

# 17FT013 REFRIGERATION AND COLDSTORAGE CONSTRUCTION

Hours Per Week :

L	T	P	C
4	1	-	4

Total Hours :

xxxx								
L	T	P	W/RA	SSH/SHS	CS	SA	S	BS
45	15	-	15	30	-	5	5	-

## Course Description and Objectives:

To enable the students to understand the various concepts behind refrigeration and air conditioning. To enable the students to solve simple problems in refrigeration and air conditioning. To enable the students to understand the various concepts behind cold storage construction, design, maintenance, and applications in food industry.

## Course Outcomes:

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

- The students are knowledgeable to construct refrigeration and air conditioning
- The students will be able to solve problems on refrigeration and air conditioning and design cold storage for food applications
- The students will be able to apply their knowledge on cold storage of perishable products.

## SKILLS:

- ✓ Suggest producers about various parameters related to cold chain structure
- ✓ Able to select appropriate freeze dryers for different perishable commodity
- ✓ Knowledge on design considerations for chillers and chilled Storages

### 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, spices and food grains.

### UNIT – III

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

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, Blast freezers, Contact Plate Freezers, conveyerized quick freezers, Individual quick freezing. Cryogenic Freezing, Freezing practice as applied to marine foods, meat and poultry, fruits and vegetables.

#### TEXTBOOKS:

1. Raymond R.Gunther: Refrigeration, Air conditioning and Cold Storage Chiltan Company, Philadelphia, USA 1957
2. Clive D.J.Dellino: Cold and Chilled Storage Technology Publisher: Kluwer Academic Publishers (1997)
3. S. Domkundwar and Subhash Arora: A Course in refrigeration and Air Conditioning: Dhanpat Rai and sons, Publishers, New Delhi (1994)
4. Andrew D. Althouse and others: Refrigeration and air Conditioning Goodheart –Willcox Company Inc. 1982
5. E.R.Hollowell: Cold Storage and Freezer Storage Manual AVI Publishing Co. (1980)

#### REFERENCEBOOKS:

1. Ed. C.P.Mallet: Frozen Food Technology Balckie Academic and Professional, (1993)
2. Aurel Gobaneu and Gabriela Laseha and others (1976) Cooling Technology in the Food Industry: Abacus Press, Tunbridge Wells, U.K.
3. Colin Dennis and Michael Stringer: Chilled Foods – A Comprehensive Guide Ellis Horwood Publishing, New York (1992)
4. D.K.Tressler and C.F.Evers: The Freezing Preservation of Foods (Vol.1&2) AVI Publishing Company Inc. USA (1965) Allied Publishers, Mumbai (1999).

#### ACTIVITIES:

- o Performance evaluation of various freeze dryers using various food products