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Department of Food Technology
School of Interdisciplinary Sciences & Technology
Jamia Hamdard, New Delhi-110062

END SEM EXAMINATION

Dec, 2025. B Tech 3rd SEM

Paper Title: Food Engineering; Paper Code: BFTC – 301

Time allotted: 2.5Hrs.

Max Marks: 60

Note: 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 (10 Marks, Attempt All)

Questions	Marks	Mapping
Q1. Relative Humidity	(2)	PO: 1,3 /CO: 2,4
Q2. Sensible heating and cooling	(2)	PO: 1,4 /CO: 3,5
Q3. Shear Rate	(2)	PO: 1,2,4 /CO: 1,2,6
Q4. Kinematic viscosity	(2)	PO: 1,2,3 /CO: 1,2,6
Q5. F value	(2)	PO: 1,4 /CO: 1,2,7

Section- B (Attempt any 5) (6 Marks Each)

- Q1. Shelf life of a product stored at 35°C is 10 days. If the Q-10 value of deterioration is 1.8 times. What will be the shelf life if the food product is stored at 5°C.
- Q2. A spherical food product is being frozen in an air-blast freezer. The initial product temperature is 10°C and the cold air -40°C. The product has a 7 cm diameter with density of 1000 kg/m³, the initial freezing temperature is -1.25°C, the thermal conductivity of the frozen product is 1.2 W/(m K), and the latent heat of fusion is 250 kJ/kg. Compute the freezing time.

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- Q3. Derive the equations for Wet and Dry basis MC.
- Q4. Skim milk is produced by centrifuging the whole milk (3.5% fat). Skim milk has 90.5% water, 3.2% protein, 5.1% carb, 0.4% fat, and 0.8% ash. Calculate the composition of whole milk.
- Q5. Calculate the specific heat of a food material with Carb 40%, Protein 10%, Fat 5% and remaining water.
- Q6. What do you understand by Food Rheology. Discuss the different models used in Rheological analysis of foods.
- Q7. Write a note on drying of foods. Discuss briefly the working of Foam mat drying.
- Q8. Derive an equation for D and Z value.

MAPPING

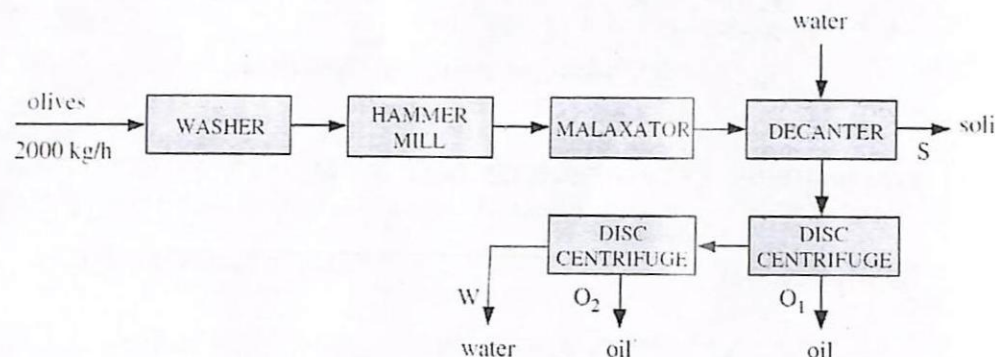
Q No	CO & PO	Q No	CO & PO
1 & 8	PO: 1,3,4/ CO: 3,4,5	4 & 5	PO: 1,2,4/ CO: 1,2,4,6
2	PO: 1,4/ CO: 1,3,5	6, 7	PO: 1,3,4/ CO: 4,5,6
3	PO: 1,4/ CO: 3,6,7		

Section C (Attempt any 2) (10 Marks Each)

- Q1. A feed of 104kg of soybean is processed in sequence of 3 stages. The feed contains 30% protein, 30% carb, 10% fibre, 11% water and 19% oil. In the first stage the beans are crushed and pressed to remove oil, giving an expressed oil stream and pressed grains with 6% oil. In the second stage the pressed grains are extracted with hexane to produce an extracted meal with 0.5% oil and hexane-oil mixture. In the last step the meal is dried to produce a meal with 8% moisture. Calculate: kg of pressed beans from the first stage, kg of extracted meal from the 2nd stage and kg of final meal and weight of protein in the dried meal.

Q2. An orange of spherical shape with diameter of 8 cm is hanging on an orange tree during a clear-sky night. The orange gains heat from the air by natural convection and loses heat by radiation. 1/3 of the orange surface is exposed to sky, while the other 2/3 is covered by the leaves of the tree which are at the same temperature as the orange. If the air temperature drops, calculate the air temperature at which the orange will reach the temperature of -1°C , which is the initial freezing point of the orange. Assume a convective heat transfer coefficient of $3 \text{ W/m}^2 \text{ }^{\circ}\text{C}$, emissivity of the orange at 0.8 and sky temperature at 230 K. If a big blower is used to circulate the air around the tree so that the heat transfer coefficient increases to $6 \text{ W/m}^2 \text{ }^{\circ}\text{C}$, what will be the air temperature at which freezing of the orange will start?

Q3. For the production of olive oil, the olives are washed, crushed, and separated into oil, water, and solids by centrifugation as in the following flow chart. Find the flow rate in the exit streams given that: a) the composition of the olives is 20% oil, 35% water, and 45% solids; b) the composition of the discharged solids stream in the decanter is 50% solids and 50% water; c) 90% of the oil is taken out in the first disc centrifuge; and d) the ratio of olives to water added in the decanter is equal to 1.



Q4. 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 $3.5 \text{ kJ/(kg }^{\circ}\text{C)}$, 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.

Q5. Calculate the D value (in minutes) at 63°C , if D value at 75°C 15 seconds. Given Z value is 6°C .

Mapping

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

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