

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: IMSC
BRANCH: FT

SEMESTER : VIII
SESSION : SP/19

SUBJECT: SAF2003- NOVEL FOOD PROCESSING AND PACKAGING

TIME: 3 hours

FULL MARKS: 60

INSTRUCTIONS:

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

- Q.1(a) Classify membrane separation processes, and mention their application in Food Processing. What are the applications of Micro filtration in food processing industry? Explain method of characterization of MF membrane by bacterial challenge method. A membrane for MF was examined microscopically and found to have about 120 000 pores with an average diameter of 0.8 μ m, per mm square of membrane surface. It is desired to estimate the hydraulic permeability of the membrane to water, using the Hagen-Poiseuille capillary model. The thickness of the membrane is 160 μ m. [6]
- Q.1(b) Explain principles of Super critical fluid extraction. Give examples of Super critical Fluids and mention their application in Food Processing. Describe with flow sheet of a commercial Supper critical fluid extraction plant. Discuss effect of Pressure and temperature of solubility parameter of Supercritical Fluid Extraction. [6]

- Q.2(a) What are advantages of microwave and radiofrequency heating? Explain their principle of operation, effect on food and applications in Food Processing Industries. [6]
- Q.2(b) Explain principle and equipment for Freeze drying, Derive heat and mass transfer equation for the process. [6]

- Q.3(a) Write technical notes on (i) High pressure processing of seafood (ii) Ultrasound assisted drying and extraction. [6]
- Q.3(b) An ultra-high pressure process is being used to reduce the population of spoilage microorganisms in a food product. The process occurs as follows: [6]

Time, min	0	1	2	3	4	5	6	7	8	9	10
Pressure, MPa	0	100	200	300	400	400	400	400	250	100	0

Estimate the reduction in microbial population that occurs as a result of this process, when the initial population is 2×10^3 . The response of the spoilage microorganism to the pressure treatment is described by D_{200} is 60 min and z_p is 130 MPa.

- Q.4(a) Describe equipment and explain mechanism of microbial inactivation using (i) Pulsed Electric Field and (ii) Ohmic Heating. What is Infrared Heating? An 8 kW oven has a hearth area of 4m² and operates at 210°C. It is loaded with two batches of bread dough in baking tins; 150 loaves on the first batch and 120 loaves on the second batch. The surface of each loaf measures 12 cm x 20 cm. Assuming that the emissivity of dough is 0.85, that the dough bakes at 100°C, and that 90% of the heat is transmitted in the form of radiant energy, calculate the efficiency of energy use (as the percentage of the supplied radiant energy which is absorbed by the food) for each batch. [7]
- Q.4(b) What are nano-materials? How are they manufactured? Discuss in application of Nanotechnology in Food Technology. [5]
- Q.5(a) Distinguish between Drag flow and Pressure flow in an extruder. What is operating point of an extruder? [6]

$$Q = \left[\frac{(\pi DN \cos \theta) WH}{2} \right] - \left[\frac{WH^3}{12\mu} \left(\frac{P_2 - P_1}{z} \right) \right]$$

Estimate the volumetric output of a single-screw extruder operating with the following data: Screw diameter, D 0.1 m; Channel depth, 0.002 m; channel width 0.05 m; Speed of rotation 6 per second; Helix Angle, 20 degrees; Length of the screw, L 1.2 m; Viscosity of the melt is estimated as 5 Pas. The pressure at the die is 1.3 MPa,gage

- Q.5(b) Sketch Temperature and pressure profile in a high shear single screw cooking extruder. What are different types of dies used in food processing? Compare application of single and twin screw extruder in food processing. What are effects of extrusion on protein and starch? [6]
- Q.6(a) Distinguish between active and intelligent packaging. Explain principles of Oxygen and Ethylene scavenging Technologies. [6]
- Q.6(b) Explain use of oriented film, coextruded film, stretch films, and shrink wrap film for food packaging. What are different techniques in antimicrobial food packaging? [6]
- Q.7(a) Describe machineries for Modified Atmosphere packaging. Explain application of High Oxygen MAP. [6]
- Q.7(b) Explain the following methods of shelf life prediction :(a) accelerated shelf life studies (b) Scientific approach [6]

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