**MEC8103: Advanced Heating, Ventilation, Air Conditioning and Refrigeration**

| Hours per Semester | | | | Weighted Total Mark | Weighted Exam Mark | Weighted Continuous Assessment Mark | Credit Units |
|---|---|---|---|---|---|---|---|
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 40 | | 10 | 45 | 100 | 60 | 40 | 3 |

**Course Description**

This course covers the concepts of HVAC which include: Human Comfort, Thermal Loads, How an HVAC System Functions, Energy Conservation Opportunities (ECO's), Psychometrics, Industrial Refrigeration Systems, Air Conditioning and Refrigeration System components.

**Course Objectives:**

- To introduce the basic principles of Refrigeration cycles and air-conditioning.
- To equip the student with the knowledge for HVAC maintenance-operation and maintenance care
- To discuss the new refrigerants technology related to the ozone depletion and global warming phenomena.
- To introduce the student to principles of refrigeration cycle servicing, electrical circuit protection of HVAC, service diagnosis and repairs and trouble shooting and fault finding.

**Course Outcomes:**

At the end of the course the student should

- Understand and apply the basics of human comfort
- Be able to determine cooling and heating loads for an occupied space
- Be able to design, size and select a HVAC system

**Course content**

**1. Fundamentals of HVAC (9 Hours)**

- Human comfort
- Fresh air requirements
- Thermal Loads
- Psychrometrics
- How an HVAC System Functions
- Energy Conservation Opportunities (ECOs)

**2. Refrigeration systems (9 Hours)**

- Vapour compression Refrigeration system analysis
- Absorption refrigeration system
- Air refrigeration systems
- Refrigeration equipment

- Simulation of refrigeration systems

**3. Cooling and heating load determination (6 Hours)**

- People loads
- Equipment loads
- Product loads
- Solar loads
- Ventilation loads
- Other loads
- Energy evaluation and management in the built environment

**4. HVAC system Components (3 Hours)**

- Distribution: Fans, ducts
- Conversion
- Controls

**5. HVAC system design and selection (6 Hours)**

- Duct and pipe sizing
- Selection of systems
- Classification of HVAC systems

**6. Introduction and use of computer-based load estimation packages software (6Hours) (6 Hours)**

- Use of CFD packages as tools to simulate flows in building
- Optimization of air conditioning design, energy estimation methods and software

**Mode of delivery**

This course will be delivered through lectures, tutorials, exercises, field visits and group projects aimed at solving real life problems.

**Method of Assessment**

Students will be assessed through assignments, tests, practical work and projects which make up the course work and a final exam at the end of the course as follows:

| | |
|---|---|
| Course work | 40% |
| Final Exam | 60% |
| Total Mark | 100% |

**Reference textbooks**

[1] Burr, R. W., et al., 1998. Fundamentals of Air System Design, American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., Atlanta, GA.

[2] Fenton, D. L., 2000. Fundamentals of Refrigeration, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta, GA. [

[3] Hegberg, R. A., 1999. Fundamentals of Water System Design, American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., Atlanta, GA.

[4] Johnson, R. R., 1999. Fundamentals of HVAC Systems, American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., Atlanta, GA.

[5] ASHRAE, 2005. ASHRAE Handbook Fundamentals 2005, Chps. 1, 2, 6, 8, 19, 27, 28, 30-35, American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., Atlanta, GA.

[6] Jones, W. P., 2001. Air Conditioning Engineering, 5th Ed., Butterworth-Heinemann, Oxford & Boston.
[7] Sauer, H. J., Howell, R. H. and Coad, W. J., 2001. Principles of Heating, Ventilating, and Air Conditioning, American Society of Heating, Refrigerating and Air-Conditioning