Western Technical College

10660132 Digital Applications

Course Outcome Summary

Course Information

Description	A continuation of Digital Fundamentals - this course will explore applications of some of the concepts and components introduced previously and will add other components and their application. Some applications are: D/A and A/D conversion, shift registers, timing and counting. The 555 timer and concepts of astable and monostable operation will be presented along with concepts of timing and duty cycle.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	1
Total Hours	27

Pre/Corequisites

Pre/Corequisite 10660131 Digital Fundamentals

Textbooks

No textbook required.

Course Competencies

1. Analyze encoder/decoder and multiplexer/demultiplexer circuits.

Assessment Strategies

1.1. Written Objective Test
1.2. Skill Demonstration

Criteria

You will know you are successful when

1.1. you investigate pullup resistor applications on integrated circuits inputs and outputs.
1.2. you compare the operation of standard and priority encoder circuits.
1.3. you analyze the operation of a BCD to decimal encoder.
1.4. you calculate the required current limiting resistors for a 7-segment LED display.
1.5. you demonstrate the operation of a Tri-State Buffer.
1.6. you build encoder/decoder circuits with MultiSIM simulation software.
1.7. you troubleshoot encoder/decoder circuits.
1.8. you investigate the operation of multiplexer and demultiplexer integrated circuits.
1.9. you define the duty cycle of a digital input/output signal.
1.10. you build multiplexer and demultiplexer circuits with MultiSIM simulation software.

Learning Objectives

1.a. Investigate pullup resistor applications on integrated circuits inputs and outputs.
1.b. Compare the operation of standard and priority encoder circuits.
1.c. Analyze the operation of a BCD to decimal encoder.
1.d. Calculate the required current limiting resistors for a 7-segment LED display.
1.e. Demonstrate the operation of a Tri-State Buffer.
1.f. Build encoder/decoder circuits with MultiSIM simulation software.
1.g. Troubleshoot encoder/decoder circuits.
1.h. Investigate the operation of multiplexer and demultiplexer integrated circuits.
1.i. Define the duty cycle of a digital input/output signal.
1.j. Build multiplexer and demultiplexer circuits with MultiSIM simulation software.

2. Apply digital data memory applications with flip flops, shift registers and counter applications.

Assessment Strategies

2.1. Written Objective Test
2.2. Skill Demonstration

Criteria

You will know you are successful when

2.1. you investigate the operation of SR, D, and JK digital flip flop circuits.
2.2. you build flip flop circuits using MultiSIM circuit simulation software.
2.3. you compare serial to parallel and parallel to serial shift registers.
2.4. you build shift register circuits using MultiSIM circuit simulation software.
2.5. you troubleshoot shift register circuits.
2.6. you investigate digital counter applications.
2.7. you compare discrete flip flop and IC based counter circuit designs.
2.8. you build digital counter circuits using MultiSIM circuit simulation software.

Learning Objectives

2.a. Investigate the operation of SR, D and JK digital flip flop circuits.
2.b. Build flip flop circuits using MultiSIM circuit simulation software.
2.c. Compare serial to parallel and parallel to serial shift registers.
2.d. Build shift register circuits using MultiSIM circuit simulation software.
2.e. Troubleshoot shift register circuits.
2.f. Investigate digital counter applications.
2.g. Compare discrete flip flop and IC based counter circuit designs.
2.h. Build digital counter circuits using MultiSIM circuit simulation software.

3. Analyze astable and monostable multivibrator timing concepts.

Assessment Strategies

3.1. Written Objective Test
3.2. Skill Demonstration

Criteria

You will know you are successful when

3.1. you investigate the internal operation of the 555 timer IC.
3.2. you calculate circuit operating parameters of an astable 555 timer circuit.
3.3. you build a discrete component and IC based astable 555 timer circuit using MultiSIM circuit simulation software.

