



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3721003

Semester – II

Subject Name: Advanced Air conditioning Engineering

Type of course: Program Elective

Prerequisite: Nil

Rationale: The course is designed to give advanced knowledge and relevant technologies in the area of Air conditioning engineering which includes load calculations, component design, air distribution and handling.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	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, GSHF and RSHE, effective surface temperature, effect of bypass factor on GSHF, analysis for using all outside air, psychrometric of partial load control	5
2	Design conditions and Heat load calculation: Selection of inside design conditions for different applications, Thermal comfort, Different equations governing thermal exchanges, environmental indices, AQ and its importance, 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.	10
3	Distribution of Air: 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.	10
4	Air conditioning systems: Factors affecting the selection of the systems, classification, design procedure, system features, controls of all air, air water, all water, DX, VAV and dual duct systems, basic idea of cold air distributions systems	5
5	Evaporative cooling equipment: Cooling tower: Types, construction, working and performance; Evaporative air cooler: Types, construction, working and performance, testing of evaporative air coolers as per IS standards, indirect evaporative cooling; Air washer: Types, construction, working, performance	5



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6	Air handling systems: Types, construction and performance characteristics of fans, fan laws, testing as per IS and AMCA standards, fan selection with the help of tables, charts and curves, fan drive arrangements and discharge from fans.	4
7	Advances in Air Conditioning: Chilled beam, clean room concept, filtration of suspended particles, PPM control and methods, types of filters	3

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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. Air Conditioning Engineering by W P Jones, Butterworth-Heinemann, Boston, Oxford
2. Refrigeration and Air conditioning by C P Arora, McGraw-Hill Publication
3. Hand book of Air conditioning Systems Design by Carrier Corporation
4. Air conditioning Principles and Systems by Edward G. Pita, John Wiley & Sons Australia Limited
5. HVAC Testing Adjusting and Balancing Manual by John Gladstone 3rd, McGraw-Hill Publication
6. ASHRAE Handbook of HVAC Systems and Equipment
7. ASHRAE Handbook of HVAC Applications
8. Fan Handbook by Frank P Bleier, McGraw-Hill Professional

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To make calculation of various Psychrometric processes	12
CO-2	To estimate the cooling load requirements of residential and commercial building and design the system components accordingly	24
CO-3	To make use of tables and nomographs to design air distribution systems	24
CO-4	To develop the skills to analyze the domestic and industrial requirement of air conditioning systems and evaporative cooling equipment	24
CO-5	To select fan for particular air conditioning system and discuss recent developments in air conditioning	16

List of Experiments: (any ten)

1. To study various instruments used in air conditioning.
2. Study of advanced air conditioning systems.
3. Study of air conditioning test rig.
4. Study of clean room.
5. Testing of fan used in air conditioning as per IS standards or AMCA standard.
6. Performance evaluation of air conditioning system with different psychrometric conditions.
7. To carry out cooling load calculation of a residential/commercial building.



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8. Design of duct system for above selected building.
9. Understand the salient features of water chilling plant.
10. To determine the capacity of window or split air conditioner.
11. To determine evaporative cooling capacity of cooling tower.
12. To determine humidifying efficiency of air cooler.

Equipment / Computational facility:

Duct type air conditioning trainer, cooling tower experimental test rig, window air conditioning test rig, split air conditioner, evaporative air cooler, centrifugal fans, air washer, models of AHU, FCU etc., pitot tube, anemometer, hygrometer, sling psychrometer

List of Open Source Software/learning website:

1. Students can refer to video lectures available on the websites including NPTEL.
2. Students can refer to the CDs which are available with some reference books for the solution of problems using software/spreadsheets. Students can develop their own programs/ spreadsheets for the solutions of problems.