BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: VIth Date: 26/04/2022 (MORNING)

Subject with Code: **FT309 MASS TRANSFER IN FOOD PROCESSING**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION SP-22)

CLASS : IMSC SEMESTER : VI
BRANCH : FOOD TECH SESSION : SP-2022

Subject with Code : FT 309 Mass Transfer in Food processing

TIME : 2.00 HOURS FULL MARKS : 50

INSTRUCTIONS :

1. The question paper contains 2 parts (Part-A carries 30 marks and Part-B carries 20 marks)
2. The missing data, if any may be assumed suitably.
2. Before attempting the question paper, be sure that you got a correct question paper.
3. Tables/Data hand book/Graph Paper etc. to be supplied to the candidates in the examination hall

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Graph paper to be supplied

PART A- Objective Type Questions (30X1=30 Marks)

Q1.	The McCabe Δ L law states that the	
	a) molar heats of vaporisation of components are nearly equal.	b) linear crystal growth rate depends on the degree of supersaturation.
	c) linear crystal growth rate does not depend on the crystal size.	d) linear crystal growth rate depends on the crystal size.
Q2.	In the constant rate period of the rate of drying curve for batch drying,	
	(a) cracks develop on the surface of the solid.	(b) rate of drying decreases abruptly.
	(c) surface evaporation of unbound moisture occurs.	(d) none of these.
Q3.	Agitator is provided in a crystalliser for	
	(a) avoiding deposition on cooler surfaces.	(b) formation of nuclei.
	(c) crystal growth.	(d) all (a), (b) and (c).
Q4.	Pick out the system with minimum boiling azeotrope at 1 atm.	
	(a) benzene-toluene	(b) ethyl alcohol-water
	(c) hydrochloric acid-water	(d) all (a), (b) and (c)
Q5.	Drying of a solid involves _____ transfer.	
	(a) Only heat	(b) Only mass
	(c) Both heat and mass transfer	(d) None of these
Q6.	Corresponding to Nusselt number in heat transfer, the dimensionless group in mass transfer is the _____ number.	
	(a) Sherwood	(b) Schmidt

	(c)Peclet	(d)Stanton
Q7.	Moisture contained by a substance in excess of the equilibrium moisture is called the _____ moisture.	
	(a) unbound	(b) free
	(b) critical	(c) bound
Q8.	Free flowing granular materials can be best dried in a _____ drier.	
	(a) rotary	(b) cylinder
	(c) drun	(d) freeze
Q9.	Bound moisture is that liquid which exerts an equilibrium vapor pressure _____ that of the pure liquid at the given temperature.	
	(a) less than	(b) more than
	(c) equal to	(d) either (o) or (b); depends on the solid
Q10.	The diffusivity (D) in a binary gas mixture is related to the temperature (T) as	
	(a) $D \propto T$	(b) $D \propto T^{0.5}$
	(c) $D \propto T^{1.5}$	(d) $D \propto T^{2}$
Q11.	Leaching of coffee from coffee beans is done by	
	(a) hot water	(b) hexane
	(c) lime water	(d) dilute H_2SO_4 (hot)
Q12.	Ideal solution obeys	
	(a) Boyle's law	(b) Amagats's law
	(c) Raoult's law	(d)All the above laws
Q13.	Mechanism of moisture removal in case of freeze drying of food stuff is by	
	(a) evaporation	(b) sublimation
	(c) dehydration	(d) adsorption
Q14.	The wet and 'dry bulb temperature for a vapour-gas mixture are 25°C and 30°C respectively. If the mixture is heated to 45°C at constant pressure, the wet bulb temperature will be _____ °C.	

