

ENERGY TECHNOLOGY
Technology Division
Henry Ford community College

COURSE SYLLABUS

Instructor Contact Information:

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I. Division: Energy Technology, Technology Division

II. Course Number and Title: MFMT 247 Power Engineering IV, Adv Power Plant-Combined-CoGen Cycles (PL)

III. Credit Hours: 2 Credit Hrs

IV. Total Contact Hours: 32 Contact

V. Prerequisites: None

VI. Co-requisites: Suggested MFMT 114, and/or MFMT 143 or concurrent

VII. Course Grading Scale: A-E

VIII. Catalog Description:

An advanced online course with lab and/or field experiences related to: Study of all the elements that make up a gas turbine and a combined cycle unit. This course also covers the safe and efficient operation of gas turbines and heat recovery steam generators and their different applications as used in combine cycle and cogeneration configurations. Online lab experiences-exercises, duplicate workplace skills meeting requirements of various National Skill Standards. Individual learners must arrange and complete plant visits during the course.

IX. Measurable Objectives - Major “General” Core Course Objectives

Skills identified below are those which are typically accomplished on a regular basis by persons who are identified as being successful on the job as a power/building engineer. This is an extensive list of workplace skills and specific skills for individual positions in the heat and power field. The ultimate number of skills from this list and any additional skills necessary to prepare for a specific field position are determined by type and extent of the equipment to be operated and maintained by the facilities or power engineer at a particular facility. These skills and the knowledge associated with them are identified in the instruction as completely as possible depending upon the facilities and equipment available to the learner and are covered online or through online laboratory or through real workplace experiences in this course.

(*Skills/competencies which apply specifically to this course, and which students must demonstrate skills and knowledge an/or experience to complete the requirements for this course:

PLANT AUXILIARIES

*Task 1: .Supplies treated and conditioned feed water to boilers through operation of treatment equipment.

*Task 2: Transfers liquids from and to various locations through the operation of pumps.

Task 3: Operates pollution control equipment to minimize effect of emissions on environment.

*Task 4: Supplies emergency power through the operation of auxiliary generating sets.

COMMISSIONING

*Task 5: Performs plant and equipment acceptance inspections and installation tests.

*Task 6: Prepares new equipment for initial start up.

*Task 7: Conducts and co-ordinates start up, running and testing.

STEAM GENERATION ELECTRICAL GENERATION/COGENERATION

*Task 8: Starts, operates and stops packaged firetube boilers.

*Task 9: Starts, operates and stops packaged watertube boilers.

Task 10: Starts, stops and operates central station and process boilers.

*Task 11: Starts, stops and operates condensing and non-condensing turbines.

*Task 12: Starts, stops and operates turbo-generators and cogenerators, synchronizing equipment and electrical distribution systems connected with generation.

REFRIGERATION AND AIR CONDITIONING

*Task 13: Starts stops, operates, maintains chillers (or heat exchangers) and other heating and cooling equipment to extract heat from spaces and products, circulating liquid by operation of mechanical refrigeration system, rejecting it to out side by working on and operating cooling towers.

Task 14: Operates, maintains refrigeration and air conditioning equipment and systems to extract heat from food, water, brine or other products by operation of mechanical refrigeration systems using various types of refrigerants.

Task 15: Starts stops, operates, maintains chillers, air handlers, air conditioning distribution equipment and systems and other heating and cooling equipment to extract heat from a closed chilled water circuit which in turn cools and dehumidifies air for space air conditioning or product cooling.

Task 16: Operates, services, maintains rooftop heating and cooling equipment and systems designed for air conditioning applications and/or specific heating, cooling or refrigeration system applications.

TESTING AND INSPECTION

Task 18: Performs chill water and cooling tower water tests.

*Task 19: Inspects and tests safety valves on turbines, boilers and engines.

*Task 20: Inspects and tests turbine, engine and other prime movers, over speed trips, control valves, governors and safety equipment.

*Task 21: Inspects and tests turbine condensers and air ejectors.

Task 22: Inspects and tests boiler operating controls, limits, combustion controls, fuel train, safety valves, low water cut-outs, and other controls in conjunction with CSD-1 and regulatory requirements.

*Task 23: Completes heat balance power plant and simple heating plant tests and calculates results, applying them to make the plant function more effectively and efficiently.

*Task 24: Inspects turbines, electrical controls, generators, engines.

AUTOMATION, CONTROL AND INSTRUMENTATION

*Task 25: Operates and maintains prime mover monitoring and control systems.

