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