

**COURSE ELT3100: ANALOG COMMUNICATION 3****Level:** Advanced**Theme:** Communication Systems**Prerequisite:** ELT2090 Analog Communication 2**Description:** Students demonstrate the principal concepts of electronic analog communication systems.**Parameters:** CAI package or ham/radio kits and related resources.**Supporting Courses:** ELT2100 Radio Communication  
ELT2080 Control Systems 2**Curriculum and Assessment Standards**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>• identify and demonstrate applications of analog communication</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>• analyzing the following electronic circuits:               <ul style="list-style-type: none"> <li>– detection, clamping, filtering circuits</li> <li>– bipolar transistors operation configurations</li> <li>– power, voltage, current amplification</li> <li>– FET circuit arrangements</li> <li>– applications of unijunction transistors</li> <li>– opto-electric devices</li> <li>– operational amplifiers</li> <li>– feedback oscillators</li> <li>– LC oscillators</li> <li>– SSB</li> <li>– amplitude, frequency modulator and AM/FM detectors</li> </ul>               using a computer simulation package.             </li> <li>• testing the following components:               <ul style="list-style-type: none"> <li>– diodes (rectifiers, zener, tunnel, light emitting, photo, etc.)</li> <li>– transistors (bipolar, unijunction, FET, etc.)</li> <li>– operational amplifiers</li> <li>– passive and active devices</li> </ul>               using test instruments such as multimeters, transistor checkers, signature analysis, oscilloscopes.             </li> </ul>	70

**COURSE ELT3100: ANALOG COMMUNICATION 3 (continued)**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>• explain differences between analog communication circuit applications used in telephone systems and consumer audio equipment</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>• analyzing advanced communication circuits such as:               <ul style="list-style-type: none"> <li>– FM transmitters/receivers</li> <li>– infrared transmitter/receiver</li> <li>– analog filters</li> <li>– oscillators</li> <li>– amplitude, frequency modulator</li> <li>– dial tone dual tone multifrequency (DTMF)</li> <li>– basic telephone set</li> </ul>               using computer simulation, experimental boards, CAI packages or trainers.             </li> <li>• constructing communication project, such as:               <ul style="list-style-type: none"> <li>– telephone enhancements</li> <li>– radio receiver projects</li> <li>– ham radio kit</li> <li>– infrared transmitter/receivers.</li> </ul> </li> </ul> <p><i>Assessment Tool</i>  <i>ELTLAB-2: Assessment Checklist: Laboratory Practice, Part 1</i></p> <p><i>Standard</i>  <i>Performance rating of 3 for each applicable task</i></p> <ul style="list-style-type: none"> <li>• explaining the differences between various analog communication circuits used in applications such as:               <ul style="list-style-type: none"> <li>– consumer stereo systems</li> <li>– PA sound systems</li> <li>– telephones</li> <li>– telephone switching networks</li> <li>– cellular telephones</li> <li>– multiband receivers</li> <li>– intercom systems</li> <li>– television</li> <li>– cable television</li> <li>– video cassette recorder (VCR).</li> </ul> </li> </ul> <p><i>Assessment Tool</i>  <i>ELTLAB-2: Assessment Checklist: Laboratory Practice, Part 1</i></p> <p><i>Standard</i>  <i>Performance rating of 3 for each applicable task</i></p>	<p>20</p>

