SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF AGRICULTURE ENGINEERING

QUESTION BANK

IV SEMESTER

1902401 - UNIT OPERATIONS IN AGRICULTURAL PROCESSING

(For branches: AGRICULTURE only)

Regulation – 2019
Academic Year 2021 – 2022

Prepared by

Mr. M. MOGANRAJ Assistant Professor/ Agriculture

SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

SUBJECT : UNIT OPERATIONS IN AGRICULTURAL PROCESSING

SEM / YEAR: IV/ II

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

1.	Define food processing.	BT-1	Remembering
2.	Define conservation of mass	BT-1	Remembering
3.	Write the difference between the steady and unsteady food processes.	BT-1	Remembering
4.	Define the mass transfer operation	BT-1	Remembering
5.	Define complementary unit operation	BT-2	understanding
6.	Define Raoult's law and state its application.	BT-2	understanding
7.	List the assumptions when evaporators are working in balance.	BT-2	Understanding
8.	Write the difference between the static and kinematic similarity	BT-1	Remembering
9.	Define the similarity theory.	BT-2	Understanding
10.	A fluid food has a viscosity of 6 poises. Obtain the value for viscosity in the international system and in the absolute English system. By definition, 1 poise is 1 g per cm and s: 1 poise = g/(cm·s) Conversion to the international system and English system	BT-3	Applying
11.	Draw Duhring plot and state its significance.	BT-1	Remembering
12.	Define heat economy.	BT-2	understanding
13.	What is vapour re-compression?	BT-1	Remembering
14.	State Latent heat of vaporization.	BT-1	Remembering
15.	Write the difference between the forward and backward feed.	BT-4	Analysis
16.	Define Duhring rule.	BT-2	understanding
17.	List out the types of natural circular evaporation.	BT-4	Analysis
18.	Define Buckum π theorem.	BT-2	understanding
19.	List out the types of forced circular evaporator	BT-1	Remembering
20.	Where the thermal pump will be used.	BT-4	Analysis
21.	How will be the heat transvers in the evaporators?	BT-3	Applying
22.	Write the equation for the heat transvers coefficient.	BT-4	Analysis
23.	Identify the situation in which vacuum evaporation is preferred.	BT-1	Remembering
24.	Write the difference between the single and multiple effect in evaporation.	BT-1	Remembering
25.	Define parallel feed.	BT-2	understanding

PART – B

1.	Explain with the help of the flow chart Discontinuous, continuous and Semi-continuous operation in the food processing.	BT-1	Remembering
2.	Classify the different type of unit operations.	BT-3	Applying
3.	Explain the various setups for solving the problems in unit operation using mathematical methods.	BT-1	Remembering
4.	Explain briefly about the various dimensional analysis methods.	BT-2	understanding
5.	Use a dimensional analysis to obtain an expression that allows the calculation of the power of a stirrer as a function of the variables that could affect it. It is known, from experimental studies, that the stirring power depends on the diameter of the stirrer (D), its rotation velocity (N), the viscosity (η) and density (ρ) of the fluid being stirred, and the gravity acceleration (g).	BT-3	Applying
6.	Derive the equation for the dynamic similarity based on the particle study	BT-1	Remembering
7.	Briefly explain about the multiple effects in the evaporation system with neat sketch.	BT-5	Evaluating
8.	Analyze the concept of Boiling point elevation and state its importance in evaporation of heat sensible materials	BT-5	Evaluating
9.	Derive the Ten- equation system by using the mass enthalpy balance and rate equation.	BT-3	Applying
10.	Briefly explain about the short tube horizontal and vertical evaporator.	BT-5	Evaluating
11.	Explain briefly about the long tube and plate evaporator	BT-1	Remembering
12.	Explain briefly about the forced circular evaporation.	BT-1	Remembering
13.	Explain berify about the following i)Thermal pump ii) Thermal compression	BT-5	Evaluating
14.	Derive the equation for calculating the boiling point rise.	BT-4	Analysis

