



C.U.SHAH UNIVERSITY – WADHWANCITY

FACULTY OF: - Diploma Studies

DEPARTMENT OF: - Mechanical Engineering

SEMESTER: - VI **CODE:** - 2TE06RAC1

NAME OF SUBJECT: - Refrigeration and Air conditioning.

Teaching & Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme				Credits	Evaluation Scheme								Total
		Th	Tu	Pr	Total		Theory				Practical (Marks)				
							Sessional Exam		University Exam		Internal		University		
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr		
<u>2TE06RAC1</u>	Refrigeration And Air Conditioning	4	0	2	6	5	30	1.5	70	3	--	20	30	150	

Objective: -

Refrigeration and air conditioning is rapidly growing branch of industries in the new millennium which is an era of knowledge, information and computers. The course is based upon engineering application of thermodynamics and heat transfers. The course content encompasses major application such as food preservation, process industries, industrial and comfort air conditioning.

The equipment and the processes of refrigeration and air conditioning should be energy efficient and environmental friendly to minimize problems of energy crisis and air pollution. It is necessary to emphasize supreme importance of sound working knowledge of related theory and practice of the subject; so that young engineers and servicemen in the field of the course can analyze the root cause of the problems and decide on the corrective action without depending on more guess work or hit and miss methods.

Course outline:-

Sr. No.	Course Contents	Number of Hours
1	Introduction. Need, Scope & importance of Refrigeration and Air-conditioning (RAC). Concept of Refrigeration and Air conditioning, Second law of thermodynamics, basic principles of refrigeration, operation cycle, classification of refrigeration systems, unit of capacity, Application of refrigeration and Air-conditioning, difference between air conditioning and air cooling.	02
2	Air Refrigeration System Bell- Coleman cycle, representation on P-V and T-S diagram. Coefficient of performance. Types of refrigeration systems and their applications. Simple and Boot Strap System.	03
3	Vapour Compression Refrigeration System (VCRS). Simple, standard vapour compression cycle and its analysis on P-h chart. Calculations of refrigerating effect, work done and C.O.P., wet and dry compression, simple examples. Effect of different parameters on vapour compression cycle. Practical vapour compression system. Types, working principle and applications compressor (Reciprocating, Rotary, Screw and scroll), condensers (Air cooled and water cooled), evaporators (Dx type, flooded, shell and tube type), expansion devices (Automatic, thermostatic and capillary tube, High side float valve) and others.	07

4	Vapour Absorption System. Simple vapour absorption system, working principle (NH ₃ -H ₂ O) and applications. Desirable characteristic of absorption pair. Practical NH ₃ -H ₂ O system. Li-Br absorption system. Electrolux system. Comparison with VCRS	04
5	Refrigerants. Primary and secondary refrigerant. Classification. Designation. Need of new refrigerants. Desirable properties of refrigerants. Properties of R 22, R 134a and R717.	03
6	Application Of Refrigeration. Study of Ice Plant, cold storage, water cooler, domestic refrigerator	03
7	Thermal Insulation. Types of Insulation and their applications. Salient features of thermocol & fibre glass.	02
8	Applied Psychrometry. Psychrometric properties of air such as Dry Bulb Temperature (DBT), Wet Bulb Temperature (WBT), Dew Point Temperature (DPT), absolute humidity, relative humidity, specific humidity, humidity ratio, degree of saturation, specific volume, enthalpy, familiarization with tables of psychrometric properties of air, simple calculations. Psychrometric charts and their use. Psychrometric processes- sensible heating, sensible cooling, addition and removal of latent heat, adiabatic mixing of air streams, cooling and dehumidification, heating and humidification, adiabatic saturation, solution of problems using psychrometric chart. Psychrometry- sensible heat factor (SHF) and its determination with the help of psychrometric chart, condition line room apparatus and coil apparatus dew point and their determination with the help of chart, estimation of dehumidified air quantity, bypass and contact factor. Examples. Human Comfort-body temperature regulation, environmental influence on Comfort chart and its limitations. Instruments for measuring psychrometric properties- sling psychrometer dew point psychrometer, organic hygrometer, aspiration psychrometer -working and applications.	12
9	Estimation Of Cooling Loads. Types and classification of cooling loads. Design conditions. Overall heat transfer coefficient and its calculation. Flywheel effect of building material. Effect of wall construction on cooling load. Concept of IHG and ICL. Heat gain through glass. Air infiltration and load due to it. Load due to ventilated air, occupants, electric lights, Product load, load due to appliances. Calculation of plant capacity. Cooling load calculation for cold storages and its capacity determination. Examples for calculating OHTC.	07
10	Air Conditioning and Air Handling Systems. Classification of Air conditioning system. Working principle of central plant, packaged plant, and window and split air Conditioners, desert cooler. Evaporative cooling systems, air washers. Air filtration -various types, principles of working of different air filters. Fans -classification, types, working, selection method, terminology used in fans, applications. Velometer and pitot tube: their construction and working. Duct design, installation and commissioning- estimation of duct size by equal friction method with the help of charts and tables, estimation of losses in ducts, different material & layouts, installation and commissioning steps and precautions. Air Distribution-importance, terms used, different types of Outlets, grill register, diffusers, location of outlets.	10
11	Refrigeration and Air Conditioning Servicing. Tube operations. System operation such as- vacuumization, leak detection, charging the system, pumping down, etc.-process, equipments used.	3

List of Experiments:-

- Student will recall and write basic thermodynamic units and different thermodynamic processes.
- Study and demonstration of Vapour Compression Refrigeration System (VCRS) components- compressor, condenser, expansion devices and evaporators-types, construction, working, common troubles, their causes and remedies.
- Demonstrate various Tubing Operations.
- Demonstrate Leak detection, evacuation and re-filling of refrigerant.

- Determination of COP of Vapour Compression Refrigeration System.
- Determination of properties of air by using different psychometric instruments.
- Study and demonstration of Domestic refrigerator, window air conditioner and split air conditioner. Determination of capacity of window / split air-conditioner.
- Study and demonstration of Air handling equipments/elements.

Books Recommended:

Refrigeration and Air conditioning, Domkundwar Dhanpat Rai & Sons.
Refrigeration and Air conditioning, Khurmi & Gupta S. Chand, New Delhi.
Refrigeration and Air conditioning, P.L. Balleney Khanna Publishers.
Refrigeration & Air Conditioning, P.S. Desai L.F.Rajput, Atul Prakashan.
Refrigeration and Air conditioning, J.S. Joshi, Nirav Prakashan.
Refrigeration and Air conditioning, C.P. Arora Tata Mc Graw Hill