration of 20% salt by weight. Steam is fed to the evaporator at a pressure corresponding to the saturation temperature of 399 K (126˚C). The evaporator is operating at atmospheric pressure and boiling point rise is 7K. Calculate the heat load and the steam economy. Data Feed temperature = 298 K (25 C) Specific heat of feed = 4.0 kJ/kg.K Latent heat of condensation of steam at 399 K = 2185 kJ/kg (from steam tables in ℃) Latent heat of vaporization of water at 373K = 2257 kJ/kg (from steam tables in ℃)		
3.	Write about the different types of feeding system in the evaporation system.	BT-1	Remember
4.	Outline about the multiple effects in the evaporation system with neat sketch.	BT-2	Understand
5.	Develop about the short tube horizontal and vertical evaporator.	BT-3	Apply
6.	Explain the construction and working of long tube evaporator with neat sketch.	BT-2	Understand
7.	Explain briefly about the forced circular evaporation.	BT-2	Understand
8.	Explain in detail about the overall view of an engineering purpose.	BT-2	Understand
9.	An evaporating is operating at atmospheric pressure. It is desired to concentrated the feed from 5% solute to 20% solute(by weight) at a rate of 5000kg/hr. dry saturated steam at a pressure corresponding to saturation temperature of 399 K (126˚C) is used. The feed is at 298K (25˚C) and boiling point rise (Elevation) i.e. B.P.E.(B.P.R) is 5 K. the overall heat transfer coefficient is 2350W/(m2.K). Calculate the economy of the evaporator and the area of heat transfer to be provided. Data Latent heat of condensation of steam at 399 K = 2185kJ/kg Latent heat of vaporization of water at 373K = 2257 kJ/kg Specific heat of feed = 4.187 kJ/kg.K	BT-5	Evaluate
10.	Illustrate briefly about circulation evaporator	BT-2	Understand
11.	Explain with neat sketch about open pan evaporator.	BT-2	Understand
12.	Write the advantages and disadvantages of long tube evaporator.	BT-1	Remember
13.	Illustrate briefly about forced circulation evaporator with horizontal external heating element.	BT-2	Understand
14.	Explain briefly about the agitated film evaporator.	BT-1	Remember
15.	Describe briefly about the forward feed and backward feed with a neat sketch.	BT-3	Apply
16.	A solution containing 10% of solids is to be concentrated to a level of 50% solids. Steam is available at a pressure of 0.2Mpa (Saturation temperature of 393K). Feed rate to the evaporator is 30000 Kg/hr. The evaporating is operating at a reduced pressure such that the boiling point is 323 K the overall heat Transfer coefficient is 2.9KW/ m^2.K estimate the steam economy The Heat transfer surface for (1) feed introduced at 293K (2) Feed introduced at 308K. Specific heat of feed = 3.98KJ/kg.K Latent heat of condensation of steam at 0.2MPa = 2202 KJ/Kg	BT-5	Evaluate

	Latent heat of vaporization of water at 323K = 2383KJ/Kg		
17.	A triple effect evaporator is concentrating a solution that has no appreciable boiling point elevation. The temperature of steam to the effect is 381.3K (108.3^0C) and boiling point of the solution in the last effect is 327.4K (51.7^0C).The overall heat transfer coefficients in the first, second and third effect are 2800, 2200 and 1100W/m^2K respectively. At what temperature will the solution boil in the first and second effects?	BT-5	Evaluate

UNIT – II: MECHANICAL SEPARATION

Filtration - Definition - Filter media - Types and requirements - Constant rate filtration - Constant pressure filtration - Filter cake resistance - Filtration equipment - Rotary vacuum filter - Filter press - Sedimentation - Gravitational sedimentation of particles in a fluid - Stoke's law, sedimentation of particles in gas - Cyclones - Settling under sedimentation and gravitational sedimentation - Centrifugal separations - Rate of separations - Liquid - Liquid separation - Centrifuge equipment.