PART-C

1.	One of the most frequently used devices for batch fermentations is the stirred tank. The power that should be applied to the stirrer (P) is a function of its rotation velocity (N) and diameter (D), density (ρ) and viscosity of the substrate, gravity acceleration (g), and time (t) since the beginning of operation. Demonstrate, using Rayleigh's and Buckingham's methods, that the power module (Po) is a function of the Reynolds (Re) number, Froude's (Fr) number, and time module (Nt), that is:	BT-3	Applying
2.	Define the irritation method for with and without boiling point rise.	BT-2	understanding
3.	A salt solution is concentrated from 5 to 40% in weight of salt. For this reason, 15,000 kg/h of the diluted solution are fed to a double-effect evaporator that operates under backward feed. The steam used in the first effect is saturated at 2.5 atm, maintaining the evaporation chamber of the second effect at a pressure of 0.20 atm. If feed is at 22°C, calculate: a) steam flow rate needed and economy of the system; b) heating area of each effect; c) temperatures and pressures of the different evaporation and condensation chambers. Data: consider that only the 40% salt solution produces a boiling point rise of 7°C. The specific heat of the salt solutions can be calculated by the expression: Cˆ P = 4.18 – 3.34 X kJ/(kg·°C), where X is the mass fraction of salt in the solution. The global heat transfer coefficients of the first and second effect are, respectively, 1860 and 1280 W/(m2 °C). Specific heat of water vapor is 2.1 kJ/(kg·°C).	BT-3	Applying

4.	Tomato juice is to be concentrated from 12% solids to 28% solids in a climbing film evaporator, 3 m high and 4 cm diameter. The maximum allowable temperature for tomato juice is 57°C. The juice is fed to the evaporator at 57°C and at this temperature the latent heat of vaporization is 2366 kJ kg-1. Steam is used in the jacket of the evaporator at a pressure of 170 kPa (abs). If the overall heat-transfer coefficient is 6000 J m-2 s-1 °C-1, estimate the quantity of tomato juice feed per hour. Take heating surface as 3 m long x 0.04 m diameter.	BT-6	create

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

1.	Define the processes of Filtration.	BT-2	Understanding
2.	What are the various types of Filtration?	BT-1	Remembering
3.	Define filter pressure.	BT-1	Remembering
4.	What is filter cake resistance?	BT-1	Remembering
5.	How do you calculate the filter rate?	BT-3	Applying
6.	Which material is prepared for the filter cake?	BT-2	Understanding
7.	At what temperature is moist NaHCO3 calcined from the drum filter?	BT-5	Evaluating
8.	How does a drum filter work?	BT-3	Applying
9.	What happens if the thickness of the filter cake increases in filtration?	BT-5	Evaluating
10.	Define Precoat filter.	BT-2	Understanding
11.	What are the processes of Sedimentation?	BT-1	Remembering
12.	What is the requirement of a good filter media?	BT-1	Remembering
13.	Define automatic belt filter	BT-1	Remembering
14.	What affect the sedimentation of the particles?	BT-1	Remembering
15.	What are the two methods of separation?	BT-1	Remembering
16.	List out the factor influence the sediment processes	BT-3	Applying
17.	Calculate the sedimentation rate in gravity separation and centrifugal separation for the particle size limiting to dlim= 7 µm. The particle density = 1040 kg/m3 ; liquid density = 1000 kg/m3 ; Viscosity of continuous phase = 1x10-3 N-s/m2	BT-4	Analysing
18.	Define centrifugation.	BT-2	Understanding
19.	Which factors have an influence on centrifugation	BT-1	Remembering
20.	Define Setting zone.	BT-2	Understanding
21.	Define stokes law.	BT-2	Understanding
22.	Define the total filtration resistant.	BT-1	Remembering
23.	Define filter medium resistance.	BT-1	Remembering
24.	Define plate pressure filter	BT-4	Analysing
25.	What are the forces acting on the spherical shape particles?	BT-4	Analysing

PART – B

1.	Explain briefly about the principles of cake and pressure drop through filter cake.	BT-1	Remembering
2.	Briefly explain about the different types of filters.	BT-5	Evaluating
3.	Derive the equation for compressible and incompressible filter cake	BT-3	Applying
4.	Derive the equation for filter medium resistance.	BT-3	Applying

