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Department of Food Technology
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END SEM EXAMINATION

Jan, 2023. M Tech 1st SEM

Paper Title: Food Engineering; Paper Code: MFTC – 105

Time allotted: 3Hrs.

Max Marks: 60

Note: Write to the point. Do not insert margins in the answer sheet. Don't waste the paper. Continuation sheet will not be provided.

Before answering make sure you have mentioned the Question No. & Section.

Important: At the END, mention how many questions from each section you have attempted.

Section-A (12 Marks, Attempt All)

<u>Questions</u>	<u>Marks</u>	<u>Mapping</u>
Q1. D value	(2)	PO: 1,3 /CO: 2,4
Q2. Bulk density	(2)	PO: 1,4/CO: 3,5
Q3. Vaporization	(2)	PO: 1,2,4/CO:1,2,6
Q4. LMTD	(2)	PO: 1,2,3/CO:1,2,6
Q5. Dry basis MC	(2)	PO: 1,4/CO:1,2,7
Q6. Manometers	(2)	PO: 1,4/CO:1,2,7

Section-B (Attempt any 5) (5 Marks Each)

Q7. Derive the equations for Wet and Dry basis MC.

OR

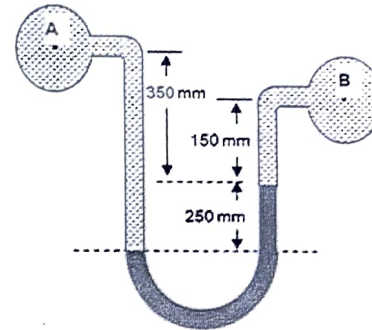
Discuss the modes of heat transfer.

Q8. Discuss the Effects of Freezing on food properties and Factors affecting freezing rate in detail.

OR

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A U-tube differential manometer is connected to two pipes at A and B. It is filled with water and oil density of 998 kg/m^3 and 1300. If the pressure at point A is 125 kN/m^2 find the pressure at point B.



Q9. Discuss in detail canning of fruits.

OR

The rate of heat transfer per unit area from a metal plate is 1000 W/m^2 . The surface temperature of the plate is 120°C , and ambient temperature is 20°C . Estimate the convective heat transfer coefficient.

Q10. A hot fluid enters a concentric pipe at a temperature of 300°F and is to be cooled to 200°F by a cold fluid entering at 100°F and heated to 150°F . Determine LMTD for (a) co-current flow and (b) counter-current flow.

OR

Water has coefficient of viscosity of 0.0001 Pas at 20°C . What Pressure difference is necessary to keep water moving

with a volumetric flow rate of $0.015 \text{ m}^3/\text{s}$ through a 3 m long pipe with a radius of 6 cm .

- Q11. Pooled raw milk at the processing plant has bacterial population of $4 \times 10^5/\text{mL}$. It is to be processed at 79°C for 21 seconds. The average D value at 65°C for the mixed population is 7 min. The Z value is 7°C . How many organisms will be left after pasteurization? What time would be required at 65°C to accomplish the same degree of lethality?

OR

Steam is used for peeling potatoes in a semi-continuous operation. Steam is supplied at the rate of 4 kg per 100 kg of unpeeled potatoes. The unpeeled potatoes enter the system with a temperature of 17°C , and the peeled potatoes leave at 35°C . A waste stream from the system leaves at 60°C . The specific heats of unpeeled potatoes, waste stream, and peeled potatoes are 3.7 , 4.2 , and $3.5 \text{ kJ}/(\text{kg K})$, respectively. If the heat content (assuming 0°C reference temperature) of the steam is 2750 kJ/kg , determine the quantities of the waste stream and the peeled potatoes from the process.

MAPPING

Question No	CO & PO
7	PO: 1,3,4/ CO: 3,4,5
8	PO: 1,4/ CO: 1,3,5
9	PO: 1,4/ CO: 3,6,7
10	PO: 1,2,4/ CO: 1,2,4,6
11	PO: 1,3,4/ CO: 4,5,6

Section-C (Attempt any 2) (11.5 Marks Each)

- Q12. Calculate the specific heat and conductivity of a food material with nutritional value of 12% protein, 8% fat, 5% fibre, 3% ash and remaining water.
- Q13. Derive Bernoulli's theorem and Poiseuille's Equation.
- Q14. A membrane separation system is used to concentrate total solids (TS) in a liquid food from 10% to 30%. The concentration is accomplished in two stages with the first stage resulting in release of a low-total-solids liquid stream. The second stage separates the final concentration product from a low-total-solids stream, which is returned to the first stage. Determine the magnitude of the recycle stream when the recycle contains 2% TS, the waste stream contains 0.5% TS, and the stream between stages 1 and 2 contains 25% TS. The process should produce 100 kg/min of 30% TS
- Q15. Find out the diameter of the spherical product being frozen in an air-blast wind tunnel. The initial product temperature is 100°C & cold air in the tunnel is at -12°C . The product density is 1000 kg/m^3 and the convective heat transfer coefficient for the air blast is $50 \text{ W/m}^2\text{K}$. The thermal conductivity of the product is 1.25 W/mK and the initial freezing temperature is -20°C . The latent heat of fusion is 300 kJ/kg . Freezing time is 2.2 hrs. (Use Plank's Equation).

MAPPING

Q. No	CO & PO	Q. No	CO & PO
7	PO: 1,3,4/ CO: 3,4,5		PO: 1,4/ CO: 3,6,7
8	PO: 1,4/ CO: 1,3,5		PO: 1,2,4/ CO: 1,2,4,6

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