PART - A

Q. No	Questions	BT Level	Competence
1.	Define the processes of filtration.	BT-2	Understand
2.	What are the various types of filtration?	BT-1	Remember
3.	Define filter pressure.	BT-1	Remember
4.	What is filter cake resistance?	BT-1	Remember
5.	What is meant by filter media?	BT-1	Remember
6.	List the types of filtration equipment.	BT-2	Understand
7.	Define Stokes law.	BT-2	Understand
8.	What is meant by constant rate filtration?	BT-3	Apply
9.	What happens if the thickness of the filter cake increases in filtration?	BT-1	Remember
10.	Define precoat filter.	BT-2	Understand
11.	What are the processes of sedimentation?	BT-1	Remember
12.	What is the requirement of a good filter media?	BT-1	Remember
13.	Define plate pressure filter.	BT-1	Remember
14.	What affect the sedimentation of the particles?	BT-1	Remember
15.	What are the two methods of separation?	BT-1	Remember
16.	List out the factor influence the sediment processes	BT-3	Apply
17.	Calculate the settling velocity of dust particles of (a) 60μm and (b) 10μm diameter in air at 21°C and 100 kPa pressure. Assume that the particles are spherical and of density 1280 kgm^3, and that the viscosity of air = 1.8×10^{-5} Ns m^{-2} and density of air = 1.2 kgm^{-3}.	BT-2	Understand
18.	Define centrifugation.	BT-2	Understand
19.	What are the factors that affect the process of centrifugation?	BT-1	Remember
20.	Define setting zone.	BT-2	Understand
21.	What are the two main components of rotary vacuum filter?	BT-1	Remember
22.	What is liquid-liquid separation?	BT-1	Remember
23.	List the component of centrifuge equipment.	BT-1	Remember
24.	How many "g" can be obtained in a centrifuge which can spin a liquid at 2000 rev/min at a maximum radius of 10cm?	BT-2	Understand

PART – B			
Q. No	**Questions**	**BT Level**	**Competence**
1.	Explain in detail about the different types of filters.	BT-3	Apply
2.	A plate and frame filter press when filtering a sludge gave 8 m^3 of filtrate in 1800 s and 11 m^3 of filtrate in 3600 s when filtration was stopped. Calculate the washing time if 3 m^3 of wash water is used to wash the cake. Neglect the resistance of a filter cloth and assume a constant pressure filtration.	BT-5	Evaluate
3.	Describe briefly about cyclone separator.	BT-3	Apply
4.	Explain in detail about the centrifuge equipment.	BT-3	Apply
5.	Illustrate briefly about the construction and working of a plate and frame filter press. Analyze its advantages and disadvantages.	BT-3	Apply
6.	Explain in detail about the rotary vacuum filter.	BT-3	Apply
7.	Illustrate in detail about characteristics of filter medium and factors affecting rate of filtration.	BT-2	Understand
8.	Illustrate briefly about liquid- liquid separator.	BT-2	Understand
9.	Explain in detail the operation, advantages, and disadvantages of primary sand filters and pressure filters.	BT-3	Apply
10.	Explain briefly about gas - liquid separator.	BT-3	Apply
11.	Design a liquid-liquid gravity separator which can handle a two phase liquid stream of 0.5 m^3/min. The feed contains 45% by volume of light phase and 55% by volume of a heavy phase. Densities of light (ρ_a) and heavy phase (ρ_b) are 900 and 1150 kg/m^3 respectively. Required settling time of light phase is 5 min while the settling time for heavy phase is 4 min.	BT-5	Evaluate
12.	Explain briefly about the gravity separation.	BT-3	Apply
13.	Calculate the sedimentation rate in gravity separation and centrifugal separation for the particle size limiting to d_{lim}= 7 µm. The particle density = 1040 kg/m^3; liquid density = 1000 kg/m^3; Viscosity of continuous phase = $1x10^{-3}$ N-s/m^2	BT-5	Evaluate
14.	Explain briefly about the centrifugal separation.	BT-3	Apply
15.	(a) A continuous separating tank is to be designed to follow after a water washing plant for liquid oil. Estimate the necessary area for the tank if the oil, on leaving the washer, is in the form of globules 5.1 x 10^{-5}m diameter, the feed concentration is 4 kg water to 1 kg oil, and the leaving water is effectively oil free. The feed rate is 1000kgh^{-1}, the density of the oil is 894kgm^{-3} and the temperature of the oil and of the water is 38°C. Assume Stokes' law. (b) If a cream separator has discharge radii of 5 cm and 7.5 cm and if the density of skim milk is 1032 kgm^{-3} and that of cream is 915 kgm^{-3}, calculate the radius of the neutral zone so that the feed inlet can be designed.	BT-5	Evaluate
16.	For a sludge filtered in a washing plate and frame the filtration equation V^2 = Kt holds well, where V is the volume of the filtrate obtained in time t. When the pressure is constant, 30 m^3 of filtrate is obtained in 10 h. (a) Calculate the washing time if 3 m^3 of wash water is forced to the cake at the end of filtration. (b) If the filtering area/surface is doubled keeping all other things	BT-5	Evaluate

