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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH4DELA2 **Max Marks: 100**
Course: Food Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Discuss the world food needs and food issues around the world. **08**

b) The volumetric flow rate of beer flowing in a pipe is 1.8 L/s. The inside diameter of the pipe is 3 cm. The density of beer is 1100 kg/m^3. Calculate the average velocity of beer and its mass flow rate in kg/s. What is the mass flow rate if another pipe with a diameter of 1.5 cm is used? What will be the velocity for the same volumetric flow rate? Given: Pipe diameter = 3 cm, volumetric flow rate =1.8 L/s and density =1100 kg/m^3 **06**

c) The following data was collected while testing a centrifugal pump for water at 308°C. Suction pressure is 5 bar, discharge pressure is 8 bar, volumetric flow rate is 15,000 L/h. Calculate the pump head at the given flow rate and power requirements. **06**

UNIT - II

2 a) Why FSSAI (Food safety and Standards Authority of India) was established? List the detailed functions performed by FSSAI. **10**

b) Explain the meaning of food adulteration and adulterants. Briefly discuss when food is considered adulterated. **10**

UNIT - III

3 a) Calculate the temperature of tomato juice of density 5,980 kg/m^3 in a steam jacketed hemispherical kettle after 5 minutes of heating. The radius of the kettle is 0.5 m. The convective heat-transfer coefficient in the steam jacket is 5000 W/m^2 °C. The inside surface temperature of the kettle is 90°C. The initial temperature of tomato juice is 20°C. Assume specific heat of tomato juice is 3.95 kJ/kg °C. **06**

b) Briefly explain the high-pressure processing of food. **06**

c) Explain the concept of ohmic heating of food and advantages. **08**

OR

4 a) A liquid food is being pumped through an ohmic heater at 0.5 kg/s. The inside diameter of the heater pipe is 0.05 m and it is 3 m long. The specific heat of the liquid food is 4000 J/kg °C. The applied voltage is 15,000 V. The overall heat transfer coefficient based on the inside pipe area is 100 W/m^2°C. The surrounding temperature of the air is 20°C. The liquid food enters the ohmic heater at 50°C. Assume that the properties of the liquid food are similar to 0.05 M sodium phosphate solution. Calculate the temperature at which the liquid food exits. **10**

Data: Electrical properties of 0.05 M sodium phosphate.

$$\sigma_o = 0.162 \frac{S}{m}$$

$$m'' = 0.048(℃^{-1})$$

b) Explain the freezing time criteria and Plank's equation for predicting freezing time. Also, write the limitations and assumptions of Plank's equation. **10**

UNIT – IV

5 a) What are chelating agents? Discuss the functions and applications of chelating agents. **08**

b) Discuss the role of humectants and anti-caking agents, leavening agents, and curing agents in food processing. **12**

UNIT - V

6 a) What are the different categories of extrusion system? Explain the method of cold extrusion used in food processing industry. **10**

b) Explain briefly the four functions of packaging of food. **10**

OR

7 a) What is an intelligent packing system? Explicit the four identified objectives for the intelligent packaging systems. **10**

b) Discuss the aseptic processing and packaging of food. **10**

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