III B.Tech II Semester

15AME32 - REFRIGERATION AND AIR CONDITIONING

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Course Objective:

This subject provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry. It gives details on how different components work and influence each other. Students will learn how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.

The objective this subject is to make the student to have complete knowledge on various refrigeration methods like VCR, VAR and latest developments, knowledge on 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 I

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 Outcome & Suggested Student Activities:

At the end of the chapter, student can able to understand the terminologies associated with refrigeration and also understand the basic principles of Refrigeration and applications. Student can also know the aspects of various natural refrigeration methods; understand the components of Air refrigeration system and the necessity of air craft refrigeration.

UNIT II

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 Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the components in the domestic refrigerator, analyzing the concepts of sub-cooling and super heating to improve the COP and also necessity of replacements for CFCs and HCFCs with new refrigerants.

UNIT III

Vapor Absorption Refrigeration (VAR) System- Description and Working of NH_3 - 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 OrHilsch Tube.

Learning Outcome & Suggested Student Activities:
After the completion of the chapter, student can know the purpose and function of each of the basic components of the absorption refrigeration system. Student can have knowledge on latest developments of Electrolux, thermo electric vortex tube methods.

UNIT IV
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 Outcome & Suggested Student Activities:
After the end of the chapter, student can have knowledge on the use of psychrometric terms in Air conditioning. Student can learn the use of psychrometric chart to know psychrometric properties of air. Student can able to understand the terms sensible heat load and latent heat load. This technical information is fundamental to all types of domestic, commercial and industrial systems for the calculations of heat loads. Student is advised to conduct experiment on A.C tutor in the laboratory.

UNIT V
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 Outcome & Suggested Student Activities:
After the completion of the chapter, student can understand the components of A/C system and describe the cooling equipment combinations. Student can describe the concept of human comfort chart and the processes by which the body produces and rejects heat. Student can be familiar with the Heat pumpcircuit analysis.

TEXT BOOKS:
1. Refrigeration and Air Conditioning, R.S.Kurmi and J.K.Guptha. S.Chand Publications.
2. Refrigeration and Air Conditioning ,CPArora,TMH, 15th edition, 2013.
3. A Course in Refrigeration and Air conditioning, S.Carora&Domkundwar, Dhanpatrai.

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

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

SUGGESTED LINKS:
- http://www.refrigerationbasics.com/index.htm http://www.howstuffworks.com/ac.htm
- http://www.ashrae.org

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Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390.

- http://www.taftan.com/thermodynamics/AIRCOND.HTM
- http://www.wisegeek.com/how-does-air-conditioning-work.htm
- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20%20 Lecture%201.pdf
- http://www.ignou.ac.in/upload/Unit%201-32.pdf ,
- http:/nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20 Cond/pdf/RAC%20 Lecture%209.pdf
- http://www.nptel.iitm.ac.in/courses/IITMADRAS/Applied_Thermodynamics/Module_6/6_Simple_Vapor_ Compression_RS.pdf
- http://www.mcquay.com/mcquaybiz/literature/lit_ch_wc/AppGuide/AG31-007.pdf
- http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20Lecture%2014.pdf
- http://en.wikipedia.org/wiki/Thermoelectric_cooling
- http://server.fst.uga.edu/kerr/FDST%204060/pdf%20files/7%20Psychrometrics.pdf
- http://people.eng.unimelb.edu.au/mjbrear/436-432/chapter%208%20-%20psychrometry.pdf
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- http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2029.pdf
- http://courses.washington.edu/me333afe/Comfort_Health.pdf
- http://web.me.unr.edu/me372/Spring2001/Heat%20Pumps.pdf

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