San Bernardino Valley College
Curriculum Approved:

I. COURSE INFORMATION:

A. Division: Technical
Department: Electricity/Electronics
Course ID: ELECTR 250B
Course Title: Radio Transmitters, Receivers and Antennas
Units: 4
Lecture: 3 hours
Laboratory: 3 hours
Prerequisite: ELECTR 115 and ELECTR 116
Corequisite: None
Dept. Advisory: None

B. Catalog Description: Course includes radio frequency amplifiers, oscillators, signal spectra, elements of noise, AM and FM modulation and demodulation, AM and FM transmitter and receiver systems, transmitter and receiver circuits, frequency and phase modulation and demodulation, phase locked loops, pulse and digital modulation and demodulation, and data communication techniques.

C. Schedule Description: A study of radio transmitters, receivers, and antennas

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES:

Upon successful completion of the course, the student should be able to:

A. Explain the fundamental operation of AM and FM transmitters and receivers.
B. Outline the major components of an AM and FM transmitters and receivers.
C. Describe the operation of oscillators and their application in modulator and demodulator circuits.
D. Define the concept of modulation and demodulation and compare AM, FM, phase, pulse and digital.
E. Discuss the design and operation of antennas and their relation to radio wave propagation.

IV. COURSE CONTENT:

A. Power Supplies
   1. Half-wave rectification
   2. Full-wave rectification
   3. Capacitive filtering
   4. Inductive filtering
B. Oscillators
   1. Types of oscillators
   2. Phase-locked loops
   3. Signal generators
C. Digital Fundamentals
   1. Gates
   2. Flip-flop circuits
   3. Registers
   4. Memories
   5. Microprocessors
   6. Interfacing to computers
D. Measuring Devices
   1. Analog and digital meters
   2. Wattmeters
   3. Ampere-hour meters
   4. Oscilloscopes
E. Audio Frequency Amplifiers
   1. Audio-frequency amplifiers
   2. Low level versus power amplifiers

3. Class A amplifier
4. Parallel push-pull class A
5. Classes B and AB
6. Classes D, E, G, H
7. Coupling methods
8. Types of distortion
9. Operational amplifiers
10. Servicing amplifiers

F. Radio Frequency Amplifiers
1. RF amplifier frequencies
2. RF power amplifiers
3. Class C biasing
4. Push-pull operation
5. Coupling RF amplifiers
6. Hazeltine neutralization
7. Frequency multipliers
8. Troubles with high power transmitters

G. Basic Transmitters
1. Radio transmitters
2. Single stage transmitters
3. Transmitter systems
4. Indications of trouble
5. Emergency repairs

H. Amplitude Modulation
1. Modulation
2. The modulated envelope
3. Sidebands
4. Bandwidth
5. Linear amplifiers
6. Microphones
7. Tuning AM transmitters

I. Amplitude Modulation Receivers
1. Demodulating
2. Crystal detectors
3. RF amplifiers and S/N ratio
4. Mixers
5. IF amplifiers
6. IF filters
7. Audio amplifiers
8. Wave traps
9. Transceivers
10. Aligning superheterodynes
11. Troubleshooting receivers

J. Frequency Modulation
1. Slope and PLL FM detection
2. Foster-Seeley discriminators
3. AFC and squelch
4. Alignment of FM receivers

K. Antennas
1. Radio waves
2. The ionosphere
3. Polarization of waves
4. The half-wave antenna
5. Hertz and Marconi antennas
6. Current and voltage in a half-wave antenna
7. Tuning antenna wires

8. Transmission lines and SWR
9. Directivity of antennas
10. Feedline coupling
11. Field strength
12. Antenna dangers

L. Two-Way Communications
1. Radio services
2. Basic communication services
3. Remote and repeater stations
4. Transmitter checks
5. Receiver checks

M. Microwaves
1. Microwave frequencies
2. Waveguide devices
3. Resonant cavities
4. Klystrons
5. Magnetrons
6. TWTs and BWOs
7. Isolators and circulators
8. Microwave test equipment

N. Fiber Optics
1. Optic fibers in general
2. Splicing and connecting fibers
3. Coaxial cable versus optic fibers
4. LED and laser light sources
5. Optical detectors
6. Multiplexing
7. Data compression

V. METHODS OF INSTRUCTION: (Please check all that apply and add any additional not listed.)

X Lecture
X Class and/or small group discussion
_____ Critical evaluation of texts, newspapers, journal articles, and other printed research
_____ Critical evaluation of films, videotapes, audiotapes, or other media forms
X Classroom demonstrations
_____ Field trips
_____ Guest speakers
_____ Other:
_____ Other:
_____ Other:

VI. TYPICAL OUT-OF-CLASS ASSIGNMENTS:

A. Reading Assignment. Reading assignments are required and may include (but are not limited to) the following: After reading the chapter on Microwaves, discuss in small groups the isolators and circulators.

