



OAKLAND
COMMUNITY
COLLEGE

Auburn Hills Campus
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ENVIRONMENTAL SYSTEMS TECHNOLOGY
ADVISORY COMMITTEE MEETING

October 17, 1996

3:30-5:30 p.m.

Room T-6

AGENDA

1. Welcome and Introductions
2. Tour of Environmental Systems Lab
3. Validity of Curriculum: learning materials, work, learning experiences, related experience
4. Evaluation of Lab Equipment
5. Assessment of Graduates
6. Job outlook: pay, promotion, growth, migration
7. Potential for Growth of Profession in Oakland County/Southeast Michigan
8. Student membership in professional organization
9. Open Discussion

Environmental Systems Technology (HVT)

Heating, Ventilation, Air Conditioning and Refrigeration Technician Option

Associate in Applied Science

Auburn Hills

This program leads to an Associate Degree in Applied Science with specialization in Environmental Systems Technology. The program is designed to qualify students for occupations and careers in air conditioning, heating and refrigeration, system designers, estimators, manufacturers' representatives, equipment fabricators, application technicians, salesmen, installation mechanics, servicemen, maintenance mechanics, and many other related skilled and semi-skilled positions.

Major Requirements		Credits
TER 111.4*	Introduction to Refrigeration	4
TER 161*	Forced Air Heating Systems	4
AET 240*	Energy Management.....	4
TER 121*	Domestic and Commercial Refrigeration	4
TER 163*	Steam and Hot Water Heating Systems.....	4
TER 143*	Residential and Commercial Control Systems	4
TER 131*	Heating, Ventilation, Air Conditioning and Refrigeration Design I	4
TER 122*	Commercial Refrigeration II	3
TER 180	Advanced Controls	4
TER 152.2*	Refrigeration Code	2
TER 170*	Heating Regulations	2

Required Supportive Courses

ELT 101*	Applied Electricity	3
APM 811	Geometry-Algebra	3
or		
MAT 110 ¹	Elementary Algebra	4
APP 815 ²	Applied Technology I	2
APP 816 ²	Applied Technology II	2
ENG 135★	Business Communications.....	3
IND 100	Introductory Seminar in Industrial Sciences	2

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on pages 47 and 50.

★ General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.

* When all the courses marked with an asterisk are completed, the student may apply for a Certificate.

¹ Or higher level math

² May be replaced with PHY 161

Students are responsible for all prerequisites and/or corequisites—see course descriptions.

Environmental Systems Technology (HVA)

Advanced Heating, Ventilation, Air Conditioning
and Refrigeration Technician Option

Extended Degree Program

Auburn Hills

Associate in Applied Science

Major Requirements		Credits
TER 111.4	Introduction to Refrigeration	4
TER 161	Forced Air Heating Systems	4
AET 240	Energy Management	4
TER 121	Domestic and Commercial Refrigeration	4
TER 163	Steam and Hot Water Heating Systems	4
TER 143	Residential and Commercial Control Systems	4
TER 131	Heating, Ventilation, Air Conditioning and Refrigeration Design I	4
TER 139	Heating, Ventilation, Air Conditioning and Refrigeration Design II	4
TER 141	Air Conditioning System Testing, Adjustment and Balancing	4
TER 180	Advanced Controls	4
AET 251	Direct Digital Controls	4
AET 242.4	Independent Research in Automated Building Systems..	4

Required Supportive Courses

ELT 101	Applied Electricity	3
MAT 115 ² ★	Intermediate Algebra	4
APP 815	Applied Technology I	2
APP 816	Applied Technology II	2
APD 856	Structural Blueprint Reading	3
CIS 100 or CIS 101 ¹	Computer Literacy	1
	Programming Literacy	2

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on pages 47 and 50.

Necessary Electives to Total 79 Credits

Students are responsible for all prerequisites and/or corequisites—see course descriptions.

This program leads to an Associate Degree in Applied Science with specialization in Environmental Systems Technology. It is designated as an Extended Degree Program because the student must complete a minimum of 73 or more required credit hours. Program graduates are encouraged to transfer to a four-year college or university to complete their education in Engineering Technology or Energy Management. However, program graduates may qualify for occupations and careers in heating, ventilating and air conditioning such as systems designers, technicians, estimators, sales engineers, and manufacturers' representatives.

