COURSE ELT3130: DATA/TELEMETRY SYSTEMS

Level: Advanced

Theme: Communication Systems

Prerequisite: None

Description: Students demonstrate the fundamentals of various data/telemetry systems, and demonstrate their applications to the real world.

Parameters: Multimeters (analog/digital), function generator, oscilloscope and related resources. Optional equipment: computers, satellite receiver, special trainer or simulators.

Supporting Courses: ELT3100 Analogue Communication 3
ELT2100 Radio Communication

Curriculum and Assessment Standards

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • distinguish the difference between analog and digital carriers with voice or data transmission	*Assessment of student achievement should be based on:* • explaining the differences between the following data/telemetry concepts: – analog link versus digital link – digital and data communication – pulse code modulations (PCM) and pulse amplitude signal (PAM) – frequency shift keying (FSK), phase shift keying (PSK) and quadrative amplitude modulation (QAM) – carrier and character synchronization – synchronous and asynchronous modems – scrambler and descrambler techniques – circuit message network and packet switching network. *Assessment Tool* *CTSPRE: Assessment Framework: Presentations/Reports* *Standard* *Performance rating of 3 for each applicable task*	20

COURSE ELT3130: DATA/TELEMETRY SYSTEMS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• explain data/telemetry communication through experimentation, circuit analysis and project work	• using advanced data/telemetry circuits, such as: – digital sampling unit – parity bit checker and detector – digital to analog (D/A) or analog to digital (A/D) converters – pulse-amplitude modulation – time division multiplexing • using computer simulation, experimental boards, CAI package or trainers to analyze the following data/telemetry concepts: – a function generator and observe how it can be used to encode digital information onto an FSK signal – an FSK decoder and observe how it can be used to convert a FSK signal back into a digital data – a PAM communication system that uses time division multiplexing – ongoing observed performance in the construction of an advanced data/telemetry project of student choice. *Assessment Tool* *ELTLAB–2: Assessment Checklist: Laboratory Practice, Parts 1 and 3* *Standard* *Performance rating of 3 for each applicable task*	55
• construct a voice or data transmission network	• constructing or installing one of the following data networks: – star – ring – multidrop • constructing or installing one of the following voice transmission networks: – simplex – half-duplex – full-duplex. *Assessment Tool* *ELTLAB–2: Assessment Checklist: Laboratory Practice, Part 2* *Standard* *Performance rating of 3 for each applicable task*	20

COURSE ELT3130: DATA/TELEMETRY SYSTEMS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• observe established laboratory procedures and safe work practices	• observed performance in following: – established laboratory procedures – demonstrated awareness of current and voltage levels in communication networks – proper handling of IC and other electronic components. *Assessment Tool* *ELTPSP: Assessment Checklist: Laboratory Procedures and Safety Practices* *Standard* *Performance rating of 3 for each applicable task*	5
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Outcomes	Notes
Safety/Resource Management	*The student should:* • identify voltage and current levels in communication networks • explain how to correctly handle IC and other electronic components • investigate the standards developed by EIA for electronic communication.	
Fundamentals	• define the following terms: – digital signal – duty cycle – sampling – coding – multiplexing – encoding – telemetry	

COURSE ELT3130: DATA/TELEMETRY SYSTEMS (continued)

Concept	Specific Outcomes	Notes
Fundamentals (continued)	*The student should:* – radio telemetry – converter – carrier – modulator – error detection – modem – analog link versus digital link • research the following networks: – star – ring – multidrop • describe the difference between the following communication systems: – simplex – half-duplex – full-duplex – full/full-duplex • explain the difference between digital and data communication • describe how a wave may be sampled • draw a block diagram of a radio-telemetry system and describe each part of the system • draw a block diagram and explain each part in the following transmission alternatives: – standard continuous modulation – telegraphy – pulse modulation – pulse code modulation • explain pulse code modulation (PCM) • sketch the wave form of a pulse amplitude signal (PAM) • explain why PCM is strictly the only true digital system of the four above • draw a block diagram of a computer data transmission system	Evolution of data transmission systems.

COURSE ELT3130: DATA/TELEMETRY SYSTEMS (continued)

Concept	Specific Outcomes	Notes
Fundamentals (continued)	*The student should:* • explain a universal asynchronous receiver/ transmitter (UART) device • describe the difference between the following forms of modulation by modems: – frequency shift keying (FSK) – phase shift keying (PSK) – quadrative amplitude modulation (QAM) • describe three types of synchronization that must be accomplished: – carrier – bit – character • explain how a modem transmits data if it were: – synchronous – asynchronous • explain line protocol • explain how error detection and correction is achieved in digital data communication • explain the difference between scramblers and descramblers • explain the difference in a network between circuit message and packet switching • explain frequency division multiplexing (FDM) in a modem • research the type of local area network (LAN) his or her school uses • list and explain the pin functions on an RS232C interface • list the two broad categories of pulse modulation • name the two types of analog pulse modulation • state the sampling Nyquist rate theorem • compare analog and digital pulse modulation. • construct a digital sampling unit (frequency counter)	Name the basic types of multiplexing and define each one.

COURSE ELT3130: DATA/TELEMETRY SYSTEMS (continued)

Concept	Specific Outcomes	Notes
Fabricating/Testing	*The student should:* • construct an error detector in data transmission—parity bit checker and detector • prototype, experiment with a basic D/A converter and A/D converter ICs • construct a simple circuit using a UART device • analyze a function generator and observe how it can be used to encode digital information onto an FSK signal • analyze an FSK decoder and observe how it can be used to convert an FSK signal back into a digital data • describe pulse-amplitude modulation techniques • test and evaluate a simple PAM modulator and demodulator • test and evaluate a PAM communication system that uses time division multiplexing • construct a simple circuit that uses analog data, convert it to digital pulses and reproduce at the output the original analog signal • install a modem and check operation • construct a project using a UART IC • install a network between several computers • research scrambling and descrambling techniques used by local cable companies • construct an elementary gated five-jack descrambler • prototype a sine-wave decoder • construct an advanced video project • construct a telephone scrambler.	*Miller's Laboratory Manual for Modern Electronic Communication.* *Communications Electronics*, 2nd edition (Louis E. Frenzel). This circuit is for experimental and education use only. For experimental and education use only.
Ethics	• report on political, legal and consumer aspects of cable TV descrambling/scrambling.	