5.	A plate-and-frame filter that operates under constant pressure requires 1 h to separate 600 l of filtrate of an aqueous suspension. Calculate the filtration capacity if the initial filtration velocity is 60 l/min, 8 l of water is needed to wash the deposited cake, and 35 min are needed to discharge, clean, and assemble the filter.	BT-4	Analyzing
6.	Derive the equation for the Rotary Vacuum Disk Filter	BT-1	Remembering
7.	A plate-and-frame press filter is used to filtrate an aqueous suspension. Working under constant filtration velocity, 250 l of filtrate are obtained after 45 min. During this period, the pressure drop increases from 0.40 kg/cm2 to 3.5 kg/cm2. If it were desired to work at a constant pressure of 3.5 kg/cm2, what amount of filtrate would be obtained after 45 min?	BT-4	Analyzing
8.	Briefly explain about the Cyclone Separator	BT-5	Evaluating
9.	Explain briefly about the following terms (i) Cyclone performance (ii) Cut diameter (iii) Collection efficiency	BT-4	Analyzing
10.	Briefly explain about Gas - Liquid Separator	BT-5	Evaluating
11.	Design a liquid-liquid gravity separator which can handle a two phase liquid stream of 0.5 m3/min. The feed contains 45% by volume of light phase and 55% by volume of a heavy phase. Densities of light (ρl) and heavy phase (ρh) are 900 and 1150 kg/m3 respectively. Required settling time of light phase is 5 min while the settling time for heavy phase is 4 min.	BT-4	Analyzing
12.	Explain Briefly about the gravity separator and Centrifugal separation.	BT-1	Remembering
13.	Derive expression for constant volume of flow in filtration processes.	BT-3	Applying
14.	Explain briefly about the cake washing.	BT-1	Remembering

PART-C

1.	It is desired to obtain 60 l/min of filtrate from an aqueous suspension that contains 0.25 kg of insoluble solids per each kg of water, using a rotary drum filter. The pressure drop suffered by the fluid is 300 mm of Hg, obtaining a cake that has a 50% moisture content and a filtrate that has a viscosity of 1.2 mPa·s and a density of 1000 kg/m3. The filter's cycle time is 5 min, with 30% of the total surface submerged. The particles that form the suspension can be considered as spheres with a 6 × 10–3 mm diameter and a 900 kg/m3 density. If it is supposed that the resistance offered by the filtering medium to filtration is negligible and that a value of 5 can be taken for the Kozeny constant, calculate (a) the specific resistance of the cake; (b) the filter's area; and (c) thickness of the deposited cake.	BT-4	Analyzing
2.	An aqueous suspension that contains 7% of insoluble solids is filtered at a rate of 10 ton/h, using a plate-and-frame press filter that works under constant pressure of 3 atm. It was found, experimentally, that the deposited cake contains 50% moisture, the density of the dry solids is 3.5 g/cm3, and the equivalent diameter of the deposited particles is 0.002 mm. The washing of the cake begins after 10,000 kg/h of feeding have been filtered using 150 l of water, while 30 min are used for the discharge, cleaning, and assembly operations. If the resistance of the filtering medium to filtration is considered negligible, calculate: (a) the specific resistance of the cake; (b) volume of water filtered after one hour; (c) time needed to carry out washing; and (d) filtration capacity.	BT-4	Analyzing
3.	Define Briefly how the sediment particle for gas are get selected	BT-5	Creating
4.	Derive an expression when the pressure drop remain constant in the filtration processes.	BT-3	Applying

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 equipment - Crushers - Jaw crusher, gyratory crusher - Crushing rolls - Grinders - Hammer mills - Rolling compression mills - Attrition, rod, ball and tube mills - construction and operation.

PART - A

1.	Define the Size reduction principal.	BT-2	Understanding
2.	Why size reduction is necessary?	BT-1	Remembering
3.	List out the type of forces used in the size reduction equipment.	BT-4	Analysis
4.	Define stress.	BT-1	Remembering
5.	Define the principles of communication.	BT-4	Analysis
6.	Define ultimate stress.	BT-2	Understanding
7.	List out the various types of Size reduction.	BT-1	Remembering
8.	Define smooth roll crushers.	BT-1	Remembering
9.	Define Attrition Mill	BT-2	Understanding
10.	Define grinders.	BT-1	Remembering
11.	List out the various types of grinders.	BT-1	Remembering
12.	Classify the Hammer Mill.	BT-3	Applying
13.	What do you mean by size reduction	BT-1	Remembering
14.	Define Rittinger's Law.	BT-4	Analysing
15.	Define Kick's Law	BT-1	Remembering
16.	Define Bond's Law	BT-4	Analysing
17.	What are the properties communicated products.	BT-1	Remembering
18.	Define crusher.	BT-1	Remembering
19.	Define ultra-grinders.	BT-1	Remembering
20.	What are the factors affecting size reduction?	BT-1	Remembering
21.	Difference between the edge and end runner mill.	BT-4	Analysing
22.	Define fluid runner mill.	BT-1	Remembering
23.	Define Pebble mill.	BT-3	Applying
24.	Define jaw crusher.	BT-2	Understanding
25.	What is meant by plastic deformation?	BT-2	Understanding