**COURSE ELT3100: ANALOG COMMUNICATION 3 (continued)**

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>• demonstrate established laboratory procedures and safe work practices</li> <li>• create a profile of a trade or occupation within the field of analog communication</li> <li>• demonstrate basic competencies.</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>• observed performance in following:               <ul style="list-style-type: none"> <li>– established laboratory procedures</li> <li>– procedures indicating awareness of transformer input/output ratings</li> <li>– procedures indicating awareness of heat sinks</li> <li>– correct use of soft fuses for equipment protection.</li> </ul> </li> </ul> <p><i>Assessment Tool</i>  <i>ELTPSP: Assessment Checklist: Laboratory Procedures and Safety Practices</i></p> <p><i>Standard</i>  <i>Performance rating of 3 for each applicable task</i></p> <ul style="list-style-type: none"> <li>• completing a career profile in the field of analog communication.</li> </ul> <p><i>Assessment Tool</i>  <i>ELTCPC: Assessment Guide: Career Profiles</i></p> <p><i>Standard</i>  <i>Completing all sections of the profile chart</i></p> <ul style="list-style-type: none"> <li>• observations of individual effort and interpersonal interaction during the learning process.</li> </ul> <p><i>Assessment Tool</i>  <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>5</p> <p>5</p> <p>Integrated throughout</p>

Concept	Specific Outcomes	Notes
<p>Safety/Resource Management</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• describe transformer input/output ratings</li> <li>• describe heat sinks</li> <li>• demonstrate knowledge of fuse ratings</li> <li>• demonstrate use of isolation transformers</li> <li>• use “soft fuses” to protect equipment</li> <li>• demonstrate correct handling of electronic components</li> <li>• use correct electronic test equipment.</li> </ul>	<p>RF frequency burns above one watt.</p> <p>Light bulb inserted in fuse holder.</p>

**COURSE ELT3100: ANALOG COMMUNICATION 3 (continued)**

Concept	Specific Outcomes	Notes
Fundamentals	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• explain such terms as:               <ul style="list-style-type: none"> <li>– sine wave</li> <li>– distortion</li> <li>– harmonic signals</li> <li>– amplification</li> <li>– noise</li> <li>– impedance</li> <li>– signal losses</li> <li>– crosstalk</li> <li>– carrier modulation, demodulation</li> <li>– amplitude modulation</li> <li>– frequency modulation</li> <li>– stereo</li> <li>– multichannel communication</li> </ul> </li> <li>• draw a block diagram of multiband receivers</li> <li>• break down diagrams using complex waveforms into their component parts</li> <li>• explain the block diagram operation of a telephone call from the local subscriber to distant subscriber to involve equipment and transmission lines in between</li> <li>• draw a block diagram of a telephone receiver</li> <li>• contrast the fundamental differences between:               <ul style="list-style-type: none"> <li>– amplitude modulation (AM)</li> <li>– frequency modulation (FM)</li> <li>– single side band (SSB)</li> </ul> </li> <li>• analyze the function of each block of multiband receiver</li> <li>• define the properties of signals in both acoustic and electrical forms</li> <li>• identify the distinction used to clarify analog versus digital techniques used in creating electrical signals</li> </ul>	<p>This course may be linked to ELT2010: Electro-assembly 2 and ELT3010: Electro-assembly 3.</p> <p>Reference: <i>Modern Electronics</i> (Miller).</p> <p>AM, FM and Shortwave Frequency.</p> <p>The intent of this SO is to encourage students to develop a strong, analog communication fundamental knowledge base.</p>

**COURSE ELT3100: ANALOG COMMUNICATION 3 (continued)**

Concept	Specific Outcomes	Notes
Fundamentals (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• describe and measure signal frequency, wavelength and phase</li> <li>• apply the terms and formulas of basic AC to electrical signals</li> <li>• use basic terminology to describe signal power, calculate power gain and show how dB units are converted to voltage, current and power ratios</li> <li>• describe the general operating characteristics of oscillator circuits used to generate sine wave signals</li> <li>• define the concepts of frequency response—power versus frequency—for telephone and audio equipment</li> <li>• state the signal-to-noise ratios required for reliable communications within telephone and audio systems</li> <li>• specify the common forms of wave form distortion applied to signals that pass through electronic circuits</li> <li>• relate the concepts of harmonic distortion and frequency generation to telephone, audio and other telecommunication systems identify the operating characteristics of a complex stereo receiver from previous block diagrams</li> <li>• specify and identify the dial tone dual tone multifrequency (DTMF)</li> <li>• identify the operating principles of a basic electronic telephone set.</li> </ul>	<p>CAI packages may be appropriate at this level to cover all the topics.</p> <p>For students who require additional time or who delve into the material, link this course with a Career Transition course.</p> <p>Text: <i>Understanding Telephone Electronics</i> 3rd edition (Stephen J. Bigelow).</p>

