

**ME404: REFRIGERATION AND AIR CONDITIONING**  
**CREDITS = 5 (L=3, T=0, P=2)**

**Course Objective:**

To analyze various refrigeration cycles, estimate air conditioning load and design its components.

**Teaching and Assessment Scheme:**

Teaching Scheme			Credits	Assessment Scheme				Total Marks
L	T	P	C	Theory		Practical		
					ESE	CE	ESE	CE
3	0	2	5	70	30	30	20	

**Course Contents:**

Unit No.	Topics	Teaching Hours
1	<p><b><u>Air cycle Refrigeration:</u></b> Bell-coleman cycle and its analysis, Reversed Brayton cycle, need for air-conditioning air-crafts, working and analysis of simple, Bootstrap and regenerative air refrigeration systems, advantages of using air cycle for air-craft applications.</p> <p><b><u>Vapour compression Refrigeration:</u></b> Modifications in reversed Carnot cycle, analysis of simple cycle, effects of load variation, temperature of condenser, liquid under cooling and suction superheating on performance, actual cycle, limitations of single stage system and need for multistaging ,compound compression with intercooler, flash gas removal and flash intercooling ,multievaporator systems, solid carbon dioxide-dry ice, manufacture of solid carbon dioxide.</p> <p><b><u>Vapour absorption Refrigeration:</u></b> Desirable characteristics of refrigerant and refrigerant-absorbent pair, working principle of Aqua-NH<sub>3</sub> system, ideal and actual COP, actual cycle, Aqua-LiBr system, comparison with vapour compression system, Electrolux refrigerator, Simple calculation.</p>	16
2	<p><b><u>Refrigerants:</u></b> Nomenclature, desirable thermal, chemical and physical properties, primary and secondary refrigerants, Second generation refrigerant, total equivalent warming impact (<b>TEWI</b>).</p> <p><b><u>Refrigeration system components:</u></b>Refrigeration system components, and selection of compressors, condensers, expansion devices, and evaporators, refrigeration piping accessories, evacuation and charging of refrigerant, properties and classification of thermal insulation</p> <p><b><u>Cryogenics:</u></b> Joule-Thomson effect, Inversion temperature, Linde-Hampson system and analysis for liquefaction of gases, Claude system.</p>	09

Unit No.	Topics	Teaching Hours
3	<p><b>Psychrometry:</b> 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, chemical dehumidification, adiabatic saturation, desert cooler.</p> <p><b>Conditioned space load:</b> Estimation of heat and moisture load, RSHF,GSHF,ESHF,fixing of supply state on space condition, basic controls of air conditioning system.</p>	11
4	<p><b>Human comfort:</b> 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.</p> <p><b>Duct design and air distribution :</b> 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.</p> <p><b>Air-conditioning systems :</b> 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.</p>	06
<b>TOTAL</b>		<b>42</b>

#### List of References:

1. "Refrigeration and Air Conditioning", C P Arora, McGraw-Hill India Publishing Ltd.
2. "Refrigeration and Air-conditioning", Ramesh Arora, Prentice Hall of India.
3. "Refrigeration and Air Conditioning", Manohar Prasad, New Age International Publisher.
4. "Principles of Refrigeration", Roy. J Dossat, Pearson Education.
5. "Refrigeration and Air Conditioning", Jordon and Prister, Prentice Hall of India Pvt. Ltd.
6. "Refrigeration and Air Conditioning", W.F. Stocker and J. W. Jones, McGraw-Hill.

#### Course Outcomes (COs):

At the end of this course students will be able to:

1. Interpret and analyze various refrigeration cycles
2. Explain refrigerants, refrigeration system components and cryogenic cycles
3. Evaluate basic calculation of psychrometric properties and process
4. Illustrate human comfort, duct design and various air conditioning systems.