PART – B

1.	Derive the equation for energy and power requirement of Size reduction	BT-3	Applying
2.	Define crusher and what are the various types of crushers?	BT-2	Understanding
3.	Derive the equation for energy using Kick's Law	BT-3	Applying
4.	Briefly explain about the properties of communicated products.	BT-5	Evaluating
5.	Derive the equation for energy using Rittinger's Law.	BT-3	Applying
6.	Explain briefly about various types revolving mils.	BT-1	Remembering
7.	A material consisting originally of 20 mm particle crushed to an average size of 5 mm and required 30 kJ/kg for this size reduction. Determine the energy required to crush the material from 20 mm to 3 mm assuming (a) Rittinger's law, (b) Kick's law and (c) Bond's Law.	BT-4	Analysing
8.	Derive the equation for energy using Bond's Law.	BT-3	Applying
9.	Briefly explain about the various types of ultra-girders.	BT-5	Evaluating
10.	Explain briefly about the various types of cutting machines.	BT-1	Remembering

11.	Write briefly about the various steps in particle size analysis.	BT-5	Evaluating
12.	Explain briefly about the various factors affecting size reduction.	BT-3	Applying
13.	Describe principle, working merits and de-merits of fluid runner Mill.	BT-4	Analysing
14.	Briefly explain about Ball Mill.	BT-1	Remembering

PART-C

<table>
<tr><td>1.</td><td colspan="4">Grain is milled at a rate of 10 t/h and the power required for this operation is 67.5 kW. Assuming that Bond's law best describes the relationship between energy required and change in particle size, determine the work index for the grain and thus find the total power requirement to mill down to a distribution where 80% passes 100 μm.

<table>
<tr><td colspan="2">Initial distribution</td><td colspan="2">Final distribution</td></tr>
<tr><td>Sieve size (μm)</td><td>Mass fraction</td><td>Sieve size (μm)</td><td>Mass fraction</td></tr>
<tr><td>6730</td><td>0.00</td><td>605</td><td>0.00</td></tr>
<tr><td>4760</td><td>0.05</td><td>425</td><td>0.08</td></tr>
<tr><td>3360</td><td>0.15</td><td>300</td><td>0.12</td></tr>
<tr><td>2380</td><td>0.70</td><td>212</td><td>0.65</td></tr>
<tr><td>1680</td><td>0.10</td><td>150</td><td>0.11</td></tr>
<tr><td></td><td></td><td>100</td><td>0.04</td></tr>
</table></td><td>BT-4</td><td>Analysing</td></tr>
<tr><td>2.</td><td colspan="3">Explain briefly about the various types of size reducing machines.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>3.</td><td colspan="3">Describe principle, working merits and de-merits of Hammer Mill.</td><td>BT-4</td><td>Analysing</td></tr>
<tr><td>4.</td><td colspan="3">Explain berfliy about the mechanism in size reduction.</td><td>BT-1</td><td>Remembering</td></tr>
</table>

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

1	Define equilibrium distribution Co-efficient.	BT-1	Remembering
2	What is mean by Equilibrium stage operations?	BT -2	Understanding
3	Define contact equilibrium separation.	BT -2	Understanding
4	Define gas absorption.	BT-1	Remembering