3.4. you calculate circuit operating parameters of a bistable 555 timer circuit.
3.5. you build a discrete component and IC based bistable 555 timer circuit using MultiSIM circuit simulation software.
3.6. you describe the term duty cycle as it applies to digital logic signals.

Learning Objectives

3.a. Investigate the internal operation of the 555 timer IC.
3.b. Calculate circuit operating parameters of an astable 555 timer circuit.
3.c. Build a discrete component and IC based astable 555 timer circuit using MultiSIM circuit simulation software.
3.d. Calculate circuit operating parameters of a bistable 555 timer circuit.
3.e. Build a discrete component and IC based bistable 555 timer circuit using MultiSIM circuit simulation software.
3.f. Review the term duty cycle as it applies to digital logic signals.

4. Demonstrate analog to digital and digital to analog conversion applications.

Assessment Strategies

4.1. Written Objective Test
4.2. Skill Demonstration

Criteria

You will know you are successful when

4.1. you investigate applications of A/D and D/A conversion circuits.
4.2. you describe the basic operation of an analog to digital converter.
4.3. you calculate the binary output of an analog to digital converter for various analog input values.
4.4. you build analog to digital converter circuits using MultiSIM circuit simulation software.
4.5. you describe the basic operation of a digital to analog converter.
4.6. you calculate the analog output of an digital to analog converter for various digital input values.
4.7. learner builds digital to analog converter circuits using MultiSIM circuit simulation software.
4.8. you define the term "Aliasing" as related to A/D and D/A conversion.
4.9. you describe filter concepts used to prevent aliased output signals of A/D - D/A conversion circuits.

Learning Objectives

4.a. Investigate applications of A/D and D/A conversion circuits.
4.b. Discuss the basic operation of an analog to digital converter.
4.c. Calculate the binary output of an analog to digital converter for various analog input values.
4.d. Build analog to digital converter circuits using MultiSIM circuit simulation software.
4.e. Discuss the basic operation of a digital to analog converter.
4.f. Calculate the analog output of an digital to analog converter for various digital input values.
4.g. Build digital to analog converter circuits using MultiSIM circuit simulation software.
4.h. Define the term "Aliasing" as related to A/D and D/A conversion.
4.i. Discuss filter concepts utilized to prevent aliased output signals of A/D - D/A conversion circuits.

5. Investigate TTL and CMOS logic family characteristics.

Assessment Strategies

5.1. Written Objective Test
5.2. Skill Demonstration

Criteria

You will know you are successful when

5.1. you investigate the internal component operation of a TTL inverter gate.
5.2. you explain why a floating input to a TTL logic gate is seen as a logical high input.
5.3. you build discrete component TTL inverter gates with MultiSIM circuit simulation software.
5.4. you describe the concepts of sinking and sourcing outputs as related to logic gates and general digital circuit applications.
5.5. you determine whether the output of a logic gate is sinking or sourcing output current for high and low output conditions.
5.6. you investigate the internal component operation of a CMOS inverter gate.
5.7. you build discrete component CMOS inverter gates with MultiSIM circuit simulation software.
5.8. you compare the basic operating characteristics of CMOS and TTL logic families.

5.9. you describe Schmitt Trigger output applications for digital logic devices.

Learning Objectives

5.a. Investigate the internal component operation of a TTL inverter gate.
5.b. Explain why a floating input to a TTL logic gate is seen as a logical high input.
5.c. Build discrete component TTL inverter gates with MultiSIM circuit simulation software.
5.d. Discuss the concepts of sinking and sourcing outputs as related to logic gates and general digital circuit applications.
5.e. Determine whether the output of a logic gate is sinking or sourcing output current for high and low output conditions.
5.f. Investigate the internal component operation of a CMOS inverter gate.
5.g. Build discrete component CMOS inverter gates with MultiSIM circuit simulation software.
5.h. Compare the basic operating characteristics of CMOS and TTL logic families.
5.i. Discuss Schmitt Trigger output applications for digital logic devices.