	constant, how long would it take to obtain 30 m^3 of filtrate?		
17.	A filter press is used to filter a sludge forming a non uniform compressible cake. At a constant pressure difference, 6000 l of filtrate is obtained in 1 h. Washing is done with 1200 l of water, it proceeds exactly as filtration. The filtrate has the same properties as the wash water. Neglecting the resistance of filter cloth, calculate the washing time required.	BT-5	Evaluate

UNIT – III: SIZE REDUCTION

Size reduction - Grinding and cutting - Principles of comminuting - Characteristics of comminuted products - Particle size distribution in comminuted products - Energy and power requirements in comminuting - Crushing efficiency - Rittinger's, Bond's and Kick's laws for crushing - Size reduction equipments - Crushers - Jaw crusher, gyratory crusher - Crushing rolls - Grinders - Hammer mills - Rolling compression mills - Attrition, rod, ball and tube mills - construction and operation.

PART -A

Q. No	Questions	BT Level	Competence
1.	Define the size reduction principal.	BT-2	Understand
2.	What is the need for size reduction?	BT-1	Remember
3.	List out the type of forces used in the size reduction equipment.	BT-2	Understand
4.	Write the formula for crushing efficiency.	BT-1	Remember
5.	Define the principles of comminuting.	BT-1	Remember
6.	Define work index.	BT-2	Understand
7.	List out the various types of size reduction.	BT-1	Remember
8.	Define smooth roll crushers.	BT-1	Remember
9.	Define attrition mill.	BT-2	Understand
10.	Define grinders.	BT-1	Remember
11.	List out the various types of grinders.	BT-1	Remember
12.	Classify the hammer mill.	BT-2	Understand
13.	Calculate the power required in hP to crush 150 ton/hr of limestone if 85% of the feed passes in a 2 inch screen and 85% of the product in a 1/8 inch screen? Let Wi for limestone is 12.74.	BT-1	Remember
14.	Define Rittinger's Law.	BT-1	Remember
15.	Define Kick's Law.	BT-1	Remember
16.	Define Bond's Law.	BT-1	Remember
17.	Define crusher.	BT-1	Remember
18.	What is choke crushing?	BT-1	Remember
19.	Difference between the crushing and grinding.	BT-2	Understand
20.	Define fluid runner mill.	BT-1	Remember
21.	Define pebble mill.	BT-2	Understand
22.	Define jaw crusher.	BT-1	Remember
23.	Write the types of jaw crusher.	BT-2	Understand
24.	Write the application of ball mill.	BT-2	Understand

PART –B

Q. No	Questions	BT Level	Competence
1.	Derive the equation for energy using Rittinger's law and Bond's law.	BT-3	Apply
2.	Explain in detail about the Blake jaw crusher with neat sketch.	BT-2	Understand
3.	Describe principle, working merits and de-merits of ball mill.	BT-3	Apply

