

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

Course Outline Cover Page

Signal Processing
Course Title

VEE 240
Department and Number

Course Description: This course continues from VEE 230 RF Communications by presenting more advanced methods of signal processing, these include further modulation methods, frequency shift keying and multiplexing.

Prepared by: Brent Villiers

State: National Campus

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3/6	16/8	48	3
Laboratory				
		Total Semester Credits:		3

Purpose of Course	Degree Requirement	_____
	Degree Elective	_____
	Advanced Certificate	XX
	Certificate	_____
	Remedial	_____
	Other (Workshop)	_____

Prerequisite Course(s): VEE 230 Radio Communications or Concurrently

Signature, Chairman, Curriculum Committee

Date Approved by Committee

Signature, President, COM-FSM

Date Approved by the President

General Objective:

This course presents the more advanced methods of processing RF signals through communication systems. The student should be able to describe the various processing methods, identify the circuitry, correctly measure the various signals and fault find the circuits.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

1. Give general descriptions of analog pulse modulation, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), and Pulse Position Modulation (PPM).
2. Describe Pulse Code Modulation (PCM), PCM circuit operation and troubleshoot PCM circuits.
3. Describe Delta Modulation (DM), DM circuit operation and troubleshoot DM circuits.
4. Describe Frequency Shift Keying (FSK), FSK circuit operation and troubleshoot FSK circuits.
5. Describe Phase Shift Keying (PSK), PSK circuit operation and troubleshoot PSK circuits.
6. Describe Time Division Multiplexing (TDM), TDM circuit operation and troubleshoot TDM circuits.
7. Describe Frequency Division Multiplexing (FDM), FDM circuit operation and troubleshoot FDM circuits.

STUDENTS SHOULD BE MADE AWARE OF OCCUPATIONAL HEALTH AND SAFETY ISSUES IN ALL SITUATIONS AND BE EXPECTED TO DEMONSTRATE SAFE WORKING PRACTICES AT ALL TIMES.

Outline of Content:

- This course contains:
1. Analog Pulse Modulation
 - PAM
 - PWM
 - PPM
 2. Pulse Code Modulation
 - The characteristics of PCM
 - PCM block diagrams
 - PCM circuit operation - modulators and demodulators
 - Troubleshooting PCM transmitters and receivers

3. Delta Modulation
 - The characteristics of DM
 - DM circuit operation - modulators and demodulators
 - Troubleshooting DM transmitters and receivers
4. Frequency Shift Keying
 - The characteristics of FSK signals, modulators, analog switch, VCO, demodulators and phase lock loop (PLL)
 - Measurement of signals in FSK modulators and demodulators.
 - Troubleshooting FSK transmitters and receivers
5. Phase Shift Keying
 - The characteristics of PSK
 - PSK circuit operation – measurement of signals in modulators and demodulators
 - Troubleshooting PSK transmitters and receivers
6. Time Division Multiplexing
 - The characteristics of TDM
 - TDM circuit operation - modulators and demodulators
 - Troubleshooting PCM transmitters and receivers
7. Frequency Division Multiplexing
 - The characteristics of FDM
 - FDM circuit operation of multiplexers and demultiplexers
 - Troubleshooting FDM transmitters and receivers

Learning Outcomes:

On completion of this course the learner will be able to:

Learning Outcome 1

Give general descriptions of analog pulse modulation, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), and Pulse Position Modulation (PPM).

Assessment Criteria

- a. Define analog modulation.
- b. Describe pulse amplitude modulation.
- c. Describe pulse width modulation.
- d. Describe pulse position modulation.

Assessment Method

Multiple choice questions
Short answer questions

Learning Outcome 2**Describe Pulse Code Modulation (PCM), PCM circuit operation and troubleshoot PCM circuits.**

Assessment Criteria

- a. Describe Pulse Code Modulation.
- b. Describe the characteristics of PCM.
- c. Describe the block diagram of a PCM modulator.
- d. Describe a typical PCM modulator circuit.
- e. Describe the block diagram of a PCM demodulator.
- f. Describe a typical PCM demodulator circuit.
- g. Observe the operation of a typical PCM modulator.
- h. Measure signals in a typical PCM modulator.
- i. Observe the operation of a typical PCM demodulator.
- j. Measure signals in a typical PCM demodulator.
- k. Determine if a PCM transmitter and receiver is operating correctly.
- l. Identify the faulted component in a malfunctioning PCM transmitter and receiver system.