**COURSE ELT3100: ANALOG COMMUNICATION 3 (continued)**

Concept	Specific Outcomes	Notes
<p>Designing and Prototyping</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• research and construct a communication project, incorporating some of the following:               <ul style="list-style-type: none"> <li>– diodes, rectifier, zener, tunnel, etc., (used in detection, clamping, filtering circuits)</li> <li>– bipolar transistors operation (used in three-basic transistor configurations)</li> </ul> </li> <li>• list circuit arrangements preferred for power amplification, voltage amplification, current amplification, polarity inversion, impedance matching, isolation and frequency operation</li> <li>• identify three basic field effect transistor (FET) circuit arrangements:               <ul style="list-style-type: none"> <li>– identify applications of unijunction transistors</li> </ul> </li> <li>• identify opto-electric devices used in communication analog electronic circuits</li> <li>• analyze simple inverting and non-inverting amplifiers using operational amplifiers</li> <li>• list the three general classes of feedback oscillators</li> <li>• calculate the frequency of common LC oscillators</li> <li>• explain the advantages, disadvantages and characteristics of amplitude modulation, SSB and frequency modulation</li> <li>• explain the operation of a basic amplitude modulator, balanced modulator, frequency modulator and AM and FM detectors.</li> </ul>	<p>A number of methods may be used:</p> <ul style="list-style-type: none"> <li>• traditional laboratories</li> <li>• textbooks, videos</li> <li>• computer-aided instruction</li> <li>• computer-aided trainers</li> <li>• computer-aided troubleshooting.</li> </ul> <p>(Using different methods would keep up student interest and motivation. Students who require additional time to complete this SO may link this course to a Career Transitions course.)</p> <p>Ideas for this SO can be obtained from the following reference:</p> <ul style="list-style-type: none"> <li>• <i>Incredible Audio and Video Projects You Can Build</i> (Rudolf F. Graf, William Sheets).</li> </ul> <p>Texts that may be used are <i>Ready To Build Telephone Enhancement</i> (Delton J. Horn).</p>

**COURSE ELT3100: ANALOG COMMUNICATION 3 (continued)**

Concept	Specific Outcomes	Notes
Fabricating/Testing	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• analyze one of the following according to project chosen and student interest:               <ul style="list-style-type: none"> <li>– measure input, output analog signals of various transducers</li> <li>– prototype and construct a simple transmitter and/or receiver using transistors and OP amps</li> <li>– prototype an infrared transmitter/receiver for analog transmission</li> <li>– develop, test and measure various signals as they pass through various analog filters</li> <li>– prototype of light wave code transmitters and receivers</li> <li>– prototype of simple diode receivers</li> <li>– construct a simple oscillator</li> <li>– develop an active filter using OP amps.</li> </ul> </li> </ul>	<p>References:</p> <p><i>Modern Electronic Communication</i> (Gary M. Miller), and Lab Manual, 4th edition (Mark Oliver).</p> <p><i>Communication Electronics</i>, Louis Frenzel.</p> <p><i>Activities Manual for Communication Electronics</i> (Louis E. Frenzel).</p>
Careers	<ul style="list-style-type: none"> <li>• research the differences in education, training and job function for electrical engineers, technologists and technicians</li> <li>• research various careers involved in communication electronics</li> <li>• research topics covered in a post-secondary institution that has an communication electronics program.</li> </ul>	<p>College, technical institution, apprenticeship. Calendars.</p>