4.	(a) Explain in detail about the gyratory crusher with neat sketch. (b) What rotational speed, in revolutions per minute, would you recommend for a ball mill 1200mm in diameter charged with 75mm balls?	BT-2	Understand
5.	Derive the equation for energy using Kick's law and Rittinger's law.	BT-3	Apply
6.	Explain briefly about various types revolving mills.	BT-3	Apply
7.	(a) A certain crusher accepts a feed material having a volume surface mean diameter of 19 mm and gives a product of volume surface mean diameter of 5 mm. The power required to crush 15 tonnes per hour is 7.5 kW. What will be the power consumption if the capacity is reduced to 12 tonnes per hour? (b) A certain crusher accepts a feed of rock having a volume surface mean diameter of 0.75 inches and discharges a product of volume surface mean diameter 0.2 inches. The power required to crush 15 tonnes per hour is 12 hp. What would be the power consumption if the capacity is reduced to 10 tonnes per hour and volume surface mean diameter is 0.15 inches Using Rittinger's law?	BT-5	Evaluate
8.	Describe principle, working merits and de-merits of hammer mill.	BT-3	Apply
9.	Illustrate in detail about action revolving/ tumbling mill.	BT-3	Apply
10.	Illustrate in detail with the neat sketch about open circuit and closed circuit grinding.	BT-1	Remember
11.	A certain crusher takes a feed of rock whose average particle diameter Is 0.025m and crushes it to a product whose average particle diameter is 0.018m at the rate of 20 tonnes /hour. At this rate the mill takes 9 HP of power and 0.46 HP power is required to run it empty. What would be the power consumption for the same capacity if the average particle diameter in the product is 0.008 meter? How much power would be required under Kick's law condition?	BT-5	Evaluate
12.	Compare between crushing and grinding.	BT-3	Apply
13.	Explain with neat sketch about colloid mills.	BT-1	Remember
14.	Illustrate about fluid energy mill.	BT-1	Remember
15.	Explain in detail about crushing rolls with application.	BT-2	Understand
16.	Illustrate in detail about the selection of crushing rolls.	BT-3	Apply
17.	(a) If crushing rolls, 1 m in diameter, are set so that the crushing surfaces are 12.5 mm apart and the angle of nip is 31◦, what is the maximum size of particle which should be fed to the rolls? (b) A roller crusher with two rolls of 500mm diameter and 300mm width is set such that the gap is 50mm and the speed of the roll is 1200rpm. Angle of nip is 40°. Determine the size of the feed and theoretical capacity of the crusher of it has to crush the rock having specific gravity of 2.65.	BT-5	Evaluate

UNIT – IV: CONTACT EQUILIBRIUM SEPARATION

Contact equilibrium separation processes - Concentrations - Gas - Liquid and solid - Liquid equilibrium concentration relationships - Operating conditions - Calculation of separation in contact equilibrium processes - Gas absorption - Rate of gas absorption - Stage - Equilibrium gas - Absorption equipment - Properties of tower packing - Types - Construction - Flow through packed towers - Extraction - Rate of extraction - Stage equilibrium extraction - Equipment for leaching coarse solids - Intermediate solids - Basket extractor - Extraction of fine material - Dorr agitator - Continuous leaching - Decantation systems - Extraction towers - Washing - Equipments.

PART – A			
Q. No	**Questions**	**BT Level**	**Competence**
1.	Define equilibrium distribution co-efficient.	BT-1	Remember
2.	What is mean by equilibrium stage operations?	BT-1	Remember
3.	Define contact equilibrium separation.	BT-1	Remember
4.	Define gas absorption.	BT-1	Remember
5.	Give example for contact equilibrium processes.	BT -2	Understand
6.	Define cascades.	BT-1	Remember
7.	What are the components of gas mixture?	BT-1	Remember
8.	A solution of ethanol in water contains 30% of ethanol by weight. Calculate the mole fractions of ethanol and water in the solution.	BT -2	Understand
9.	Define the rate of gas absorption.	BT-1	Remember
10.	Define gas absorption equipment.	BT-1	Remember
11.	Define washing.	BT-1	Remember
12.	Difference between the steady and unsteady leaching.	BT -2	Understand
13.	Define thickener.	BT-1	Remember
14.	What is meant by hydro cyclones?	BT-1	Remember
15.	Define percolation tank leaching.	BT-1	Remember
16.	Draw the neat sketch of shank system.	BT-1	Remember
17.	List out the uses of Agitation vessel.	BT -2	Understand
18.	Define principal of leaching.	BT-1	Remember
19.	What are the applications of leaching?	BT-1	Remember
20.	Define number of ideal stages for constant underflow.	BT-1	Remember
21.	What is meant by dispersed-solid leaching?	BT-1	Remember
22.	Define number of ideal stages for variable under flow	BT-1	Remember
23.	What is the difference between the constant and variable underflow	BT-1	Remember
24.	Define stage efficiency.	BT-1	Remember
PART B			
Q. No	**Questions**	**BT Level**	**Competence**
1.	In 100kg raw material there will be 18% oil, that is 82kg bean solids and 18kg oil. In the final underflow, 82 kg bean solids will retain 41 kg of solution, the solution will contain 10% of the initial oil in the beans, that is, 1.8kg so that there will be (18 - 1.8) = 16.2kg of oil in the final overflow, Extract contains (16.2 x 60/40) = 24.3kg of solvent Total volume of final overflow = 16.2 + 24.3 = 40.5kg Total solvent entering = (39.2 + 24.3) = 63.5kg Note that the solution passing as overflow between the stages is the same weight as the solvent entering the whole system, i.e. 63.5kg.	BT-5	Evaluate
2.	Derive an equation for constant equilibrium stage operating condition.	BT-3	Apply
3.	Explain briefly about the rate of gas absorption and stage equi1ibrium gas absorption.	BT -2	Understand
4.	A calculation was made for a single stage, steam stripping process to remove taints in the cream, by contact with a counter flow current of steam. Consider, now, the case of a rather more difficult taint to remove in which the equilibrium concentration of the taint in the	BT-5	Evaluate

