University Course

Refrigerant Management

Special Course for Future Engineers

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Background

Over the last two decades exhaustive training programmes was offered for the servicing technicians - refrigeration good practices, emissions reduction and sound management of refrigerants.

These training programs offered also opportunity to field engineers to get involved but majority of the training recipients were field technicians.

The level of training programmes is always simplified to the minimum scientific level with more focus on hands-on practices and service techniques.

HVAC courses in universities cover Cooling load estimation, Duct design, Psychrometrics, Air Conditioning system types, How to design HVAC systems

HVAC courses do not cover Effect of alternative refrigerants on the environment, The Montreal Protocol and Kigali’s Amendment, Impact of technologies used in different HVAC systems
University Course
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Introducing an Environmental HVAC Course to:

- Support the engineering education process at different engineering institutes and colleges by acquainting the Future Engineers with the available alternative refrigerants
- Understand the technical and policy aspects associated with the refrigeration and air-conditioning industry
- Introducing young minds into these fields will have them create new, groundbreaking and novel ideas/approaches and technology
- Introduce the next generation to the severity of consequences of this challenges if business as usual resumes.
- Introduce a generation of young engineers that can persuade and encourage local businesses to pursue product development by interacting with local Universities and Research Institutions
- This special course is first of its kind, about refrigerants management, that offer comprehensive scientific information and knowledge suitable for the academic level
- This effort is an upgrade and update of an earlier efforts offered by Kuwait University and American University in Beirut, almost 10 years ago, for similar course but more broader covering all ODS at that time.
Course Objectives

• Create awareness regarding environmental concerns related to select Multilateral Environmental Agreements, in general, and Montreal Protocol and Kigali Amendment in particular.

• Develop in students skills in evaluating the impacts of ODS and high GWP alternatives on systems performance.

• Introduce the main standards concerning refrigerant safety.

• Expose students to good practices in safely handling and managing refrigerants.

• Introduce students to the refrigerant containment process and its impacts. Discusses the environmental issues related to engineering, more specifically HVAC

• Study the current commercially available HVAC technologies, and address future and new technologies
Refrigerant Management
Course Modules and Topics

• Module 1: Air Conditioning Industry, Evolution of Refrigerants & Environmental Impacts
• Module 2: Alternative Refrigerants for Different Sectors & Lubricants
• Module 3: Containment of Refrigerants, Service & Maintenance of Air Conditioning and Refrigeration Systems
• Module 4: Safe Use & Handling of Refrigerants
• Module 5: Related Standards and Codes of Systems and Substances
1. Introduction
2. Air conditioning Industry: History and Timeline
3. Basics of Vapor Compression Cycle
   a. Components and Types of Compressors
4. Refrigerants:
   a. Definitions
   b. Evolution and History
   c. Refrigerants Generations
   d. Characteristics, Selection and Effect of Refrigerants
   e. Classification
   f. Designation
   g. Blends
5. Environmentally Harmful Practices
6. Structure of the Atmosphere (Ozone Layering)
7. ODS and Applications
8. Vienna Convention and Montreal Protocol
9. Global Warming
   a. Definition
   b. Effects
   c. Suggested Solutions
10. Ozone Depletion
    a. Definition
    b. Effects
    c. Suggested Solutions
11. Introduction to UNEP
MODULE 2

3.5 WEEKS

1. INTRODUCTION
2. TYPES OF REFRIGERATION SYSTEMS
3. ALTERNATIVE TECHNOLOGY
4. SUBSTITUTES AND PROPERTIES
5. RETROFITTING: OPTIONS FOR EXISTING SYSTEMS
6. LUBRICATION
1. SELECTION AND REQUIREMENTS
7. OIL LUBRICANT PROPERTIES
8. OIL LUBRICANT CATEGORIES
9. MINERAL COMPOSITION
10. COMPATIBILITY AND APPLICATIONS
11. SYNTHETIC LUBRICANTS

ALTERNATIVE REFRIGERANTS FOR DIFFERENT SECTORS AND LUBRICANTS
MODULE 3
3 WEEKS

1. Introduction and Definition of Containment
2. Refrigerant Leakage
3. Recovery, Recycling and Reclamation (RRR)
4. Equipment & Design
5. Methods of Servicing and Good Practices with demonstration Videos
   a. Avoiding Contaminants
   b. Installation (Tubing, Brazing, Selection of material)
   c. Evacuation
   d. Purging
   e. Leak Detection
   f. Charging
6. System Maintenance
7. References

CONTAINMENT OF REFRIGERANTS, SERVICE AND MAINTENANCE OF AIR CONDITIONING AND REFRIGERATION SYSTEMS
1. Introduction
2. Refrigerant Management, Implementation and Impact
3. Disposal Needs in A5 Countries
4. Patterns and Options of Disposal Needs
5. Safe Use of Refrigerants
6. Handling of Refrigerants
7. References
MODULE 5
2 WEEKS

1. Introduction to Standards and Benefits
2. Development of Standards
3. Main Standardization Organizations
4. Main ASHRAE Standards
5. Remarks
6. References

RELATED STANDARDS AND CODES OF SYSTEMS AND SUBSTANCES
How Universities Can Benefit from this Course

- Engineering institutes and colleges are encouraged to use it as an elective course for their mechanical engineering students.
- The course is developed taking into consideration international academic standards used in engineering education.
- Users of the course are also encouraged to keep abreast with the development at the global level in relation to environment and technology.
Student Team Activities

• Students disassemble AC unit, and understand the actual design of refrigeration cycle
• Students study AC manuals and calculate the COP.
• Students prepare posters on the causes and consequences of global warming and ozone depletion
• Students learn how to conduct leakage tests on refrigerant cycles with the presence of a technician - done on a split AC unit
• Students learn how to charge and discharge the refrigerant with the presence of a technician - done on a split AC unit
Outcomes

• Students get a proper hands on experience in practical work in HVAC
• Students research about refrigerants efficiency, GWP, and ODS, write reports and make presentations regarding these issues
• Students study how the HVAC industry evolved throughout the century
• Students are able to compare between different refrigerants performance at different outdoor conditions
• Students conduct research and presentations in teams, enhance their teamwork skills and learned from each other
ASHRAE/ UNEP
Coordination on Course Delivery
ASHRAE/ UNEP Coordination on Course Delivery

- ASHRAE and UN Environment are teaming up to promote the course
- ASHRAE has 313 Student Branches at universities around the world with concentrations in Asia, Indian Subcontinent, South America, and Middle East (71 student branches are in developing countries).
- ASHRAE so far identified 40 of these Student Branch advisers to pilot the course in Winter and Spring semesters.
- Feedback used to officially offer course for Summer and Fall 2018 scheduling, including suitability of content level, need for regional modification, acceptability of student knowledge retention.
After pilot, course is available for free download upon registration by all ASHRAE Student Branch Advisors with focus on developing countries.

ASHRAE will promote this course at meetings and chapter visits

ASHRAE will follow up with advisors and students to identify other training and professional development needs.
Questions?

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