Task 26: Inspects, tests, adjusts, repairs positioning control systems, metering control systems for prime movers, prime mover auxiliaries and generating plant equipment.

Task 27: Operates, monitors, adjusts, programs computerized prime mover plant/building data acquisition and control systems and simulation equipment.

Task 28: Analyzes control system malfunctions, observes, interprets charts, digital displays and computer printouts to calibrate controls, adjusts set points, tunes loops, to effect changes in controlled systems.

MAINTENANCE

*Task 29: Maintains and repairs raw water, boiler water, potable water, and other water treatment systems.

*Task 30: Maintains and repairs compressor systems and equipment.

*Task 31: Maintains prime mover electrical drives and speed control systems.

*Task 32: Maintains turbines, engines by cleaning, adjusting, inspecting and repairing.

*Task 33: Maintains air compressor systems by cleaning, adjusting, lubricating and repairing.

*Task 34: Maintains pumps by cleaning, adjusting, lubricating and repairing.

Task 35: Maintains piping systems by coding, inspecting, maintaining and repairing.

Task 36: Maintains plant or building chill water systems.

Task 37: Maintains plant or building air conditioning systems.

*Task 38: Maintains plant electrical distribution system and electrical and electronic controls.

SAFETY AND BASIC SKILLS

*Task 39: Practices safety in power, process or heating plant environments.

*Task 40: Maintains compliance in safety skills and applications, meeting local and national regulatory requirements and meeting national skill standards.

X. Assessment of Academic Achievement

1. Assessment is completed by one or more of the following based upon the indication of standards and industry requirements:

- a) Written exam or multiple quizzes on specific subjects.
- b) Online quizzes, exams or exercises.
- c) Performance-based exercises, lab experiences or in-industry practical application training.
- d) Scenario or context-based exercises, activities or applications based upon field conditions or situations.
- e) Written paper, report, project or collaborative exercise.
- f) Presentation, learning object development, or creative research on specific subject/s.
- g) Proctored, supervised or real workplace experience in specific subject areas.
- h) Independent study, internship, externship or coop education experience.
- i) Other active performance-type experiences-exercises as approved by instructors.

2. Energy Technology courses and programs provide students with the capability to meet or exceed the requirements for entry and advanced level multi-functional power or process plant engineers, boiler operators or heating plant operators, building engineers, HVAC heating and cooling service technicians, instrument and control technicians, and multi-skilled maintenance technicians. All courses in each program are performance-based, practically oriented to field conditions and are designed to with assessments to ensure students meet minimum National Skills

Standards and minimum mandatory critical incident workplace competencies to perform at designated field proficiency levels.

3. Courses include National Skills Standards requirements as specified by nationally recognized heating/cooling field organizations including ARI/GAMA, (Air-Conditioning & Refrigeration Institute) and as specified by internationally recognized power field organizations including NIULPE (National Institute for the Uniform Licensing of Power Engineers), VTECS (Southern Association of College and Schools), National Skills Standards, and studies by HFCC faculty currently under way or completed for the occupations included in the program. Compliance with standards for governmental agencies such as OSHA, NIOSH and local regulations and laws where applicable are included as part of instruction.

4. Where required, and within the scope of the above noted assessment techniques, assessment of student achievement (with approval) may be adjusted at the discretion of the individual instructor to satisfy specific and specialized occupational requirements as is necessary for some learners seeking to meet exacting industry standards.

XI. General Course Requirements and Recommendations

1. Relative to all Energy Technology courses-programs, all learners must have accessibility to an Internet-connected, computer on a regular basis throughout the semester.

2. Learners must be computer literate entering the program having abilities for e-mail, Internet browser use, basic word processing and similar computerized activities.

3. Online learners and partially online learners must take quizzes, exams, and complete other exercises recording them on the instructional management system at the college.

4. Curriculum technology integration is required in this course which mandates that learners in such Energy Technology courses complete a minimum of 8-16 Internet industry-type site visits, assignments and exercises for each course.

5. Field trips are specified by license agencies granting experience credit for education activities and are an integral part of this course. Field trips must be attended or made up by learners not initially participating when scheduled.

XII. Texts

1) Steam Plant Operation, Latest Ed., Woodruff/Lammers. New York: McGraw-Hill, Professional & Reference Department.

2) Power Engineer's Steam and Refrigeration License Study Manual & Workbook - Part II, Boilers and Auxiliaries, Latest Revision, (or E-Book – CD version) PER Associates Inc.

