

flow rate of refrigerant, the compressor power requirement, and the C.O.P. Assume the unit operates under saturated conditions and the compressor efficiency is 80%. (8)

6. Explain the following with a well labeled diagram :
(any three) (6×3=18)

- (a) Super critical fluid extraction
- (b) Basket centrifuge
- (c) Electrodialysis system
- (d) Shell and tube heat exchanger

7. (a) Derive the expressions for the following parameters with the help of a schematic diagram and Pressure-Enthalpy Diagram : (10)

- I. Refrigerating effect
- II. Work done by the compressor
- III. Coefficient of performance (COP)
- IV. Heat rejected in the condenser.

- (b) One face of a stainless-steel plate 2 cm thick is maintained at 120°C, and the other face is at 80°C. Assuming steady-state conditions, calculate the rate of heat transfer per unit area through the plate. The thermal conductivity of stainless steel is 17 W/(m °C). (8)

(400)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2035

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Unique Paper Code : 2202032403

Name of the Paper : Food Engineering – I

Name of the Course : **B.Sc. (H) Food Technology (NEP-UGCF)**

Semester : IV, Core

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question no. **1** is compulsory.
4. All parts of the question should be attempted together.
5. Use of Scientific Calculator, Refrigeration chart, Conversion tables and chart is permitted.

1. Describe the following briefly : **(Any Nine)**

(9×2=18)

- (a) Refrigerants
- (b) Unit operation
- (c) Thermal conductivity

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- (d) Newton's law of cooling
 - (e) Filter aid
 - (f) Overall heat transfer coefficient
 - (g) Microfiltration
 - (h) Dimensional analysis
 - (i) System of units
 - (j) Steam Distillation
2. Differentiate between the following : **(Any Three)**
(6×3=18)
- (a) Hildebrandt and Bollman extraction
 - (b) Spiral wound and hollow fibre membrane modules
 - (c) Conduction and convection
 - (d) Tubular and Disc bowl centrifuge
 - (e) R-12 and R-717
3. Write short notes on the following : **(any three)**
(6×3=18)
- (a) Fick's law of diffusion
 - (b) Rectification
 - (c) Frozen food storage
 - (d) Radiation: a mode of heat transfer
 - (e) VCR Cycle

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4. (a) Develop calculations involving for designing a tubular heat exchanger under steady-state heat transfer conditions. (8)
- (b) Compute the freezing time for a spherical food product which is being frozen in an air-blast freezer. The initial product temperature is 8°C and the cold air -40°C. The product has a 6 cm diameter with density of 1000 kg/m³, the initial freezing temperature is -1.5°C, the thermal conductivity of the frozen product is 1.2 W/(mK), and the latent heat of fusion is 250 kJ. (8)
- (c) Discuss the desirable properties of a refrigerant for a VCR System. (2)
5. (a) Describe the different types of heat transfer equipment used for food processing. (6)
- (b) Convert the following : (4)
- (i) viscosity value of 30 cp to Pa s
 - (ii) pressure value of 17.11 psig to kPa
- (c) A cold storage room is being maintained at 4°C using a vapor-compression refrigeration system that uses R-134a. The evaporator and condenser temperatures are -6 and 40°C, respectively. The refrigeration load is 25 tons. Calculate the mass

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