

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74d- REFRIGERATION AND AIR CONDITIONING**

(Professional Elective-III)

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**Course Objectives:** The objectives of the course are to make the students learn about

- Provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry.
- Introduce the students how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.
- Expose the students on various refrigeration methods like VCR, VAR and latest developments.
- Know the various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

**UNIT – 1: Introduction To Refrigeration**

**10 Hrs**

**Introduction To Refrigeration:** Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods.

**Air Refrigeration:** Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Refrigeration Needs of Air Crafts.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the terminologies associated with refrigeration. L2
- Describe the first and second law applied to refrigerating machines. L2
- Demonstrate the Bell-Coleman cycle in air refrigeration. L2
- Identify the various refrigeration cycles. L3

**UNIT – II: Vapour Compression Refrigeration**

**10Hrs**

Vapour Compression Refrigeration ( VCR ) System - Basic Cycle - Working Principle and Essential Components of the Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Appraise the importance of vapour compression refrigeration system. L5
- Draw the T-S and P-h charts for representation of cycle L1
- Classify various refrigerants used in vapour compression refrigeration systems L1
- Model the numerical problems on refrigeration cycles. L3
- Demonstrate the influence of various parameters on system performance L2

**UNIT – III: Vapor Absorption Refrigeration ( VAR ) System-**

**10Hrs**

**Vapor Absorption Refrigeration ( VAR ) System-** Description and Working of NH<sub>3</sub> - Water System and Li Br -Water ( Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

**Steam Jet Refrigeration System:** Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Appraise the importance of vapour absorption refrigeration system. L5
- Identify the latest developments of Electrolux, thermo electric vortex tube methods. L3
- Illustrate the working of various components of steam jet refrigeration system. L2
- Estimate the motive steam required for steam jet refrigeration system L6
- Describe the working principle of Thermo- Electric refrigerator and vortex tube refrigerator L2

**UNIT – IV: Introduction To Air Conditioning**

**8 Hrs**

**Introduction To Air Conditioning:** Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts.

**Air Conditioning Systems:** Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate the psychrometric properties & processes L2
- Select the air conditioning systems for different realistic situations L6
- Define the terms sensible heat load and latent heat load L1
- Draw the psychrometric charts for various air conditioning environments L1

**UNIT – V: Air Conditioning Equipment**

**8Hrs**

**Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.**

**Human Comfort:** Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Appraise the importance of humidifiers and dehumidifiers. L5
- Select the requirements of temperature and humidity for human comfort. L6
- Demonstrate the heat pump working and its components. L2
- List the various air conditioning equipments. L1

**Text Books:**

1. Refrigeration and Air Conditioning ,CPA Arora, TMH, 15<sup>th</sup> edition, 2013.
2. A Course in Refrigeration and Air conditioning, S.C Arora & Domkundwar, Dhanpatrai

**Reference Books:**

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2<sup>nd</sup> edition, 2013
2. Principles of Refrigeration - Dossat / Pearson Education, 4<sup>th</sup> edition, 2007
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2<sup>nd</sup> edition, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N. Ananthanarayanan / TMH, 4<sup>th</sup> edition, 2013.

**NOTE:** Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychrometric property Tables and charts are permitted in Exam

**Course Outcomes:**

At the end of this Course the student will be able to

- Summarize the various refrigeration and air conditioning equipments and it's working L3
- Apply the basic knowledge to operate the refrigeration systems L6
- Evaluate the COP for vapour absorption system L4