3) High Capacity Fossil Fuel Plant Operator's Manual - EPA, (or E-Book – CD version), Latest Edition

4) Steam Plant Operation and Maintenance Guide – CIBO Publication, Current Edition (Available online)

5) Pan-Global Power Engineering Materials – 4th Class Essentials

6) or, Equivalent current texts, instructional materials and/or lab manuals.

XIII. Typical - Core Course Topics

PEFT Adv Energy Plants-Systems-Combined-CoGen Cycle Plants

(Text materials for this course are identified by online research and site visits to obtain the most pertinent and current data available for this “changing” field on subjects covered in this course!

Below is an example of the text materials which will be accessed and used for the course)

Introductory Module – Combined Cycle and Go Gen Plants

1.3 COGENERATION OPPORTUNITIES	4
1.4 REFERENCES	
5	
2. COGENERATION TECHNOLOGY ISSUES.....	7
2.1 TECHNOLOGY DESCRIPTION	7
2.2 NATIONAL ENERGY ACTS.....	9
2.3 ENVIRONMENTAL REGULATIONS.....	11
2.3.1 Clean Air Act.....	11
2.3.1.1 National Ambient Air Quality Standards	14
2.3.1.2 New Source Performance Standards	14
2.3.1.3 National Emission Standards for HAPs	16
2.3.1.4 Permitting requirements	19
2.3.1.5 State permitting programs	23
2.3.2 Clean Water Act	24
2.4 BENEFITS AND BARRIERS.....	
25	
2.4.1 Benefits and Potential Applications	25
2.4.2 Barriers to Implementation.....	27
2.5 REFERENCES	
29	

Module 1 Week 2 – Start Reading – Study this Manual Pp. 33-56

3. PRIME MOVERS.....	33
3.1 STEAM TURBINES	
33	
3.1.1 Description	33
3.1.2 Design and Performance Characteristics	36
3.1.2.1 Efficiency	39
3.1.2.2 Capital cost.....	40
3.1.2.3 Availability.....	40
3.1.2.4 Maintenance	41
3.1.2.5 Heat recovery	41
3.1.2.6 Fuels and emissions.....	41
3.1.3 Potential Applications.....	41
3.2 GAS TURBINES.....	
42	
3.2.1 Description	43
3.2.2 Design and Performance Characteristics	44
3.2.2.1 Efficiency	46
3.2.2.2 Capital cost.....	49
3.2.2.3 Availability.....	49
3.2.2.4 Maintenance	49
3.2.2.5 Heat recovery	50

3.2.2.6 Fuels and emissions.....	50
3.2.3 Potential Applications.....	51
3.3 MICROTURBINES.....	
52	
3.3.1 Description	52
3.3.2 Design and Performance Characteristics	52
3.3.2.1 Efficiency	54
3.3.2.2 Capital cost.....	54
3.3.2.3 Availability.....	54
3.3.2.4 Maintenance	55
3.3.2.5 Heat recovery	55
3.3.2.6 Fuels and emissions.....	55
3.3.3 Potential Applications.....	55

Module 2 Week 3 – Start Reading – Study this Manual Pp. 56 - 71

3.4 RECIPROCATING INTERNAL COMBUSTION ENGINES	56
3.4.1 Description	56
3.4.2 Design and Performance Characteristics	56
3.4.2.1 Efficiency	57
3.4.2.2 Capital cost.....	60
3.4.2.3 Availability.....	60
3.4.2.4 Maintenance	60
3.4.2.5 Heat recovery	60
3.4.2.6 Fuels and emissions.....	61
3.4.3 Potential Applications.....	61
3.5 FUEL CELLS	
61	
3.5.1 Description	62
3.5.2 Design and Performance Characteristics	62
3.5.2.1 Efficiency	63
3.5.2.2 Capital cost.....	64
3.5.2.3 Availability.....	65
3.5.2.4 Maintenance	65
3.5.2.5 Heat recovery	65
3.5.2.6 Fuels and emissions.....	65
3.5.3 Potential Applications.....	65
3.6 REFERENCES	
66	

Module 3 Week 4 – Start Reading – Study this Manual Pp. 71-103

4. HEAT-RECOVERY EQUIPMENT.....	71
4.1 UNFIRED UNITS	
71	
4.1.1 Unfired Heat-Recovery Steam Generators	74
4.1.2 Heat-Recovery Mufflers	75