	steam is only 7.5 times as great as that in the cream. If the relative flow rates of cream and steam are given in the ratio 1: 0.75, how many contact stages would be required to reduce the taint concentration in the cream to 0.3ppm assuming (a) 100% stage efficiency and (b) 70% stage efficiency? The initial concentration of the taint is 10ppm.		
5.	Explain briefly about extraction and washing equipment.	BT -2	Understand
6.	After precipitation and draining procedures, it is found that 100kg of fresh casein curd has a liquid content of 66% and this liquid contains 4.5% of lactose. The curd is washed three times with 194kg of fresh water each time. Calculate the residual lactose in the case in after drying. Also calculate the quantity of water that would have to be used in a single wash to attain the same lactose content in the curd as obtained after three washings. Assume perfect washing, and draining of curd to 66% of moisture each time.	BT-5	Evaluate
7.	Briefly explain about the Dorr balanced-tray thickeners.	BT-3	Apply
8.	Briefly explain about the Bollman extractor.	BT-3	Apply
9.	Briefly explain about the Rotocel extractor.	BT-3	Apply
10.	Explain briefly about the percolation tank leaching.	BT-3	Apply
11.	Define agitation vessel its uses and setup of the vessel.	BT -2	Understand
12.	Explain briefly about the continuous countercurrent leaching.	BT-3	Apply
13.	Explain with neat sketch about the packed towers and tower packing.	BT-3	Apply
14.	Explain about selection of solvent for extraction in detail.	BT-3	Apply
15.	Crushed oil seeds containing 55% oil (by wt) is to be extracted at the rate of 4000kg/hr using 100kg/min of n-hexane containing 5% oil (by wt) as the solvent. Countercurrent two stage extraction system is employed. The oil seeds will retain 1kg of solution per kg of oil free cake. Estimate the percent recovery of oil (based on original feed) obtained under the above condition.	BT-5	Evaluate
16.	A solution containing 5% acetaldehyde and 95% toluene is to extracted with water in 5 stages cross current extraction unit to extract acetaldehyde. Toluene and water are essentially insoluble. If 25 Kg of water each time are used per 100kg of feed, calculate the amount of acetaldehyde extracted and final concentration of exit solution. The equilibrium relationship is given as **y = 2.2 x** Where y = kg of acetaldehyde/kg H_2O, x = kg of acetaldehyde/kg Toluene.	BT-5	Evaluate
17.	List method of extraction and explain about single stage contact extraction.	BT-3	Apply

UNIT – V: CRYSTALLISATION AND DISTILLATION

Crystallization - Equilibrium - Rate of crystal growth stage - Equilibrium crystallization - Crystallizers Equipment – Classification - Construction and operation - Crystallizers - Tank-Agitated batch-Swenson-Walker and Vacuum crystallizers – Distillation - Binary mixtures - Flash and differential distillation - Steam distillation - Theory - Continuous distillation with rectification - Vacuum distillation - Batch distillation - Operation and process - Advantages and limitation - Distillation equipments - Construction and operation - Factors influencing the operation.

Q. No	Questions	BT Level	Competence
1	Define crystallization.	BT-1	Remember
2	Write the two stages of crystal growth.	BT-2	Understand
3	What is equilibrium crystallization?	BT-1	Remember