5	Give example for contact equilibrium processes.	BT -4	Analysing
6	Define Cascades.	BT -2	Understanding
7	What are the components of gas mixture?	BT-1	Remembering
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 -4	Analysing
9	Define the rate of gas absorption.	BT-1	Remembering
10	Define Gas Absorption Equipment.	BT -2	Understanding
11	Define washing.	BT-3	Applying
12	Difference between the steady and unsteady leaching.	BT -4	Analysing
13	Define thickener.	BT -2	Understanding
14	What is meant by Hydro cyclones?	BT-1	Remembering
15	Define percolation tank leaching.	BT-1	Remembering
16	List out the different types of leaching.	BT -2	Understanding
17	Draw the neat sketch of shank system.	BT -4	Analysing
18	List out the uses of Agitation vessel.	BT-3	Applying
19	Define principal of leaching.	BT-1	Remembering
20	What are the applications of leaching?	BT-1	Remembering
21.	Define number of ideal stages for constant underflow.	BT -2	Understanding
22.	What is meant by Dispersed-Solid leaching?	BT-1	Remembering
23.	Define number of ideal stages for variable under flow	BT-3	Applying
24.	What is the difference between the constant and variable underflow	BT -4	Analysing
25.	Define stage efficiency.	BT -2	Understanding

PART B

1	Air is reported to contain 79 parts of nitrogen to 21 parts of oxygen, by volume. Calculate the mole fraction of oxygen and of nitrogen in the mixture and also the weight fractions and the mean molecular weight. Molecular weight of nitrogen is 28, and of oxygen 32.	BT -4	Analysing
2	Derive an equation for constant equilibrium stage operating condition.	BT-3	Applying
3	Explain briefly about the Rate of Gas absorption and Stage Equi1ibrium Gas absorption.	BT -2	Understanding
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 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.	BT-3	Applying
5	Explain briefly about Extraction and Washing Equipment.	BT -2	Understanding
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 casein 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 -4	Analysing
7	Briefly explain about the Dorr Balanced-tray Thickeners.	BT-5	Evaluate
8	Briefly explain about the Bollman Extractor.	BT-5	Evaluate

9	Briefly explain about the Rotocel Extractor.	BT-5	Evaluate
10	Explain briefly about the percolation tank leaching.	BT-1	Remembering
11	Define agitation vessel it's uses and setup of the vessel.	BT -2	Understanding
12	Explain briefly about the continuous countercurrent leaching	BT -2	Understanding
13	Explain briefly about the properties of tower packing.	BT-1	Remembering
14	Given that the Henry's Law constant for carbon dioxide in water at 25oC is 1.6x105 kPa mole fraction-1 , calculate the percentage solubility by weight of carbon dioxide in water under these conditions and at a partial pressure of carbon dioxide of 200kPa above the water.	BT-3	Applying

PART – C

1	A continuous deodorizing system, involving a single stage steam stripping operation, is under consideration for the removal of taints from cream. If the taint component is present in the cream to the extent of 8 parts per million (ppm) and if steam is to be passed through the contact stage in the proportions of 0.75kg steam to every 1kg cream, calculate the concentration of the taint in the leaving cream. The equilibrium concentration distribution of the taint has been found experimentally to be in the ratio of 1 in the cream to 10 in the steam and it is assumed that equilibrium is reached in each stage.	BT -4	Analysing
2	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-3	Applying
3	Explain briefly about stage equilibrium extraction.	BT -2	Understanding
4	Briefly explain about the different types of extractor equipment.	BT-5	Evaluate

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.

PART – A

1	Define Crystal Geometry.	BT-2	understanding
2	What is meant by yield?	BT-1	Remembering
3	Define heterogeneous nucleation.	BT-1	Remembering
4	If sodium chloride solution, at a temperature of 40oC, 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-3	Applying
5	Define about the Crystallization Equipment.	BT-2	understanding
6	Define batch criticizer.	BT-1	Remembering
7	What would be the size of nucleus in equilibrium with supersaturation of	BT-4	Analysis

