



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-5 (Diploma)

Subject: Refrigeration and Air-Conditioning- DETME15220

Type of course: Professional Elective Courses

Prerequisite: To have the basic knowledge of Thermal Engineering and thermodynamic cycles.

Rationale: Refrigeration and Air Conditioning is a vital subject that provides fundamental knowledge of cooling systems, thermodynamics, and heat transfer, widely applied in industries, commercial spaces, and households for thermal comfort, food preservation, and industrial processes. It develops technical skills in refrigeration cycles, HVAC components, psychrometry, and energy-efficient cooling solutions. With growing demand in manufacturing, pharmaceuticals, and building services, RAC knowledge enhances job opportunities and entrepreneurship prospects. Additionally, it promotes sustainability by focusing on eco-friendly refrigerants and energy conservation, making it essential for modern engineering education.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	00	50	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.



Course Content:

Unit No	Course content	Hrs.	% Weightage
1	Fundamentals of Refrigeration: Definition of Refrigeration; Refrigerating effect-unit of refrigeration- Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle; Air refrigeration-Bell - Coleman cycle, PV& TS diagram; Advantage and disadvantages in air refrigeration; Simple problems	6	15
2	Refrigeration systems: Basic Components, Flow diagram of working of Vapour compression cycle; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Expression for Refrigerating effect, work done and power required; Types of Vapour Compression cycle; Effects of super heating and under cooling, its advantages and disadvantages; Simple Vapour absorptions cycle and its flow diagram; Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle.	10	25
3	Refrigeration Equipment: Compressor - types of compressors; Hermetically sealed and semi hermetically sealed compressor; Condensers - Air Cooled, water cooled, natural and forced draught cooling system; Advantages and disadvantages of air cooled and water-cooled condensers; Evaporators - natural, convection, forced convection types. Expansion valve - Capillary tube; Automatic Expansion valve; Thermo static expansion valve; High side and low side float valve; Solenoid valve; Evaporator pressure regulator. Refrigerants and Lubricants: Introduction to refrigerants; Properties of good refrigerants; Classification of refrigerants by group number and commonly used refrigerants in practice; Detection of refrigerants leakage; Charging the system with refrigerant; Lubricants used in refrigeration and their properties.	15	30
4	Air conditioning: Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Psychometric process-sensible heating and cooling, Humidifying and dehumidifying; Adiabatic saturation process; Equipment's used in air conditioning cycle; Air conditioning units and plants. Applications, Installation and Servicing of RAC: Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers. Tools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure	14	30



Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	COP Calculation of Home Refrigerator: Each student will calculate the Coefficient of Performance (COP) of a home refrigerator by measuring temperatures and applying the COP formula. Students must take photos while taking the readings and provide their COP calculations. Finally, they should prepare a PDF report with their findings and upload it on the GMIU web portal.	10
2	Know Your Refrigerant: Each student will be assigned a specific refrigerant and must prepare a table of its thermodynamic properties, including boiling point, critical temperature, latent heat, specific heat, pressure-temperature relation, GWP, ODP, and compatibility with lubricants. Students must research and compile the data in a structured table. Finally, prepare a PDF report with the table and findings, and upload it on the GMIU web portal.	10
3	Psychrometric Property Analysis: Form a group of 3-4 students and measure the dry bulb and wet bulb temperatures of your surroundings using thermometers. Plot the values on a psychrometric chart to determine psychrometric properties. Each group must submit a brief report with their findings and conclusions. Upload a clear photo of the psychrometric chart with plotted values on the GMIU web portal.	10
Total		30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20 %	30 %	30 %	10 %	5 %	5 %

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand refrigeration concepts, cycles, and solve related problems
CO2	Analyze refrigeration systems and solve problems using P-H, T-S, and P-V diagrams.
CO3	Identify refrigeration system components, their functions, types, and applications
CO4	Explain air conditioning principles, processes, equipment, applications and servicing.



List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	Refrigeration tubing operations (cutting, bending, flaring, brazing)	4	4
2	Leak detection, evacuation, and refilling of the refrigerant	3	4
3	Determine the Coefficient of Performance (COP) of VCRS	2	2
4	Plot P-H and T-S diagrams for a vapour compression cycle	2	2
5	Study and identify components of a vapour compression refrigeration system	3	2
6	Determine air properties using a psychrometric chart (DBT, WBT, RH, etc.)	4	4
7	Determine the cooling capacity of a window or split air conditioner	4	4
8	Study of different types of compressors, condensers, evaporators, and expansion devices	3	2
9	Study of vapour absorption refrigeration system and Electrolux system	2	2
10	Industrial visit to a refrigeration/air conditioning plant and submission of report	All	4
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

- [1] Refrigeration and Air Conditioning by R. K Rajput, S.K. Kataria & Sons
- [2] Refrigeration and air conditioning by Stocker, McGraw Hill Education | 3rd edition
- [3] Refrigeration and Air Conditioning by Arora C. P, Tata McGraw-Hill
- [4] Refrigeration and Air-Conditioning by S.S. Thipse, Jaico Publications

