

## 20FT013 - REFRIGERATION AND COLD STORAGE

Hours Per Week :

Total Hours :

| L | T | P | C |
|---|---|---|---|
| 3 | - | - | 3 |

| L  | T  | P |
|----|----|---|
| 45 | 15 | - |

| WA/RA | SSH/HSB | CS | SA | S | BS |
|-------|---------|----|----|---|----|
| 15    | 30      | -  | 5  | 5 | -  |

### Course Description and Objectives:

This course deals with technologies related to Principles of Refrigeration, Components of a Refrigeration system. The objective of this course is to impart skill and knowledge required to apply the principles and concepts behind Refrigeration and Cold Storage processing including Chilling of Foods, Cooling load calculations, Problems on sensible heat factor.

### Course Outcomes:

Upon successful completion of this course student should be able to:

- Gain knowledge on Principles of Refrigeration techniques Refrigerants, characteristics of different refrigerants.
- Know about novel techniques and Design to improve and construction and Cold load estimation; prefabricated systems, walk-in-coolers, and Refrigerated.
- Know the Knowledge Operation and maintenance, Controlled atmosphere and modified atmosphere storages.

## **SKILLS**

- ✓ Identify the non-polluting refrigerants, net refrigerating effect, ton of refrigeration - Components of a Refrigeration system: Compressor, condenser, Evaporator, Expansion valves piping and different controls.
- ✓ Explain and understand the Chilling equipment for liquid foods. Secondary refrigerants and direct expansion techniques in chilling.
- ✓ Suggest suitable freezer types, Design of complete air-conditioning systems; humidifiers and dehumidifiers.

## **UNIT – I**

Principles of Refrigeration: Refrigeration cycles, Vapour Compression and Vapour Absorption cycles, Refrigerants, characteristics of different refrigerants, Ozone Depletion Potentials, Green house Potential Refrigerants, use of non-polluting refrigerants, net refrigerating effect, ton of refrigeration - Components of a Refrigeration system: Compressor, condenser, Evaporator, Expansion valves piping and different controls. Atmospheric air and its properties, Psychometrics, Energy considerations.

## **UNIT – II**

Cold Storage Design and Construction: Small and large commercial storages, Cold Room temperatures, Insulation, properties of insulating materials, air diffusion equipment, Doors and other openings. Cold load estimation; prefabricated systems, walk-in-coolers, and Refrigerated. Container trucks: Freezer Storages, Freezer room Temperatures, insulation of freezer rooms: Pre-cooling and pre freezing. Cold Storage practice, Stacking and handling of material in and around cold rooms, Optimum temperatures of storage for different food materials-meat and poultry products, marine products, fruits and vegetables.

## **UNIT III**

Cooling load calculations: Load sources, product cooling, conducted heat, Convicted heat, internal heat sources, heat of respiration, peak load; etc. Operation and maintenance - Controlled atmosphere and modified atmosphere storages: Operation and maintenance, Cleanliness, defrosting practices, preventive maintenance, safety measures Controlled atmosphere and Modified atmosphere storages Principles and basics of their construction.

## **UNIT IV**

Chilling of Foods: Chilling equipment for liquid foods. Secondary refrigerants and direct expansion techniques in chilling. Chilled foods transport and display cabinets - Basics of Chilled

foods microbiology, Packaging of Chilled foods - Hygienic design considerations for chillers and chilled storages. Cool storages and their applications. Evaporative cooling and its applications.

## **UNIT V**

Problems on sensible heat factor; Duct design methods. Design of complete air-conditioning systems; humidifiers and dehumidifiers. Freezing of foods: Freezing equipment, freezing rates, growth rate of ice crystals, crystal size and its effect of texture and quality of foods, Freezer types, freezing practice as applied to marine foods, meat and poultry, fruits and vegetables.

### **ACTIVITY:**

- o Report on different equipment and design used in the food processing Industry.

### **TEXT BOOKS:**

1. Suggested Reading William C. Whitman, William M. Johnson, John A. Tomczyk and Eugene Silberstein. 2009. Refrigeration & Air Conditioning Technology, 6th Ed. Delmar, Cengage Learning, NY, USA.
2. C.P. Arora. 2000. Refrigeration and Air Conditioning, 2nd Ed. Tata McGraw-Hill Publishing Co. Ltd., New Delhi. W.F. Stoecker and J.W. Jones.1982. Refrigeration and Air Conditioning, 2nd Ed. McGraw-Hill Book Co., New York, USA. Ashrae Handbook, 2006: Refrigeration.

### **REFERENCE BOOKS:**

1. D.K.Tressler and C.F.Evers: The Freezing Preservation of Foods (Vol.1&2) AVI Publishing Company Inc. USA (1965)
2. J.S.Pruthi: Quick Freezing Preservation of Foods (2 Volumes) Allied Publishers, Mumbai (1999)