COURSE ELT3090: MICROPROCESSOR INTERFACE

Level: Advanced

Theme: Computer Logic Systems

Prerequisite: ELT3080 Microprocessors

Description: Students demonstrate how to interface microprocessors/microcontrollers with real-world applications.

Parameters: Microprocessor trainer, interfacing trainer, with accompanying CAI package and related resources.

Supporting Course: ELT2080 Control Systems 2

Curriculum and Assessment Standards

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe microprocessor interface output and input circuits	*Assessment of student achievement should be based on:* • explaining the following – input/output circuits as they apply to microprocessors – the two main methods of I/O operation in microprocessors – a simplified microprocessor interface – the term "interrupt" – the difference between various interface devices – how to interface a D/A converter to a microprocessor system. *Assessment Tool* *ELT3090–1: Presentations/Reports: Microprocessor Interface* *Standard* *Performance rating of 3 for each applicable task*	10

COURSE ELT3090: MICROPROCESSOR INTERFACE (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• explain the operation of a serial interface device	• explaining the following: – an interface device and its relationship to data, control circuits and data direction registers – how serial data can be represented using both amplitude and frequency modulation techniques – the difference between asynchronous and synchronous serial data transmission – convert serial data to parallel and vice versa. *Assessment Tool* *ELT3090–1: Presentations/Reports: Microprocessor Interface* *Standard* *Performance rating of 3 for each applicable task*	10
• interface a digital-to-analog (D/A) and analog-to-digital (A/D) converter to a microprocessor	• constructing a student project that will be interfaced to a microprocessor, using D/A and A/D converter. *Assessment Tool* *ELTLAB–3: Assessment Checklist: Laboratory Practice, Parts 1 and 2* *Standard* *Performance rating of 3 for each applicable task*	40
• connect a microprocessor to a sensor device used in home, industrial and/or transportation applications	• locating, researching, experimenting or constructing a device to be connected to a microprocessor • writing a program to accept data and return data to a device, such as: – photo resistor – temperature and optical sensors – photo diodes and photo transistors – optocouplers – Hall effect devices – DC stepper motors	35

COURSE ELT3090: MICROPROCESSOR INTERFACE (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • constructing, connecting, interfacing and operating a microprocessor devices such as: – robots – weather stations – home environment systems – security systems – automotive – data transmission. *Assessment Tool* *ELTLAB–3: Assessment Checklist: Laboratory Practice, Part 2* *Standard* *Performance rating of 3 for each applicable task*	
• demonstrate established laboratory procedures and safe work practices	• observed performance in following: – established laboratory procedures – procedures indicating awareness of voltage/current transients. *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:* • describe voltage/current transients in real-world applications that connect to low voltage computers • safely interface computers to real-world applications.	Spikes, Surges, Static, Counter EMF.

COURSE ELT3090: MICROPROCESSOR INTERFACE (continued)

Concept	Specific Outcomes	Notes
Fundamentals	*The student should:* • describe the basic difference between system boards • outline the memory allocations in a typical microcomputer system using RAM, ROM, EPROM, EEROM and I/O • define input/output as they apply to microprocessors • state the two main methods of I/O operation in microprocessors • describe a simplified microprocessor interface device • define the term interrupt • explain the bus structure of a typical microprocessor system • explain three-state logic • draw a simplified block diagram of an interface device and explain the purpose of the data, control and data direction registers • write a simple program that will configure an interface device in any I/O combination • describe how serial data can be represented using both amplitude and frequency modulation techniques • explain the difference between asynchronous and synchronous serial data transmission • explain how to interface a ROM, EPROM or RAM • define the difference between a UART, BSRT and USART device • write and execute a program to convert serial data to parallel and parallel to serial.	A microprocessor trainer and interfacing application trainer may be used to complete these SOs. Several CAI packages are available that work through similar SOs.

COURSE ELT3090: MICROPROCESSOR INTERFACE (continued)

Concept	Specific Outcomes	Notes
Real-world Applications	*The student should:* • research/experiment with some of the following concepts that apply to microprocessors: – interface a D/A converter to a microprocessor system – describe how D/A converters are used to control the direction of rotation, speed and position of DC motors – define the function of a servo amplifier in a motor control circuit – describe and provide an example of a microprocessor-based industrial control system – construct a microprocessor-controlled thermometer – construction a microprocessor-controlled SCR or TRIAC circuit – explain how a microprocessor can control the effective current to a load using an SCR or TRIAC – state the advantages of using an opto-isolator in a microprocessor control circuit – design, construct and explain a microprocessor/stepper motor interface and control circuit – explain how a microprocessor is used to control exhaust emissions and fuel economy in an automobile – explain how microprocessors can be used to control a robot • list several consumer product applications of a microprocessor • explain how multiple microprocessors are used in advanced personal computer and business systems • describe several microprocessor applicators in the aviation and medical industries • explain several business applications of microprocessors including computers, word processors, copiers/printers, registers and inventory control.	

COURSE ELT3090: MICROPROCESSOR INTERFACE (continued)

Concept	Specific Outcomes	Notes
Designing and Prototyping	*The student should:* • construct, connect, interface and operate a microprocessor with devices such as: – photo resistive – temperature and optical sensors – photo diodes and photo transistors – optical interrupter and optical reflectors – optocouplers – Hall effect devices – DC motors • construct a project incorporating a microprocessor/microcontroller to control the operation; e.g.: – robots – weather stations – home environment systems – security systems – automotive applications – modems • construct a project using EPROM's memory and various interface devices.	Could be linked to ELT2010, ELT3010 and robotics for printed circuit.