	0.029,under the chlorine is consistent with an apparent interfacial tension of 2.5 ergs/cm^2,at a temperature of 80° F (300 k)		
8	Define kelvin equation	BT-1	Remembering
9	Write van't Hoff equation and explain terms.	BT-3	Applying
10	Draw the system diagram for the following condition the gas constant R is 8.314m3 kPa mol -1 K -1 .	BT-6	Creating
11	What are the various growth co-efficient consider in the crystal growth?	BT-1	Remembering
12	Write the difference between the circulation – liquid method and circulation-magma method.	BT-4	Analysis
13	Define Vacuum crystallizers.	BT-1	Remembering
14	Define Flash Distillation.	BT-1	Remembering
15	What is meant by steam Distillation?	BT-6	Creating
16	Estimate the osmotic pressure of a solution of sucrose in water containing 20% by weight of sucrose. The density of this solution is 1081 kgm-3 and the temperature 20^oC.	BT-1	Remembering
17	Define Net flow rate in Distillation.	BT-1	Remembering
18	What is meant reflux ratio?	BT-1	Remembering
19	What is the simplest method of plotting the operation line?	BT-1	Remembering
20	What are the requirements of heating and cooling requirements?	BT-1	Remembering
21	Define homogeneous nucleation.	BT-1	Remembering
22	What is mean supersaturation?	BT-1	Remembering
23	Classify the crystallographic based on the shape.	BT-3	Applying
24	What is meant by Invariant crystals?	BT-1	Remembering
25	List out various nucleation methods.	BT-3	Applying

PART-B

1	Briefly explain about the equilibrium and yield.	BT-5	Evaluate
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 57oC to 10oC. Lactose crystallizes with one molecule of water of crystallization. The specific heat of the lactose solution is 3470Jkg-1oC -1 . The heat of solution for lactose monohydrate is -15,500 kJmol-1 . The molecular weight of lactose monohydrate is 360 and the solubility of lactose at 10oC is 1.5g/l0g water. Assume that 1% of the water evaporates and that the heat loss through the vat walls is 4x 104 kJ. Calculate the heat to be removed in the cooling process.	BT-3	Applying
3	Explain briefly about the rate of crystal growth.	BT-1	Remembering
4	Calculate the yield of sugar in each evaporator and the concentration of sucrose in the mother Liquor leaving the final evaporator. SUGAR CONCENTRATIONS (g/100g water) On Weight seeding Solubility crystallized First effect 456 385 71 Second effect 525 330 195 Third effect 614 287 327 Fourth effect 809 265 544	BT-2	Understanding
5	Briefly define about the Draft – tube –baffle crystallizer	BT-6	Creating
6.	A solution of sucrose in water at 25oC is to be concentrated by reverse osmosis. It is found that, with a differential applied pressure of 5000kPa, the rate of movement of the water	BT-3	Applying

	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 with a sucrose concentration of 20%. Density of 20% sucrose is 1081kgm-3 and for 10% is 1038kgm-3. For sucrose, the molecular weight is 342 so for a 10% solution, molar concentration is 0.30moles m-3 and for 20%, 0.62 moles m-3 .		
7	Explain briefly about the Vacuum crystallizers.	BT-1	Remembering
8	Briefly explain about the Flash distillation of binary mixtures.	BT-5	Evaluate
9	Explain briefly about the continuous Distillation with rectification.	BT-1	Remembering
10	Explain briefly about Batch Distillation.	BT-1	Remembering
11	Derive an equation for material in Plate columns.	BT-6	Creating
12	Define batch Distillation and also explain about advantages and limitation	BT-1	Remembering
13	Briefly explain about condition for feeding.	BT-4	Analysis
14	Derive an equation for feed line concept.	BT-2	Understanding

PART – C

1.	Briefly explain about the various equipment's used for the crystallization.	BT-5	Evaluate
2.	A mixture of 50 moles percent of benzene and 50 percent toluence is subjected to flash distillation at a separator pressure of 1 atm. The incoming iquid is heated to a temperature that will cause 40 percent of the feed to flash. (a) What are the compositions of the vapour and liquid leaving the flash chamber? (b) What is the required feed temperature?	BT-4	Analysis
3.	In a six-step sugar-boiling crystallization process, the proportions of the sucrose present removed in the successive crystallizations are 66.7%, 60%, 60%, 50%, 50% and 33%. If the original sugar was associated with 0.3% of its weight of non-sucrose solids, calculate (a) the percentage of non-sucrose material in the dry solids of the final molasses and (b)the proportion of the original sugar that remains in the molasses. Assume that after each crystallization, all of the impurities remain with the mother liquor..	BT-4	Analysis
4.	Explain briefly about the Distillation equipment.	BT-1	Remembering