4	If sodium chloride solution, at a temperature of 40°C, has a concentration of 50% when the solubility of sodium chloride at this temperature is 36.6g/100 g water, calculate the quantity of sodium chloride crystals that will form once crystallization has started.	BT-2	Understand
5	What is evaporative crystallizers?	BT-1	Remember
6	Define vacuum crystallizers.	BT-1	Remember
7	Write the types of evaporative crystallizers.	BT-2	Understand
8	List the advantages of evaporative crystallizers.	BT-1	Remember
9	List the application of crystallizers.	BT-1	Remember
10	Write the advantages of batch distillation.	BT-2	Understand
11	List the parts of crystallizers.	BT-1	Remember
12	Classify the crystallographic based on the shape.	BT-1	Remember
13	Define flash distillation.	BT-1	Remember
14	What is meant by steam distillation?	BT-1	Remember
15	List the methods of distillation.	BT-1	Remember
16	Write any two continuous rectification.	BT-2	Understand
17	State Raoult's law.	BT-2	Understand
18	What is Azeotropic distillation?	BT-1	Remember
19	Write the limitations of batch distillation.	BT-2	Understand
20	List the types of distillation equipment.	BT-1	Remember
21	What is continuous distillation?	BT-1	Remember
22	What is simple distillation?	BT-1	Remember
23	Define reflux ratio.	BT-1	Remember
24	What is super saturation?	BT-1	Remember
PART - B			
Q. No	**Questions**	**BT Level**	**Competence**
1.	Describe in detail about the mechanism of crystallization.	BT-2	Understand
2.	Lactose syrup is concentrated to 8g lactose per l0g of water and then run into a crystallizing vat which contains 2500kg of the syrup. In this vat, containing 2500kg of syrup, it is cooled from 57°C to 10°C. Lactose crystallizes with one molecule of water of crystallization. The specific heat of the lactose solution is 3470 $Jkg^{-1}{}^{o}C^{-1}$. The heat of solution for lactose monohydrate is -15,500 kJ mol^{-1}. The molecular weight of lactose monohydrate is 360 and the solubility of lactose at 10°C is 1.5g/l0g water. Assume that 1% of the water evaporates and that the heat loss through the vat walls is $4x\ 10^4$ kJ. Calculate the heat to be removed in the cooling process.	BT-5	Evaluate
3.	Explain briefly about the rate of crystal growth.	BT-3	Apply
4.	Explain about Azeotropic distillation and entrainer with neat sketch.	BT-3	Apply
5.	Describe in detail about agitated batch crystallizer and tank crystallization.	BT-2	Understand
6.	A solution of sucrose in water at 25°C is to be concentrated by reverse osmosis. It is found that, with a differential applied pressure of 5000 kPa, the rate of movement of the water molecules through the membrane is 25 $kgm^{-2}\ h^{-1}$ for a 10% solution of sucrose. Estimate the flow rate through the membrane for a differential pressure of 10,000kPa with the 10% sucrose solution, and also estimate the flow rate for a differential pressure of 10,000 kPa but	BT-5	Evaluate

	with a sucrose concentration of 20%. Density of 20% sucrose is 1081kgm^{-3} and for 10% is 1038 kgm^{-3}. For sucrose, the molecular weight is 342 so for a 10% solution, molar concentration is 0.30 moles m^{-3} and for 20%, 0.62 moles m^{-3}.		
7.	Explain briefly about the vacuum crystallizers.	BT-3	Apply
8.	Explain with neat sketch about the krystal crystallizer.	BT-3	Apply
9.	Explain briefly about the continuous rectification with binary system.	BT-3	Apply
10.	Describe in detail about steam distillation and simple distillation with neat sketch and applications.	BT-1	Remember
11.	Describe in detail about the construction, working and Swenson Walker crystallizer	BT-2	Understand
12.	The protein concentration in whey, from cheese manufacture, by a factor of 12 by the use of ultrafiltration to give an enriched fraction which can subsequently be dried and used to produce a 50% protein whey powder. The whey initially contains 6% of total solids, 12% of these being protein. Pilot scale measurements on this whey show that a permeate flow of 30kgm^{-2}h^{-1} can be expected. If the plant requirement is to handle 30,000kg in 6 hours, estimate the area of membrane needed. Assume that the membrane rejection of the protein is over 99%, and calculate the membrane rejection of the non-protein constituents.	BT-5	Evaluate
13.	Derive the design of distillation column.	BT-3	Apply
14.	Explain in detail about the simple distillation and differential distillation with neat sketch and applications.	BT-3	Apply
15.	Describe in detail about the mechanism of crystallization.	BT-2	Understand
16.	Explain in detail about extractive distillation with neat sketch.	BT-3	Apply
17.	Explain in detail about the simple distillation with neat sketch and applications.	BT-2	Understand