



## FACULTY OF ENGINEERING & TECHNOLOGY

### First Year Master of Engineering

#### Semester II

**Course Code: 102440202**

**Course Title: Advance Refrigeration and Air conditioning**

**Type of Course: Core Course IV**

**Course Objectives: The course is prepared to provide the detailed understanding of principles of Refrigeration and Air conditioning.**

#### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				Total
Lecture	Tutorial	Practical		Internal		External		
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	40 / 16	20 / 08	60 / 24	30 / 12	150 / 60

\* J: Jury; V: Viva; P: Practical

#### Detailed Syllabus:

Sr.	Contents	Hours
1	REFRIGERANTS Properties of refrigerants: primary, secondary and mixtures, Alternate eco-friendly refrigerants and their properties, Montreal and Kyoto Protocols	3
2	VAPOUR COMPRESSION REFRIGERATION Balancing of vapour compression refrigeration system, dual pressure vapour compression system and its analysis, compound compression with flash cooler and flash intercooler, multiple expansions, parallel operation, sectionalizing, booster operations, various types of cascade systems and their analysis. Vapour absorption refrigeration system with LiBr-H <sub>2</sub> O and NH <sub>3</sub> -H <sub>2</sub> O solutions, Electrolux system and solar energy applications, thermoacoustic refrigeration system, VRF and VAV systems.	8
3	APPLIED PSYCHOMETRIC Different psychrometric charts, combinations of different processes and their representation on psychrometric charts, psychrometric calculations for cooling and dehumidification, high latent heat load, dehumidified air quantities based on total and effective room loads, GSHP and RSHP, effective surface temperature, effect of bypass factor on GSHP, analysis for using all outside air, psychrometric of partial load control	5



<b>4</b>	<b>DESIGN CONDITIONS AND HEAT LOAD CALCULATION</b> Selection of inside design conditions for different applications, Thermal comfort, Basic terminology for heat load calculation, heat transfer through walls and roofs, heat gain through glass, solar heat gain factor, shading of glass, shading devices and its selection, load due to other sources, stack effect, brief idea about other ASHRAE methods of calculating cooling load.	<b>5</b>
<b>5</b>	<b>DISTRIBUTION OF AIR</b> Terminology, outlet performance, types of outlets, location of outlets, factors affecting grill performance, selection of outlets using nomographs and tables, room air diffusions performance index (ADPI) and its use in outlet selection, types of ducts, duct materials and their accessories, duct construction, factors affecting duct construction, friction charts and other correction factors, losses, design velocity and its selection, duct heat gain or loss, duct insulation, duct layouts, duct sizing methods, noise and their isolation.	<b>6</b>
<b>6</b>	<b>AIR CONDITIONING SYSTEMS</b> Air conditioning systems: Duct design, Spray systems, chilled water and DE Coils, absorption and adsorption systems, Humidifiers, Air conveying: fans and air diffusion equipment.	<b>4</b>
<b>7</b>	<b>CONTROL DEVICES</b> Thermostatic and automatic expansion valve, side glass, filter dryer etc. Refrigeration Tubing: Cutting, flaring, pinching, savaging, soldering etc.	<b>4</b>
<b>8</b>	<b>ADVANCES IN AIR CONDITIONING</b> Chilled beam, clean room concept, filtration of suspended particles, PPM control and methods, types of filters	<b>4</b>
<b>9</b>	Click or tap here to enter text.	Click
<b>10</b>	Click or tap here to enter text.	Click
<b>11</b>	Click or tap here to enter text.	Click
<b>12</b>	Click or tap here to enter text.	Click
<b>13</b>	Click or tap here to enter text.	Click
<b>14</b>	Click or tap here to enter text.	Click
<b>15</b>	Click or tap here to enter text.	Click



## Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
10%	20%	20%	20%	25%	05%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## Reference Books:

1	Refrigeration and air conditioning, C. P. Arora, McGraw Hill
2	ASHRAE Hand Book, (1) Fundamentals (2) Refrigeration
3	Principles of Refrigeration, R J Dossat, Pearson Education Asia
4	Refrigeration and air conditioning, Stocker, McGraw Hill
5	Refrigeration and air conditioning, Jordan and Priester, McGraw Hill
6	Industrial Refrigeration Handbook, Stoecker, McGraw Hill
7	Air Conditioning Engineering, W P Jones, Butterworth-Heinemann, Boston, Oxford
8	Air conditioning Principles and Systems, Edward G. Pita, John Wiley & Sons Australia Limited
9	HVAC Testing Adjusting and Balancing Manual, John Gladstone, McGraw-Hill Publication
10	Fan Handbook, Frank P Bleier, McGraw-Hill Professional

## Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Appraise refrigerants, their properties and applications.	10
CO-2	Discuss different vapour compression refrigeration systems and vapour absorption systems and analyze them.	14
CO-3	To make calculation of various Psychrometric processes	14
CO-4	To estimate the cooling load requirements of residential and commercial building and design the system components accordingly and make use of tables and nomographs to design air distribution systems	28
CO-5	To select fan for particular air conditioning system and discuss recent developments in air conditioning	18
CO-6	Discuss various control devices and tubing operation used in refrigeration.	16
CO-7	Click or tap here to enter text.	Click
CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click



## List of Practicals / Tutorials:

Click or tap here to enter text.

1	Study of domestic Refrigerator and Air Conditioner
2	Study of Tool kit used for the maintenance of the Refrigeration system
3	Charging of Refrigerant in Refrigerator
4	Study of Refrigerants
5	Performance analysis of VCR system using capillary tube as a throttling device
6	Performance analysis of VCR system using thermostatic expansion valve as a throttling device
7	Experiment on Cascade Refrigeration system
8	Study of Working of Vapour Absorption refrigeration system and Performance analysis of "Electrolux" refrigerator
9	Visit to Ice Plant and to understand construction and working of Ice Plant and determine COP of the system
10	To estimate cooling load and star rating (energy efficiency rating) for any refrigeration application like, domestic refrigerator, deep freezer, water cooler etc.
11	Click or tap here to enter text.
12	Click or tap here to enter text.
13	Click or tap here to enter text.
14	Click or tap here to enter text.
15	Click or tap here to enter text.

## Supplementary learning Material:

1	Click or tap here to enter text.
2	Click or tap here to enter text.
3	Click or tap here to enter text.
4	Click or tap here to enter text.
5	Click or tap here to enter text.

## Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22