	(a) 25	(b) > 25
	(c) < 25	(d) - 25
Q15.	With increase in temperature, the leaching rate increases due to	
	(a) decreased liquid viscosity	(b) increased diffusivity
	(c) both (a) and (b)	(d) neither (a) nor (b)
Q16.	The critical moisture content in case of drying indicates the _____ rate period.	
	(a) beginning of falling	(b) beginning of constant
	(c) end of falling	(d) none of these
Q17.	Rayleigh's equation applies to _____ distillation.	
	(a) continuous	**(b)** steam
	(c) differential	**(d)** flash
Q18.	Rose oil is extracted from rose leaves using _____ distillation.	
	(a) high pressure	(b) low pressure
	(c) extractive	(d) steam
Q19.	Dry bulb temperature of the gas is _____ the wet bulb temperature.	
	(a) less than	(b) more than
	(c) equal to	(d) none of these
Q20.	The solvent used in liquid-liquid extraction should have _____ less than one.	
	(a) selectivity	(b) distribution co-efficient
	(c) both (a) and (b)	(d) neither (a) nor (b).
Q21.	McCabe-Thiele method	
	(a) uses molal units for material and energy balance.	(b) uses weight fractions to express liquid and vapour composition
	(c) can use any type of units.	(d) is more accurate than Ponchan-Savarit method.

Q22.	Adsorption is an unit operation which generally involves _____ systems.	
	(a) liquid-solid	(b) gas-solid
	(c) fluid-solid	(d) solid-solid
Q23.	Chemisorption compared to physical absorption has	
	(a) lower adsorption rate.	(b) lower capacity of the solvent for the solute gas.
	(c) increased utilisation of stagnant zones of the liquid phase.	(d) none of these
Q24.	Reboiler is considered as one theoretical plate, because	
	(a) of the assumption that vapour and liquid leaving the reboiler are in equilibrium.	(b) vapour is recycled to the column.
	(c) reboiler itself contains one plate.	(d) none of these.
Q25.	Drying of a wet solid under constant drying conditions means the exposure of the wet solid to the air of constant	
	(a) humidity	(b) velocity
	(c) temperature	(d) all (a), (b) & (c)
Q26.	Fenske equation determines the	
	(a) maximum number of ideal plates.	(b) height of the distillation column.
	(c) minimum number of theoretical plates.	(d) optimum reflux ratio.
Q27.	The amount of steam required per unit quantity of distillate in case of steam distillation will be reduced by	
	(a) raising the temperature.	(b) lowering the total pressure.
	(c) both (a) and (b).	(d) neither (a) nor (b).
Q28.	Overall efficiency of the distillation column is	
	(a) the ratio of number of ideal plates to actual plates.	(b) the ratio of number of actual plates to ideal plates.
	(c) same as the Murphree efficiency.	(d) always more than the point efficiency.
Q29.	Physical absorption is	

	(a) an irreversible phenomenon.	(b) a reversible phenomenon.
	(c) accompanied by evolution of heat.	(d) both (b) and (c)
Q30.	At minimum reflux ratio for a given separation	
	(a) number of plates is zero.	**(b)** number of plates is infinity.
	(c) minimum number of the theoretical plates is required.	(d) separation is most efficient.

PART B - Subjective Questions (5X4= 20 Marks)

Q1.	Calculate the rate of diffusion of hydrogen (A) through nondiffusing methane (B) at 25^0Cand 101 kN/m^2 pressure (D_{AB} = 6.6 x 10^{-5} m^2/s). The diffusion path is 5 mm long and the concentration of hydrogen at the two ends of the path in terms of partial pressure is 12 kN/m^2 and 8.4 kN/m^2 respectively.)
Q2.	A time of 5 hr was taken to dry a material from an initial moisture of 30% to a final moisture of 7%. Critical and equilibrium moisture are found to be 15% and 2% respectively. How much further time would be required to dry the material to final moisture of 4%. All moisture contents are on wet basis.
Q3.	. Soyabean seed are extracted with hexane in batch Extracter. The flaked seed contain 18.6% oil, 69.0% solid and 12.4 % moisture. At the end of the process, cake of milk is separated from the hexane oil mixture. The cake analysis yield 0.8% oil, 87.7% solid and 11% moisture. Find the % recovery of oil. All % are by wt only.
Q4.	A continuous fractionating column operating at atmospheric pressure is to separate a feed containing 30% CS_2 and 70% $CC1_4$ into an overhead product of 95 % CS_2 and a bottom product of 95 mole % $CC1_4$. The feed enters as a liquid at its boiling point. Assuming an overall plate efficiency of 70% and a reflux ratio of 3:1 estimate the number of plates needed. All the compositions are in mole %. Equilibrium data:

x	0.0296	0.0615	0.258	0.39	0.532	0.663	0.758	0.86
y	0.0823	0.1555	0.494	0.634	0.747	0.830	0.880	0.932