¹ Choice to be approved by program director.

² Or higher level Mathematics course.

★ General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.

Environmental Systems Technology (TER)

Special Interest Option

Associate in Applied Science

Auburn Hills

This program leads to an Associate Degree in Applied Science with specialization in Environmental Systems Technology. Program graduates may qualify for occupations and careers in heating, ventilating and air conditioning, environmental technologies or energy management. Students may also design their program for transfer to four-year colleges or universities in energy management, engineering technology or environmental studies.

Major Requirements		Credits
AET 201	Solar and Other Renewable Energy Systems	4
AET 240	Energy Management.....	4
AET 242.4	Independent Research in Automated Building Systems.	4

Required Supportive Courses

Students must choose a minimum of 25 credit hours from the following:

ACC 111	Fundamental Accounting	3
ACC 217	Business Taxation.....	3
ACC 251	Principles of Accounting I.....	4
APP 815	Applied Technology I	2
APP 816	Applied Technology II	2
APT 150	Applications in Technology	4
ATF 140	Introduction to Hydraulics.....	3
BIO 150★	Environmental Science	4
BIO 153★	Principles of Biology.....	4
BIS 210.1-7		
BUS 101	Principles and Practices of Business.....	3
BUS 121	Starting and Operating a Small Business	3
BUS 254	Small Business Finance	3
CAD 100	Fundamentals of Engineering Graphics	4
CAD 115	CAD Applications in Architecture/ Civil Engineering Technology	3
CIS 101	Programming Literacy	2
CIS 105	Personal Computer Applications.....	4
CIS 112	Structured Programming I (C).....	4

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★ General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.

Students are responsible for all prerequisites and/or corequisites—see course descriptions.

Environmental Systems Technology (TER)

Special Interest Option
(continued)

Auburn Hills

Associate in Applied Science

DDT 100	Fundamentals for the Drafting Industry	3
DRT 114	Electronics Drafting	3
ECT 208	Introduction to Microprocessors	4
ELT 101	Applied Electricity	3
ETT 121	Electrical Construction Wiring I (Residential).....	3
ETT 125	National Electrical Code	3
ETT 250	Electrical Machines	4
ETT 270	Electrical Controls.....	4
HCA 111	Health Facility Maintenance and Sanitation.....	3
MKT 102	Salesmanship	3
MKT 252	Fundamentals of Marketing Theory and Practice	3
PHY 161★	College Physics I.....	4
PHY 162★	College Physics II	4

Any courses in these areas:

AET	Alternate Energies
ARC	Architectural Engineering
BIO	Biology - Courses numbered 200 and above
CHE	Chemistry - Courses numbered 200 and above
TEO	Technical Apprentice - Stationary Engineer
TER	Climate Control

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on pages 47 and 50.

★ General Education courses listed as Required Supportive may be used to meet requirements of the General Education component.

Students are responsible for all prerequisites and/or corequisites—see course descriptions.

Program Section - 97

Environmental Systems Technology (HVF)

Facilities Management Option

Associate in Applied Science

Auburn Hills

This program leads to an Associate Degree in Applied Science with specialization in Environmental Systems Technology. Program graduates may qualify for occupations and careers in facilities management supervision, maintenance and operation in residential and commercial settings.

Major Requirements		Credits
ELT 101	Applied Electricity	3
AET 240	Energy Management	4
TER 161	Forced Air Heating Systems	4
TER 111.4	Introduction to Refrigeration	4

Required Supportive Courses

SPE 129	Interpersonal Communication	3
APD 856	Structural Blueprint Reading	3

In addition, the student must choose a minimum of 25 credit hours from the following:

ACC 111	Fundamental Accounting	3
AET 222	Waste Management and Biomass	4
AET 251	Direct Digital Controls	4
APP 815	Applied Technology I	2
APP 816	Applied Technology II	2
APT 813	Plumbing Code	3
BUS 101	Principles and Practices of Business	3
BUS 131	Principles of Supervision	3
CIS 105	Personal Computer Applications	4
ENG 056	English for Problem Solving	4
ETT 111	Industrial Electrical Systems	3
ETT 121	Electrical Construction Wiring I (Residential)	3
ETT 122	Wiring Technology Lab I	2
ETT 123	Commercial Wiring II	3
ETT 124	Wiring Technology Lab II	2
ETT 125	National Electrical Code	3

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Students are responsible for all prerequisites and/or corequisites—see course descriptions.

