SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Mechanical Engineering Department

B. Tech. Semester VI

Course Name: **Heating, Ventilation and Air-conditioning** **Subject Code: BTME15605**

Type of course: **Open Elective Course**

Prerequisite: Fluid Mechanics, Engineering Thermodynamics, Heat Transfer

Rationale: The course is designed to provide fundamental knowledge of different refrigeration cycles, refrigerants, moist air properties and their behavior under various conditions, different air conditioning terms, heating and cooling load calculation, indoor air quality, designing of various components of air distribution system.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
3	0	0	3	60	25	15	00	00	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Vapor Compression Refrigeration System:** Concept of ton of refrigeration, air conditioning, coefficient of performance and applications of refrigeration-air condensing system. Simple system on P-h and T-s diagrams, analysis of the simple cycle, factors affecting the performance of the cycle. Introduction to air refrigeration systems, bootstrap air refrigeration system.	8	16%

Sr. No.	Topics	Teaching Hrs.	Module Weightage
2.	**Vapour Absorption Refrigeration System and Refrigerants:** Practical H_2O -NH_3 cycle, LiBr – H_2O system and its working. Classification, nomenclature, desirable properties, secondary refrigerants, future industrial refrigerants.	**6**	**14%**
3.	**Psychrometry:** Dalton's law of partial pressure, Properties of moist air, temperature and humidity measuring instruments, psychrometric chart, and psychrometric processes such as sensible heating and cooling, heating and humidification cooling and dehumidification.	**6**	**14%**
4.	**Air Conditioning for Human Comfort:** Selection of inside design conditions, thermal comfort, heat balance equation for a human being, factors affecting thermal comfort, Effective temperature, comfort chart and factors governing effective temperature, selection of outside design conditions.	**6**	**14%**
5.	**Duct Design and Air Distribution:** Function; classification and economic factors influencing duct layout, equal friction method of duct design, use of friction chart, dynamic losses and its determination, Requirements of air distribution system, air distribution, grills, outlets, application, location.	**8**	**16%**
6.	**Air-conditioning Systems:** Classification, system components, all air; all water; and air-water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems	**6**	**14%**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
7.	**Applications of Refrigeration and Air Conditioning:** Comfort Air Conditioning, Residential air conditioning, Commercial air conditioning, Industrial air conditioning, Industrial Refrigeration, Chemical and process industries, Dairy plants, Petroleum refineries, Food processing and food chain and Miscellaneous. Indoor Air Quality, Ventilation.	**5**	**12%**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
25	**25**	**15**	**15**	**10**	**10**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels

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 Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Refrigeration and Air Conditioning	C. P. Arora	McGraw-Hill India Publishing ltd.	2020	4th
2	Principles of Refrigeration	Roy J. Dossat	Pearson Education	2002	5th
3	A Textbook of Refrigeration and Air Conditioning	Er. R. K. Rajput	Kataria, S. K., & Sons	2013	3rd
4	Refrigeration and Air Conditioning	W. F. Stocker and J. W. Jones	McGraw-Hill	--	--
5	Refrigeration and Air-Conditioning	Dr. D.S. Kumar	S. K. Kataria	2019	1st
6	Psychrometry Hand Book	--	ASHRAE	--	--

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Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Illustrate the basic concepts of refrigeration and air conditioning system.	15
CO-2	Differentiate between different types of refrigeration systems with respect to application as well as conventional and non-conventional refrigeration systems.	25
CO-3	Apply the principles of Psychometrics to design the air conditioning system.	20
CO-4	Determine cooling loads of air conditioning systems.	20
CO-5	Design of duct and components of central air conditioning system.	20

Mapping of (CO's) with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO-1	1	1	1	1	1	0	1	0	0	0	1	1			
CO-2	2	1	2	2	1	2	1	1	0	0	1	1			
CO-3	1	2	1	1	0	0	0	0	0	0	0	0			
CO-4	1	1	2	1	2	1	1	0	1	0	1	0			
CO-5	0	1	1	1	0	1	1	0	1	0	1	0			
Rationale*	**5**	**6**	**7**	**6**	**4**	**4**	**4**	**1**	**2**	**0**	**4**	**2**			

Rationale - Mapping of CO's with PO's and CO's with PSO's:

It states that the course will develop engineering knowledge to analysed complex engineering problems reaching substantiated conclusions using principles of natural sciences and engineering sciences, design solutions for complex engineering problems and design system components.

This course highly maps with Program outcomes 1, 2, 3,4,5,6,7,11. it states that the course will develop Engineering knowledge, Problem analysis, Design / development of solutions, Conduct investigations of complex problems, Modern tool usage, The engineer and society, Environment and sustainability, Project management and finance.

Assignments to be given as per the requirement of the course.

List of Open learning website:

1. https://nptel.ac.in, www.vlab.co.in

List of Open Source Software:

1. https://www.ashrae.org/technical-resources/free resources/software