Assessment Method

Multiple choice questions
 Short answer questions
 Practical exercises/tests

Learning Outcome 3**Describe Delta Modulation (DM), DM circuit operation and troubleshoot DM circuits.**

Assessment Criteria

- a. Describe Delta Modulation.
- b. Describe the characteristics of DM signals.
- c. Describe a typical DM modulator circuit.
- d. Describe the MC3418 DM modulator integrated circuit.
- e. Describe a typical DM demodulator circuit.
- f. Describe the MC3418 DM demodulator integrated circuit.
- g. Observe the operation of a typical DM modulator.
- h. Measure signals in a typical DM modulator.
- i. Observe the operation of a typical DM demodulator.
- j. Measure signals in a typical DM demodulator.
- k. Determine if a DM transmitter and receiver is operating correctly.
- m. Identify the faulted component in a malfunctioning DM transmitter and receiver system.

Assessment Method

Multiple choice questions
 Short answer questions
 Practical exercises/tests

Learning Outcome 4**Describe Frequency Shift Keying (FSK), FSK circuit operation and troubleshoot FSK circuits.**

Assessment Criteria

- a. Describe Frequency Shift Keying.
- b. Describe the characteristics of FSK signals.
- c. Describe a typical FSK modulator circuit.
- d. Describe the MC 14066 analog switch and d1CL8038 VCO integrated circuits.
- e. Describe a typical FSK demodulator circuit.
- f. Describe the NE565 and NE567 PLL integrated circuits.
- g. Observe the operation of a typical FSK modulator.
- h. Measure signals in a typical FSK modulator.
- i. Observe the operation of a typical FSK demodulator.
- j. Measure signals in a typical FSK demodulator.
- k. Determine if a FSK transmitter and receiver is operating correctly.
- l. Identify the faulted component in a malfunctioning FSK transmitter and receiver system.

Assessment Method

Multiple choice questions
 Short answer questions
 Practical exercises/tests

Learning Outcome 5**Describe Phase Shift Keying (PSK), PSK circuit operation and troubleshoot PSK circuits.**

Assessment Criteria

- a. Describe Phase Shift Keying.
- b. Describe the characteristics of PSK signals.
- c. Describe a typical PSK modulator circuit.
- d. Describe a typical PSK demodulator circuit.
- e. Observe the operation of a typical PSK modulator.
- f. Measure signals in a typical PSK modulator.
- g. Observe the operation of a typical PSK demodulator.
- h. Measure signals in a typical PSK demodulator.
- i. Determine if a PSK/QPSK transmitter and receiver is operating correctly.
- j. Identify the faulted component in a malfunctioning PSK/QPSK transmitter and receiver system.

Assessment Method

Multiple choice questions
 Short answer questions
 Practical exercises/tests

Learning Outcome 6

Describe Time Division Multiplexing (TDM), TDM circuit operation and troubleshoot TDM circuits.

Assessment Criteria

- a. Describe Time Division Multiplexing.
- b. Describe the characteristics of TDM signals.
- c. Describe a typical TDM multiplexer.
- d. Describe the MC14051 circuit used as a TDM multiplexer.
- e. Observe the operation of a typical TDM multiplexer.
- f. Measure signals in a typical TDM multiplexer.
- g. Observe the operation of a typical TDM demultiplexer.
- h. Measure signals in a typical TDM demultiplexer.
- i. Determine if a TDM transmitter and receiver is operating correctly.
- j. Identify the faulted component in a malfunctioning TDM transmitter and receiver system.

Assessment Method

Multiple choice questions
Short answer questions
Practical exercises/tests

Learning Outcome 7

Describe Frequency Division Multiplexing (FDM), FDM circuit operation and troubleshoot FDM circuits.

Assessment Criteria

- a. Describe Frequency Division Multiplexing.
- b. Describe the characteristics of FDM signals.
- c. Describe a typical FDM multiplexer circuit.
- d. Describe the NE564 PLL circuit used as a FM modulator.
- e. Describe a typical FDM demultiplexer circuit.
- f. Describe the NE564 used as a FM demodulator.
- g. Observe the operation of a typical FDM multiplexer.
- h. Measure signals in a typical FDM multiplexer.
- i. Observe the operation of a typical FDM demultiplexer.
- j. Measure signals in a typical FDM demultiplexer.
- k. Determine if a FDM transmitter and receiver is operating correctly.
- l. Identify the faulted component in a malfunctioning FDM transmitter and receiver system.

Assessment Method

Multiple choice questions
Short answer questions
Practical exercises/tests

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(s), handouts provided by instructor
- b. Ring binder
- c. College ruled note sheet, pencil or pen
- d. Scientific calculator

Reference Materials:

Electronic Devices, *Fourth Edition*

Thomas L. Floyd,

Modern Electronic Communication, *Seventh Edition*

Gary M. Miller, Jeffrey S. Beasley

Method of Instruction:

1. Computer Aided Instruction
2. Practical/Experimentation
3. Lecture/Demonstration

Evaluation:

Final Grade for this course will be based on meeting the course requirements at the following percentage 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