

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE – PILANI, HYDERABAD CAMPUS
ACADEMIC-GRADUATE STUDIES AND RESEARCH DIVISION
FIRST SEMESTER 2023-2024
(COURSE HANDOUT: PART-II)

Date: 10/08/2023

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

Course No. : **ME G513**
Course Title : **HEATING AND COOLING OF BUILDINGS**
Instructor-in-charge : **R. PARAMESHWARAN**
Instructor : **R. Parameshwaran**

1. Course Description

Introduction to HVAC design, basic scientific principles, climatic conditions, building heat transmission surfaces, infiltration and ventilation, heating loads, heat gains and cooling loads, HVAC psychometrics, codes and standards for HVAC systems design, acoustics and vibration, human comfort, air distribution, duct system design, fans and central air systems, air system heating and cooling, air cleaning and filtration, introduction to electrical systems, controls for air distribution systems.

2. Scope and Objective

The purpose of this course is to provide introductory knowledge and a state-of-the-art learning of different HVAC systems including their design aspects pertaining to the real-world heating and cooling applications in buildings. Besides the theoretical knowledge, emphasis will also be provided on interactive approach to analyze the design aspects of a variety of HVAC systems. The course will certainly interest students aiming to build-up a career in building services engineering through energy efficient design of HVAC systems in buildings.

3. Text Books:

- T1. Jan F. Kreider, Peter S. Curtiss, Ari Rabl, Heating and Cooling of Buildings: Design for Efficiency, Revised Second Edition, CRC Press, 2010.
- T2. Robert McDowall, Fundamentals of HVAC Systems, SI Edition, Elsevier, 2009.

Reference Books:

- R1. W.P. Jones, Air Conditioning Engineering, Fifth Edition, Butterworth Heinemann, 2005.
- R2. D R Oughton, S L Hodgkinson, Faber & Kell's Heating and Air-Conditioning of Buildings, Tenth Edition, Butterworth Heinemann, Elsevier, 2008.

4. Course Plan*

Lecture No.	Learning objectives	Topics to be covered	Book
1-2	Introduction to HVAC systems design in buildings	Brief history of HVAC, energy efficiency in buildings, role of HVAC engineers, phases of building design procedure	T1, T2
3-6	Building physics and elements of heat transfer	Basic terms and definitions, climatic design conditions, comfort criteria, methods of measurement, heat transfer through building elements, evaporation and moisture transfer	T1, R1, R2
7-11	Psychrometrics, thermal comfort and ventilation	Psychrometric processes and chart, thermal comfort factors and conditions, thermal balance, air change rates, ventilation methods, acceptable air quality, decay equation and applications	T1, T2, R1
12-15	Heating and cooling loads	Air exchange, principles of load calculations, zones, heating methods, methods for cooling load calculations, Standards and Codes of practices	T1, T2, R1

16-17	Technical Seminars/Guest Lectures		
18-21	Heat generation and cooling equipments	Boilers, furnaces, heat exchanger and heat pumps selection, refrigeration systems, chillers, evaporative coolers, performance aspects	T1, R1
22-23	Acoustics and vibration	Sound pressure, sound power, measurement of sound, room acoustics, noise and vibration control	R2
24-27	Hydronic systems and architecture	Terminal units, panel heating and cooling, fan coils, hot water systems, chilled water systems, piping design and pressure loss calculations	T1, T2
28-33	Air conditioning systems	All-air systems, air-water systems, HVAC system design sizing and energy calculations	T1, R2
34-35	Technical Seminars/Guest Lectures		
36-38	Air distribution systems design	Ventilation rates, airflow in ducts, basic sizing and duct design, total and static pressure calculations, fan laws, pressure loss calculations, performance of air handling units	T1, R1
39-40	Air cleaning and filtration	Particle sizes, behaviour and collection, efficiency, filter types and safety aspects	R1
41-42	HVAC control systems	Controls basics, design considerations, DDC of air handling units, intelligent controllers, building management systems	T1, T2, R2

*Guest lectures by industry experts may be organized as part of course deliverables.

5. Evaluation Scheme

Evaluation Component	Duration	Weighting (%)	Date & Time	Nature of Component
Mid-Term Test	90 min	20	14/10 - 4.00 - 5.30PM	Closed Book
Lab-based Experiential Learning through Case Studies	---	20	To be announced in the Class	Open Book (Continuous Evaluation)
Literature Survey	---	5		
Design Projects	---	10		
In-Class Self-Assessment Test (IC-SAT)	---	10		
Comprehensive Exam	180 min	35	21/12 AN	Closed Book

6. Chamber Consultancy Hour: To be announced in the class room.

7. Notices: All notices concerning this course shall be displayed only on the Mechanical Engineering Notice Board. Besides this, students are advised to visit regularly CMS (the Institute's web based course management system) for latest updates.

8. Make-up Policy: Make-up shall be given only to the genuine cases with prior confirmation. Request for the make-up tests, duly signed by the students, should reach the under signed well before the scheduled test.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-Charge
ME G513**