Total number of printed pages: **04** **Programme (Degree)/5th Semester/UFET 502**

2023

Food Process Engineering

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

Answers any four (4) from question no. 2 to 7 and question 1 is compulsory

1.	A	**Match the Column**		10X01=10
		i. Direct Drying	a) Number of kcal necessary to raise the temperature of 1kg dry air	
		ii. Kilogram of water vapor present in one kilogram	b) Convective Drying	
		iii. Dehumidification can be done	c) Percentage Humidity	
		iv. Line inclined to the horizontal and intersects saturation curve at DBT point	d) Wet Bulb Temperature Line	
		v. The oblique straight lines are plotted in the chart with steeper slopes than those of wet bulb lines	e) Specific Volume Line	
		vi. The process in which the air is cooled sensibly and at the same time the moisture is removed from	f) The process in which the air is heated and at the same time moisture is removed from	
		vii. Ratio of absolute air humidity with respect to the absolute air humidity at saturation	g) Absolute Humidity	
		viii. Humid Heat	h) Cooling and De-humidification process	
		ix. Heating and De-	i) Dielectric methods	

		humidification Process		
		x. Instrument based on capacitance	j) Cooling and reheating the air	
	B	**Multi choice questions**		10X01=10

i. The changing of a liquid into vapors from the surface of the liquid without heating is called

(a) expansion (b) contraction
(c) evaporation (d) fusion

ii. In Multiple effect evaporation, if the feed is cold, then the method of feeding is of

(a) Backward Type (b) Forward Type
(c) Rising Film (d) Falling Film Type

iii. Number effects in multiple effect evaporator system is limited by

(a) Final Product Concentration (b) Steam Pressure
(c) Total boiling point rise (d) None of the mentioned

iv. Freeze drying time is directly proportional to the _____of the material being dried.

(a) Thickness (b) Square of the thickness
(c) Cube of the thickness (d) Forth power of thickness

v. The moisture content of the material at which the drying rate of a material changes from constant rate period to falling rate period is called

(a) EMC (b) Moisture Content (WB)
(c) Critical Moisture Content (d) Moisture Content (DB)

vi. An atomizer in spray drying controls the

(a) Droplet size (b) Size distribution
(c) Speed of droplet (d) All of the above

vii. Which of the following is not the application of filtration?

(a) Sterilization of media (b) Removal of debris
(c) Plasma clarification (d) Off-gas analysis

viii. Moisture contained by a substance in excess of the equilibrium moisture is called the _____ moisture

(a) Unbound (b) Critical
(c) Free (d) Bound

ix. The difference between WBT and DBT

(a) Increase as air gets drier (b) Remains constant

		(c) Increase at Atm. pressure (d) Increase as air gets wet **x.** When moisture is removed from air at constant DBT, the process is known as (a) De-humidification (b) humidification (c) Sensible cooling (d) Aeration	
2.	a)	What do you mean by Drying? Discuss Mechanism of drying. Write a note on factors which affect rate of drying	
	b)	500 kg of paddy at 23% moisture content (wb) is dried to 12% moisture content (db) for milling. Calculate (i) The amount of moisture removed in drying. (ii) The initial moisture content (db) and final moisture content in (wb). (iii) What shall be the moisture content (db) when final weight is 186 kg.	10
3.	a)	The result of EMC determination are given below From above data, compute the constant C and n for Henderson/s equation	10
	b)	What do you mean by EMC? Write down the different models associated with EMC of agricultural products	10
4.	Differentiate the following (any four)		4X5=20
	a)	Constant Rate Period and Falling rate Period	
	b)	Falling Film Evaporator and Rising Film Evaporator	

Experiment	Temperature	Relative Humidity	EMC
Experiment No.-1	60^0C	40%	8.65 %, db
Experiment No.-2	30^0C	50%	10.51 %, db

	c)	Drying and Dehydration	
	d)	Wet basis and Dry basis of moisture content	
	e)	Bound moisture content and un-bound moisture content	
5.	a)	The relative humidity at 30% and dry bulb temperature (DBT) of 30°C Find out other properties of atmospheric air. a) Humidity Ratio b) Degree of saturation c) Humid volume (Data given partial pressure of water vapor: 0.019 bar, dew point temperature: 17^0C, Saturation pressure of vapor: 0.032 bar; 101.32 kPa is 0.012 kg/kg of dry air) Refer/Use Psychometric chart for details	10
	b)	Describe in a tabular form the advantages and dis-advantages of various evaporation systems.	10
6.	a)	List out and discuss different process in psychometric chart with diagram.	10
	b)	Describe with a neat diagram drum dryer and its application in food processing.	3+7=10
7.	Write short notes on the following (any four)		4X5=20
	a)	Hysteresis effect	
	b)	Calendria Evaporator	
	c)	Factors affecting filtration process	
	d)	Forward Feeding arrangement	
	e)	Contact Drying	
	f)	De-Humidifier	