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Total No. of Pages : 03

Total No. of Questions : 09

M.Sc (Food Technology) (2018 Batch) (Sem.–1)

PRINCIPLES OF FOOD ENGINEERING

Subject Code : MSFT-512-18

Paper ID : [75592]

Time : 3 Hrs. **Max. Marks : 70**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A contains SEVEN questions carrying TWO marks each and students has to attempt any ALL questions.**
2. **SECTIONS-B consists of FOUR Subsections : Units-I, II, III & IV. Each Subsection contains TWO questions each carrying FOURTEEN marks each and student has to attempt any ONE question from each Subsection.**

SECTION-A

Q1. Answer in brief :

a) What is the principle of material balance calculations?

b) What is dynamic viscosity of a fluid? Give its units.

c) Differentiate between thermal conductivity and thermal diffusivity of food.

d) Define Z value.

e) Define psychrometrics.

f) Differentiate between dry and wet bulb temperature.

g) What are the functions of a pallet truck?

SECTION-B

UNIT-I

Q2 a) How much dry sugar must be added in 100 kg of aqueous sugar solution in order to increase its concentration from 10% to 50%? (4)

b) Water is flowing through a pipe of 5 cm diameter under pressure of 30 N/cm^2 (gauge) with mean velocity of 2.0 m/s. Find the total head or energy per unit weight of the water at a cross section which is 10 m above the datum line. (4)

c) Differentiate between : (3 × 2)

i) Fluid statics and fluid dynamics.

ii) Newtonian and non-Newtonian fluids.

iii) Streamline and turbulent flow.

Q3 a) Milk at the rate of 1000 kg/h is heated in a heat exchanger from 45°C to 72°C. Water is used as the heating medium. It enters the heat exchanger at 90°C and leaves at 75°C. Calculate the mass flow rate of the heating medium, if the heat losses to the environment are equal to 1 kW. The heat capacity of water is given equal to 4.2 kJ/kg°C and that of milk 3.9 kJ/kg°C. (6)

b) Explain the principle, construction and working of a centrifugal pump with the help of a neat line sketch. (8)

UNIT-II

Q4 a) The rate of heat transfer per unit area from a metal plate is 1200 W/m^2. The surface temperature of the plate is 120°C, and ambient temperature is 30°C. Estimate the convective heat transfer coefficient. (6)

b) Explain the construction, working and applications of plate heat exchanger. (8)

Q5 a) In a counter current flow heat exchanger, milk is being cooled by chilled water at 1°C. The milk is flowing at the rate of 250 kg/h and cooled from 35°C to 4°C. The flow rate of water is four times the flow rate of milk. If overall heat transfer coefficient of heat exchanger is 593 W/m^{2}C and specific heat of milk and water are is 3.89 and 4.18 kJ/kg°C, respectively. Estimate the surface area. (7)

b) Write detailed procedure of calculation of process time in continuous flow system. (7)

UNIT-III

Q6 a) Write a brief notes on the following psychometric properties : (5 × 2)

i) Specific volume

ii) Humid heat

iii) Dew point temperature

iv) Humidity ratio

v) Wet bulb temperature

b) Air at 60°C dry bulb temperature and 27.5°C wet bulb temperature, and a humidity ratio of 0.01 kg water/kg dry air is mixed with water adiabatically and is cooled and humidified to a humidity ratio of 0.02 kg water/kg dry air. What is the final temperature of the conditioned air? (4)

Q7 a) What is a psychometric chart? Discuss its uses in food dehydration and air conditioning processes. (7)

b) Calculate the rate of thermal energy required to heat 10 m^3/s of air at 30°C dry bulb temperature and 70% relative humidity to a dry bulb temperature of 80°C. Use psychrometric chart. (7)

UNIT-IV

Q8 a) Define material handling. Give detailed classification of material handling equipment. (6)

b) Differentiate between conveyors and elevators. Write the constructional and working detail of a screw conveyor. (8)

Q9 a) Write the constructional and working detail of bucket conveyor with suitable line diagrams. (7)

b) Write a brief note on the advantages and methods of sorting of food materials. (7)