College of Micronesia – FSM
P.O. Box 159
Kolonia, Pohnpei

Course Outline Cover Page

Refrigeration II	VEM 114
Course Title	Dept and number

Course Description: This course primarily covers operation principles, installation, preventive maintenance and repair of split type air conditioning systems.

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	Hours/week	No. of weeks	Total Hours	Semester Credits
Lecture	3	16	48	3
Laboratory	3	16	48	1
Total Semester Credits				4

Purpose of Course		
	Degree Requirements	
	Degree Elective	
	Advance Certificate	
	Certificate	XX
	Apprentice	XX
	Remedial	
	Other (Workshop)	

Pre-requisite Course(s): VEM113

Signature, Chairman, Curriculum Committee	Date Approved by Committee
Signature, President, COM-FSM	Date Approved by the President

General Objective: This course is design to equip individual with operational skills in Air Conditioning and Refrigeration service to install, service and maintain, trouble shoot and repair split type air conditioning units.

Learning Outcomes: Upon successful completion of this course students will be able to:

1. Select suitable installation site.
2. Install split type air conditioning unit.
3. Install system piping.
4. Connect electrical system of split type air conditioning unit.
5. Service and maintain split type air conditioning unit.
6. Troubleshoot split type air conditioning unit.
7. Recover and recycle refrigerant in split type air conditioning unit.
8. Repair and retrofit split type air conditioning unit.
9. Perform start up and commissioning.

Outline of Content: This course contains:

1. Selection of suitable installation site.
   - Installation site for equipment
   - Site for piping installation
   - Site for air distribution
   - Installation site for electric controls and wirings

2. Install split type air conditioning unit.
   - Troubles related with the installation work.
   - Procedures of installation
   - Bringing in
   - Cautions for installation
   - Pipe holes

3. Install system piping.
   - Refrigerant piping work
   - Allowable piping length and level difference
   - Actual piping length and equivalent piping length
   - Leak test
   - Evacuation
   - Refrigerant charge

4. Connecting electrical system of split type air conditioning unit.
   - Wiring of split system air conditioner
   - Power supply wiring
   - Controls and protective devices
   - Thickness of electric wires
   - Procedures for grounding work

5. Service and maintain split type air conditioning unit.
    - Mechanical components, controls and operating conditions
    - System lubrication
    - Refrigerant charge
    - Air distribution system

6. Troubleshoot split type air conditioning unit.
    - Troubleshooting decision aid
    - Diagnoses by use of pressure gauge
    - Explanation of major troubles with the refrigeration cycle
    - Troubles and countermeasures

7. Recover and recycle refrigerant in split type air conditioning unit.
    - Assessment of unit for refrigerant recovery/recycling
    - Steps in setting up recovery/recycling equipment
    - Procedures in refrigerant recovery/recycling

8. Repair and retrofit split type air conditioning unit.
    - Evaluation of system condition
    - Retrofitting
    - Identification of refrigerant
    - Refrigerant cylinder and color codes
    - Safety precautions in handling refrigerant

9. Perform start up and commissioning.
    - Inspection before test run
    - Test run
    - Measuring items
    - Standard operation data
    - Data measurement in the field

Learning Outcomes:	On completion of this course students will be able to:
Learning Outcome 1	Select suitable installation site.
Assessment Criteria	Select installation site for equipment Provide piping installation plan Maximize air distribution Plot site for electric controls and wiring installation
Assessment Method	Direct observation Short answer questions Written test

Learning Outcome 2	Install indoor and outdoor unit.
Assessment Criteria	Identify troubles related with the installation work. Explain the procedures of installation Demonstrate bringing in of units Discuss safety precautionary measures for installation Make pipe holes
Assessment Method	Direct observation Practical task Short answer questions Written test
Learning Outcome 3	Install system piping and refrigerant charging.
Assessment criteria	Determine allowable piping length and level difference Compute actual piping length and equivalent piping length Connect refrigerant piping Demonstrate leak testing Evacuate air conditioning unit Charge refrigerant in the system
Assessment Method	Direct observation Practical task Short answer questions Written test
Learning Outcome 4	Connect electrical system of split type air conditioning unit.
Assessment criteria	Lay-out wiring of split system air conditioner Install power supply wiring Install controls and protective devices Determine the sizes of electric wires Discuss the procedures for grounding work Test run electrical system
Assessment Method	Direct observation Practical task Short answer questions Written test
Learning Outcome 5	Service and maintain split type air conditioning unit.
Assessment criteria	Check mechanical components operating condition. Perform system lubrication Measure refrigerant charge

	Clean air distribution system
Assessment Method	Direct observation Practical task Short answer questions Written test
Learning Outcome 6	Troubleshoot split type air conditioning unit.
Assessment criteria	Discuss troubleshooting decision aid Diagnose system by use of pressure gauge Explain major troubles with the refrigeration cycle Determine unit troubles and countermeasures
Assessment Method	Direct observation Practical task Short answer questions Written test
Learning Outcome 7	Recover and recycle refrigerant in split type air conditioning unit.
Assessment criteria	Assess unit for refrigerant recovery/recycling Demonstrate steps in setting up recovery/recycling equipment Operate refrigerant recovery/recycling equipment.
Assessment Method	Direct observation Practical task Short answer questions Written test
Learning Outcome 8	Repair and retrofit split type air conditioning unit/commercial refrigeration unit and its accessories.
Assessment criteria	Evaluate system condition Explain retrofitting Identify refrigerant Recognize refrigerant cylinder and color codes Practice safety precautions in handling refrigerant
Assessment Method	Direct observation Practical task Short answer questions Written test

Learning Outcome 9	Perform start up and commissioning.
Assessment criteria	Inspect before test run Perform unit test run Measure operating items Prepare standard operation data Conduct data measurement in the field
Assessment Method	Direct observation Practical task Short answer questions Written test

Required Textbook: Althouse, A., Turnquist, C., & Bracciano, A., Modern Refrigeration and Air Conditioning, The Goodheart-Wilcox Co., Inc USA. Latest Edition

Required Course Materials:

1. Instructor:
    a. CAI classroom with whiteboard or chalkboard
    b. Laboratory equipment with tools of the trade
    c. Text, Teacher's Resource Guide, workbook
    d. Overhead projector, transparencies

2. Student:
    a. Text
    b. Handouts provided by instructor
    c. Ring binder
    d. College ruled note sheet, pencil or pen
    e. Scientific calculator

Reference Materials:

1. John Tomczyk, Troubleshooting and Servicing Modern Air Conditioning and Refrigeration Systems.
2. Roger A. Fischer, Air Conditioning and Refrigeration Repair.
3. David Tenenbaum, Arco Air Conditioning and Refrigeration Toolbox Manual (Arco's On-The-Job References Series)
4. Richard Jazwin, Troubleshooting and Servicing HVAC&R Electrical System
5. Antonio Mejias, Refrigeration License Examinations: A Complete Guide to The Written and Practical Exams (Arco Professional Certification and Licensing Examination Series)

Method of Instruction:

1. Computer Aided Instruction
2. Practical/Experimentation
3. Lecture/Demonstration
4. Trainee hands-on

Evaluation:
Final grade for this course will be based on meeting the course requirements at the following percentages rates:

90% - 100%	A – Superior
80% - 89%	B – Above Average
70% - 79%	C – Average
60%-69%	D – Below Average
0% - 59%	F – Failure

Attendance:
The COM-FSM attendance policy will apply.

Honesty:
The COM-FSM Honesty policy will apply.