Environmental Systems Technology (HVF)

Facilities Management Option

(continued)

Auburn Hills

Associate in Applied Science

TEO 125	Boiler Operation	3
TEO 126	3rd Class Stationary Engineer I	3
TEO 127	3rd Class Stationary Engineer II	3
TEO 128	2nd Class Stationary Engineer	3
TEO 129	1st Class Stationary Engineer I	3
TEO 130	1st Class Stationary Engineer II	3
TER 121	Domestic and Commercial Refrigeration	4
TER 131	Heating, Ventilation, Air Conditioning and Refrigeration Design I	4
TER 143	Residential and Commercial Control Systems	4
TER 163	Steam and Hot Water Heating Systems	4
TER 180	Advanced Controls	4

General Education Requirements

See graduation requirements for an Associate in Applied Science Degree on pages 47 and 50.

Necessary Electives to Total 62 Credits

Students are responsible for all prerequisites and/or corequisites—see course descriptions.

ENVIRONMENTAL SYSTEMS TECHNOLOGY

COURSE DESCRIPTIONS

AET 201 Solar and Other Renewable Energy Systems 4 Credits

The student will learn and demonstrate the principles of energy efficient and solar design analysis, and construction. Students will analyze the solar energy systems and will calculate solar savings fractions, backup heat needs and economic analysis. The student will investigate the technologies and applications of other nonpolluting and renewable forms of energy including wind power, photovoltaics, and alternative transportation vehicles.

AET 222 Waste Management and Biomass 4 Credits

The student will demonstrate a working knowledge of contemporary recycling, source reduction and other waste management technologies through research, experiments and reports. The student will analyze the economic and environmental effects of a variety of waste management alternatives. Other forms of biomass production, including alternative transportation fuels, will be discussed and assessed.

AET 240 Energy Management 4 Credits

Prerequisite: TER 111.4 or TER 161, or consent of instructor.

The student will perform critical examinations of energy consuming facilities both domestic and commercial for the purpose of identifying energy conservation opportunities. In addition, the student will identify various energy conservation techniques as well as equipment which can be installed to further conserve energy. Energy audits will be performed in the classroom and at various facilities in Oakland County during field trips and individually arranged times.

AET 242.1-4 Independent Research in Automated Building Systems 1-4 Credits

Prerequisites: AET 251 and either AET 201 or AET 240 or consent of instructor.

This course is designed for persons who are interested in researching and/or developing building automation energy technology projects. Examples of these projects include: programming energy management systems and conducting performance tests; researching energy technology development and conducting a technical and economic analysis of market potential; developing control strategies for building automation. This course is designed to be taken in the student's last semester or with permission of instructor.

AET 251 Direct Digital Controls 4 Credits

Prerequisite: TER 180 and AET 240, or consent of instructor.

Direct Digital Controls is designed to investigate the theory, operation, design considerations and servicing of advanced commercial and industrial computerized control systems. Additional emphasis will be given to computerized single zone and multi zone systems, as well as other computerized applications as presently used and/or proposed in automated building control.

TER 111.4 Introduction to Refrigeration 4 Credits

The student will learn the basic principles of 25 current refrigeration systems and their application to the refrigeration cycle. Each type of unit is examined to determine function, best operating procedures and physical requirements.

TER 121 Domestic and Commercial Refrigeration 4 Credits

Prerequisites: TER 111.4 or consent of instructor.

This course is designed to integrate the theory and troubleshooting consideration of domestic hermetic refrigerator and freezer systems with the theory and application of light commercial refrigeration with systems, such as walk-in coolers, reach-in and display coolers, ice machines, and multievaporator systems. Emphasis on head pressure control, pump-down systems and capacity control will be given.

TER 122 Commercial Refrigeration II 3 Credits

Prerequisites: TER 111.4, TER 143.

The student will learn the theory, application, operation, selection, installation and repair of common commercial refrigeration units such as ice machines, walk-in refrigerators and commercial storage units, covering topics such as: system components, controls, compressors, condensers, receivers, cooling towers and water treatment, defrosting, motor protectors, capacitors, accessories and dehydration.