4.1.3 Recuperators	76
4.1.4 Regenerators	77
4.1.5 Ebullient Cooling Systems	77
4.1.6 Forced Circulation Cooling Systems	77
4.1.7 Aftercoolers	77
4.1.8 Heat Exchangers.....	78
4.2 FIRED UNITS	
78	
4.2.1 Supplementary Fired Heat-Recovery Steam Generators	78
4.2.2 Industrial, Commercial, and Institutional Boilers.....	84
4.3 REFERENCES	
87	
5. ELECTRIC POWER GENERATION.....	91
5.1 ELECTRICAL GENERATORS.....	
91	
5.1.1 Synchronous Generators.....	92
5.1.2 Induction Generators	93
5.2 INVERTERS.....	
93	
5.3 CONTROL SYSTEMS.....	
94	
5.4 SAFETY	
94	
5.5 LIABILITY.....	
95	
5.6 INTERCONNECTION ISSUES.....	
95	
5.7 REFERENCES	
96	
6. COOLING EQUIPMENT AND ROTATING MACHINERY	
97	
6.1 ABSORPTION CHILLERS	
97	
6.2 DESICCANT DEHUMIDIFIERS.....	97
6.3 ROTATING MACHINERY.....	98
6.3.1 Air Compressors.....	98
6.3.2 Pumps	99
6.3.3 Fans.....	99
6.3.4 Refrigeration Compressors	100
6.4 REFERENCES	
100	

Module 4 Week 5 – Start Reading – Study this Manual Pp. 103-162

7. COMBINED HEAT AND POWER SYSTEMS	103
7.1 TOPPING-CYCLE SYSTEMS	

103	
7.1.1	Steam Turbine Topping Systems..... 103
7.1.2	Gas Turbine Topping Systems 107
7.1.2.1	Open-cycle gas turbine topping systems 108
7.1.2.2	Closed-cycle gas turbine topping systems..... 110
7.1.3	Reciprocating Engine Topping Systems..... 112
7.1.4	Fuel Cell Topping Systems..... 113
7.1.5	Microturbine Topping Systems 114
7.2	BOTTOMING-CYCLE SYSTEMS 116
7.3	COMBINED-CYCLE SYSTEMS..... 117
7.4	TRIGENERATION 121
7.5	REFERENCES 123
8.	PRELIMINARY DESIGN CONSIDERATIONS 125
8.1	THERMODYNAMIC CYCLES 125
8.2	PRIME MOVER SELECTION..... 125
8.3	FUEL AND EMISSION CONTROL ISSUES..... 127
8.4	HEAT-RECOVERY SCHEMES..... 133
8.5	COMBINED HEAT AND POWER OPTIONS..... 133
8.6	REFERENCES 146
9.	FEASIBILITY EVALUATION..... 147
9.1	EVALUATING COGENERATION POTENTIAL 149
9.1.1	Walk-Through and Data Collection 149
9.1.1.1	Energy savings opportunities 151
9.1.1.2	Preliminary screening..... 151
9.1.2	Preliminary Design..... 156
9.1.3	Economic Screening Analysis 156
9.1.4	Health, Safety, and Environmental Issues 158
9.1.4.1	Noise and vibration 158
9.1.4.2	Engineered and administrative controls 158
9.1.4.3	Electrical hazards 158
9.1.4.4	Emissions control 159
9.1.4.5	Permits..... 159
9.1.5	Electrical Grid Considerations..... 160
9.2	INFORMATION SOURCES..... 160
9.3	REFERENCES 162
	BIBLIOGRAPHY

GLOSSARY.....

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Remaining Course Topics – Added during the semester depending upon the changes in this field and the research and development of resources completed by each student!

IV. Credit for this course can be granted through credit for prior college-level learning!

This course is considered capable of providing college credit based upon a determination by appropriate faculty through consideration of one or more of the following: 1) field experience, 2) licenses held, 3) completing course exams and/or 4) performance sequences, and/or 5) completing a portfolio and, 6) Assessment of private trade school or other extensive college level industry training or learning by a departmental faculty member.

Note: Courses with the (PL) designation qualify for prior college-level learning credit evaluation, which may be granted, based upon completion of the PLACE portfolio development course MFMT 108 or through departmental exams. This course may include field-type “hands-on” experiences such as field trips, plant visits, field quests or activities which will be identified and/or included as mandatory requirements for the course depending upon license agency mandates, learner needs or program requirements, instructor-determined requirements, and/or employer requirements,