SECOND SEMESTER 2020 – 2021

Date: 18.01.2021

Course Handout (Part II)

In addition to Part-I (general handout for all courses in the time-table), this handout provides specific details regarding the course.

Course No.:	ME F461
Course Title:	Refrigeration and Air-conditioning
Instructor-in-charge:	Dr. Suvanjan Bhattacharyya
Co-Instructors:	-----

1. Course Description: This course will teach the basic principles of refrigeration and air-conditioning to students, including the design and analysis of refrigeration and air-conditioning systems.

2. Scope and Objective of the Course: The course is designed to give an in depth study of theory of refrigeration and air-conditioning and their applications. The technique of analysis and design of refrigeration and air-conditioning systems will also be discussed.

3. Text Books:

1. **Text Books:** Arora, C.P. Refrigeration and Air-conditioning, 3rd Ed., McGraw-Hill India, 2009.

4. Reference Books:

1. Arora, R.C. Refrigeration and Air-conditioning, Prentice Hall India, 2010.
2. Stoecker,W. Jones J. Refrigeration and Air Conditioning 2nd Ed.
3. Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler, Heating, ventilating and air conditioning: analysis and design, 6th ed., Wiley, 2004.
4. P N Anathanarayanan, Basic Refrigeration and Air Conditioning, 4th Ed., 2013, McGraw-Hill Education.
5. Rajput, R. K. Refrigeration and Air-conditioning, 4th Ed., 2015, S. K. Kataria and Sons.

5. Course Plan:

Lecture No.	Lecture Session	Reference	Learning outcomes
1	**Introduction and review**	1, 2	Concepts of Refrigeration and Air-conditioning. Unit of refrigeration, Refrigerants.
2-4	**Simple Vapour Compression Refrigeration System(Simple VCRS)**	3	Vapour compression cycle on ph and T-s diagrams, Vapor compression systems calculation, Cycles with sub-cooling and superheating, their effects, actual Vapour Compression Cycle.
5-6	**Refrigerants**	4	Designation, comparative study of refrigerants and their selection, chemical and physical requirements, and substitute of refrigerants.
7 - 9	**Vapour Absorption Refrigeration System (VARS)**	12	Advantages of VARS over VCRS. Working principle of simple VARS, practical VARS. Limitations of VARS, maximum COP of a VARS, Lithium bromide-water System; Aqua-ammonia systems.
10-11	**Air Refrigeration System (ARS).**	11	Bell-Coleman refrigerator. COP determination, actual air refrigeration Cycle.
12 - 15	**Major Refrigeration Equipment.**	6, 7, 8, 9	Compressors: Types; reciprocating, rotary & centrifugal, Condensers: types used in refrigeration systems; Evaporators: types and heat transfer in evaporators. Expansion devices: types of expansion devices and capillary tubes and ejector expansion.

16 - 20	**Psychometry of air conditioning Processes.**	14, 15 and Class Notes	Basic definitions and principles related to Psychometry ; Psychometric Charts & Their Uses; Heating, Cooling, Heating & Humidification & Cooling & Dehumidification processes. Adiabatic Saturation, Cooling Coils, By-pass Factor.
21 – 22	**Duct.**	21 and Class Notes	Duct Sizing & Design
23 - 27	**Design conditions and Human Physiology**	16 and Class Notes	Inside and outside design conditions. Thermodynamics of human body.
28 – 31.	**Load calculations.**	19 and Class Notes	Sensible Heat Factors. Heat Load estimation: Simple cases of Cooling and Dehumidification.
32– 35.	**Thermal Comfort and Solar Cooling**	Class Notes	Requirement of comfort air-conditioning. Solar cooling technologies.
36 – 37.	**Air-conditioning equipment.**	Class Notes	Air-handling units, Cooling Towers.
38.	**Non-conventional cooling techniques**	Class Notes	ODP, GWP, TWEI

6. Evaluation Scheme:

Components	**Duration**	**Weight age (%)**	**Date & Time**	**Remarks**
Presentation	15 mins.	15	Will be announced	Open book
Quiz	20 mins.	05	Will be announced	Open Book (Multiple Choice Questions)
Mid Semester Test	90 mins.	35	<TEST_1>	Closed book
Comprehensive Test	3 h	(15 + 30)	<TEST_C>	Close Book and Open Book

7. Consultation Hours (Instructor In-charge): Time: 3.00-4.00 PM, Monday.

8. Notices: All notices related to this course will be put on the Nalanda/Email.

9. Make-up Policy:

1. Make up will be given to genuine students only, but prior permission is required.
2. No makeup for lecture test.

10. Note:

I). NC will be given to students obtaining overall marks less than 20% of the total (less than 20 out of 100).

II). Mid-semester grading: It will be announced normally in the month of March. It is done in the same manner as that of the final grading.

III). Presentation: One before Mid-semester test and one before Comprehensive test.

IV). Quiz: One quiz (MCQ) would be conducted after mid-semester.

Instructor-in-charge
Dr. Suvanjan Bhattacharyya
ME F461