TER 131 Heating, Ventilation, Air Conditioning and Refrigeration Design I 4 Credits

Prerequisites: APM 811 or MAT 110 or equivalent, APP 815, APP 816, TER 111.4 and TER 161, or consent of instructor.

The student will develop the skills and abilities to use the concepts of human comfort and air conditioning system performance in the analysis of psychrometric properties, as well as to apply American Society of Heating, Refrigeration and Air Conditioning Engineers guide data to performing a comprehensive heat loss and gain analysis on residential and light commercial buildings. Additional emphasis will be given to computerized load and duct calculations. Lab experiments will be structured to reinforce the principles of equipment performance and servicing requirements.

TER 139 Heating, Ventilation, Air Conditioning and Refrigeration Design II 4 Credits

Prerequisites: TER 131 or consent of instructor.

The student will be required to analyze system heat loss and gain and apply air flow design principles to the design of duct and hydronic systems. In addition, the student will be exposed to the theory of mechanical refrigeration and heat pump application as it relates to the design process. Control theory and zoning requirements will be studied, as well as their application to the several types of air conditioning systems found in the field. Emphasis will be given to lab performance objectives pertinent to servicing package equipment, as well as use of the computer to calculate load and duct sizing and piping systems.

TER 141 Air Conditioning System Testing, Adjustment and Balancing 4 Credits

Prerequisites: TER 139 or consent of instructor.

This course is designed to give the student practice in applying the design theories learned in Heating, Ventilation, Air Conditioning and Refrigeration Design I and II or field service personnel familiar with design concepts of the skills necessary to quantitatively evaluate air conditioning systems performance. The student will be required to utilize fan and hydronic performance formulas and data, together with state of the art test instruments (inclined manometer, velometer, anemometer, liquid flow indicators, etc.) to test, adjust, and balance air and hydronic systems to specifications.

TER 143 Residential and Commercial Control Systems 4 Credits

Prerequisites: TER 111.4, TER 161 or consent of instructor.

The student will learn to read and interpret residential and light commercial wiring diagrams by identifying and tracing the schematics of several types of heating, refrigeration and air conditioning systems. Considerable emphasis on electrical problem solving will be given by lab simulators and trainers and troubleshooting.

TER 152.2 Refrigeration Code 2 Credits

Prerequisite: TER 121, or consent of instructor.

This course provides the student or apprentice with the refrigeration safety code of the American Standard Association as approved by the American Society of Heating, Refrigerating and Air Conditioning Engineers. The topics considered are scope and purpose, definitions, refrigeration systems classification, refrigerant classification, systems required for various establishments, installation requirements, piping, valves, fittings, and related parts, safety devices, design and construction of equipment, refrigerant containing pressure vessels, methods of field tests and instructions.

TER 161 Forced Air Heating Systems 4 Credits

This course is designed to teach the student the theory, installation requirements, and troubleshooting practices of residential gas, oil, and electric forced air systems. Additional emphasis will be placed on heating controls and the application of modern high-tech energy efficient residential and commercial heating systems.

TER 163 Steam and Hot Water Heating Systems 4 Credits

Prerequisite: TER 161 or consent of instructor.

Steam and Hot Water Heating Systems will provide the student a comprehensive exposure to the theory, installation and servicing of hydronic and steam heating systems. The student will calculate heat loss (Institute of Boilers and Radiation method) as well as layout and size radiation and piping plus select appropriate boiler. Additional consideration will be given to operational characteristics and troubleshooting of steam and hot water systems.

TER 170 Heating Regulations 2 Credits

Prerequisite: TER 163 or consent of instructor.

Heating Regulations is required by all students as preparation for obtaining a license. It will provide the student with Local and National Codes governing the safe design, construction, installation, testing and licensing as applied to heating. Safety features required for various types of fuel burning equipment, pressure vessels and system application. Rules applying to existing buildings and new construction. Requirements for approved equipment. Inspection and enforcement regulations. Relief devices and testing.

TER 180 Advanced Controls 4 Credits

Prerequisites: TER 143 or consent of instructor.

Advanced Controls is designed to investigate the theory, operation, design considerations and servicing of advanced commercial and industrial proportional control systems. Additional emphasis will be given to proportional single zone and multizone systems, as well as other proportional applications as presently used and/or proposed in automated building control.