B. Writing Assignment. Writing assignments are required and may include (but are not limited to) the following: Written homework assigned each week from the questions and problems in each chapter.
Typical Questions:
1. Why is a logarithmic taper pot better for an AF gain control?
2. What transformer ratio matches a common 600-ohm AF line to a 16-ohm speaker?

C. Critical Thinking Assignment. Critical thinking assignments are required and may include (but are not limited to) the following: Identify three AC coupling circuits, draw their schematics and explain their operations.

VII. EVALUATION:

A student's grade will be based on multiple measures of performance and will reflect the objectives explained above. A final grade of "C" or better should indicate that the student has the ability to successfully apply the principles and techniques taught in this course. These evaluation methods may include, but are not limited to, the following (Please check all that apply, and add additional ones not listed):

_____ Portfolios
X Projects
_____ Written papers or reports
_____ Presentations (oral and visual)
_____ Work performance (internships or field work)
X Lab work
X Comprehensive examinations (cumulative finals or certifications)
_____ Peer evaluation
_____ Self evaluation
X Classroom participation
X Homework
_____ Other:
_____ Other:
_____ Other:

VIII. TYPICAL TEXTS:

A. Shrader, R. L., Electronic Communication, 6th Edition, Glencoe, New York, 2000
B. Dungan, F. R., Electronic Communications Systems, Delmar, New York, 1998
C. Wheeler, T. A., Electronic Communications for Technicians, Prentice Hall, New Jersey, 2001

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

Scientific calculator

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COURSE GRID FORM

Target Course: ELECTR 250B Radio Transmitters, Receivers and Antennas

Prerequisite Course: ELECTR 115 Alternating Current Circuit Analysis

Instructions:
1) List exit competencies (skills) from Prerequisite Course. These skills are listed in the "Student Outcomes" section of the Course Outline ("upon completion of the course, the student should be able to…")
2) Indicate which of the listed exit competencies (skills) are necessary entry skills needed for success in the target course. Mark with an "X" each needed skill.
3) Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:

1=Critical 2=Very Helpful 3=Desirable

Skills Analysis

Entry Skills in Target Course	Exit Skills Provided by Prerequisite Course (Mark with an X if needed and indicate Prerequisite Course if more than one).	Degree of Importance (Rate 1 – 3)
1. Define magnetism, electromagnetism, and electromagnetic induction.	X	1
2. Explain the generation of AC voltage from electro-mechanical generators.	X	2
3. Define reactance; inductive/capacitive, units of measurement, their source, and their relation to resonance.	X	1
4. Describe the interaction between volts, ohms, current, and frequency in AC series and parallel circuits.	X	1
5. Apply circuit analysis to series and parallel and complex circuits.	X	1
6. Use rectangular and polar number systems, in series and parallel variational analysis.	X	2
7. Distinguish between half-wave, full-wave, and bridge rectifier circuits.	X	1
8. Analyze the filtering process of an LC pi filter network.	X	1

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COURSE GRID FORM

Target Course: ELECTR 250B Radio Transmitters, Receivers and Antennas

Prerequisite Course: ELECTR 116 Alternating Current Circuit Laboratory

Instructions:

1) List exit competencies (skills) from Prerequisite Course. These skills are listed in the "Student Outcomes" section of the Course Outline ("upon completion of the course, the student should be able to…")
2) Indicate which of the listed exit competencies (skills) are necessary entry skills needed for success in the target course. Mark with an "X" each needed skill.
3) Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:

1=Critical 2=Very Helpful 3=Desirable

Skills Analysis

Entry Skills in Target Course	Exit Skills Provided by Prerequisite Course (Mark with an X if needed and indicate Prerequisite Course if more than one).	Degree of Importance (Rate 1 – 3)
1. Explain the oscilloscopes operation and controls and be able to use it to measure voltage and time.	X	1
2. Use the function generators operation and controls.	X	1
3. Explain the layout of a QT board and be able to construct circuits on it.	X	1
4. Use a multi-meter to measure voltage, check for continuity, and verify polarity.	X	1
5. Describe electrical safety procedures.	X	1