Lesson 3.4 – Programmable Logic Devices

**Concepts**

1.      A PLD is a digital IC capable of being programmed to provide specific logic functions.

2.      PLD family consists of a variety of device architectures and configurations.

3.      Most common PLDs are based on AND/OR logic gate arrays and are programmable with SOP expressions.

4.      PLDs can be programmed, erased and reprogrammed many times allowing easier design modifications.

5.      PLDs offer design flexibility, reduce board space and package count and can be used to develop digital designs more quickly than fixed –function logic.

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| **Performance Objectives** | **Standards** |
| Students will be able to design and implement combinational logic circuits using reprogrammable logic devices. | [Science 2.6](JavaScript:HHCTRL.TextPopup(S26,MyFont,9,9,-1,-1))  [Science 4.1](JavaScript:HHCTRL.TextPopup(S41,MyFont,9,9,-1,-1))  [Math 2.2](JavaScript:HHCTRL.TextPopup(M22,MyFont,9,9,-1,-1))  [Math 2.3](JavaScript:HHCTRL.TextPopup(M23,MyFont,9,9,-1,-1))  [Math 5.1](JavaScript:HHCTRL.TextPopup(M51,MyFont,9,9,-1,-1))  [Math 6.1](JavaScript:HHCTRL.TextPopup(M61,MyFont,9,9,-1,-1))  [Math 6.2](JavaScript:HHCTRL.TextPopup(M62,MyFont,9,9,-1,-1))  [Math 6.3](JavaScript:HHCTRL.TextPopup(M63,MyFont,9,9,-1,-1))  [Math 6.4](JavaScript:HHCTRL.TextPopup(M64,MyFont,9,9,-1,-1))  [Math 8.4](JavaScript:HHCTRL.TextPopup(M84,MyFont,9,9,-1,-1))  [Math 9.2](JavaScript:HHCTRL.TextPopup(M92,MyFont,9,9,-1,-1))  [Math 9.3](JavaScript:HHCTRL.TextPopup(M93,MyFont,9,9,-1,-1))  [Math 10.1](JavaScript:HHCTRL.TextPopup(M101,MyFont,9,9,-1,-1))  [Math 10.2](JavaScript:HHCTRL.TextPopup(M102,MyFont,9,9,-1,-1))  [Math 10.3](JavaScript:HHCTRL.TextPopup(M103,MyFont,9,9,-1,-1))  [Technology 1.3](JavaScript:HHCTRL.TextPopup(T13,MyFont,9,9,-1,-1))  [Technology 3.1](JavaScript:HHCTRL.TextPopup(T31,MyFont,9,9,-1,-1))  [Technology 3.3](JavaScript:HHCTRL.TextPopup(T33,MyFont,9,9,-1,-1))  [Technology 4.1](JavaScript:HHCTRL.TextPopup(T41,MyFont,9,9,-1,-1)) |
| Students will create PLD logic files that define combinational circuit designs using Boolean Expressions. | [Science 1.2](JavaScript:HHCTRL.TextPopup(S12,MyFont,9,9,-1,-1))  [Science 4.2](JavaScript:HHCTRL.TextPopup(S42,MyFont,9,9,-1,-1))  [Math 2.2](JavaScript:HHCTRL.TextPopup(M22,MyFont,9,9,-1,-1))  [Math 2.3](JavaScript:HHCTRL.TextPopup(M23,MyFont,9,9,-1,-1))  [Math 5.1](JavaScript:HHCTRL.TextPopup(M51,MyFont,9,9,-1,-1))  [Math 6.1](JavaScript:HHCTRL.TextPopup(M61,MyFont,9,9,-1,-1))  [Math 6.2](JavaScript:HHCTRL.TextPopup(M62,MyFont,9,9,-1,-1))  [Math 6.3](JavaScript:HHCTRL.TextPopup(M63,MyFont,9,9,-1,-1))  [Math 6.4](JavaScript:HHCTRL.TextPopup(M64,MyFont,9,9,-1,-1))  [Math 8.4](JavaScript:HHCTRL.TextPopup(M84,MyFont,9,9,-1,-1))  [Math 9.2](JavaScript:HHCTRL.TextPopup(M92,MyFont,9,9,-1,-1))  [Math 9.3](JavaScript:HHCTRL.TextPopup(M93,MyFont,9,9,-1,-1))  [Math 10.1](JavaScript:HHCTRL.TextPopup(M101,MyFont,9,9,-1,-1))  [Math 10.2](JavaScript:HHCTRL.TextPopup(M102,MyFont,9,9,-1,-1))  [Math 10.3](JavaScript:HHCTRL.TextPopup(M103,MyFont,9,9,-1,-1))  [Technology 1.3](JavaScript:HHCTRL.TextPopup(T13,MyFont,9,9,-1,-1))  [Technology 3.1](JavaScript:HHCTRL.TextPopup(T31,MyFont,9,9,-1,-1))  [Technology 3.3](JavaScript:HHCTRL.TextPopup(T33,MyFont,9,9,-1,-1))  [Technology 4.1](JavaScript:HHCTRL.TextPopup(T41,MyFont,9,9,-1,-1)) |
| Students will understand and use logic compiler software to create JEDEC files for programming PLDs. | [Science 4.2](JavaScript:HHCTRL.TextPopup(S42,MyFont,9,9,-1,-1))  [Science 5.6](JavaScript:HHCTRL.TextPopup(S56,MyFont,9,9,-1,-1))  [Math 2.2](JavaScript:HHCTRL.TextPopup(M22,MyFont,9,9,-1,-1))  [Math 2.3](JavaScript:HHCTRL.TextPopup(M23,MyFont,9,9,-1,-1))  [Math 5.1](JavaScript:HHCTRL.TextPopup(M51,MyFont,9,9,-1,-1))  [Math 6.1](JavaScript:HHCTRL.TextPopup(M61,MyFont,9,9,-1,-1))  [Math 6.2](JavaScript:HHCTRL.TextPopup(M62,MyFont,9,9,-1,-1))  [Math 6.3](JavaScript:HHCTRL.TextPopup(M63,MyFont,9,9,-1,-1))  [Math 6.4](JavaScript:HHCTRL.TextPopup(M64,MyFont,9,9,-1,-1))  [Math 8.4](JavaScript:HHCTRL.TextPopup(M84,MyFont,9,9,-1,-1))  [Math 9.2](JavaScript:HHCTRL.TextPopup(M92,MyFont,9,9,-1,-1))  [Math 9.3](JavaScript:HHCTRL.TextPopup(M93,MyFont,9,9,-1,-1))  [Math 10.1](JavaScript:HHCTRL.TextPopup(M101,MyFont,9,9,-1,-1))  [Math 10.2](JavaScript:HHCTRL.TextPopup(M102,MyFont,9,9,-1,-1))  [Math 10.3](JavaScript:HHCTRL.TextPopup(M103,MyFont,9,9,-1,-1))  [Technology 1.3](JavaScript:HHCTRL.TextPopup(T13,MyFont,9,9,-1,-1))  [Technology 3.1](JavaScript:HHCTRL.TextPopup(T31,MyFont,9,9,-1,-1))  [Technology 3.3](JavaScript:HHCTRL.TextPopup(T33,MyFont,9,9,-1,-1))  [Technology 4.1](JavaScript:HHCTRL.TextPopup(T41,MyFont,9,9,-1,-1)) |

**Anticipatory Set**

Teacher Demonstration:

Show the students a fully assembled, fully functional solution to the problem you developed for the Unit Anticipatory set using PLDs.

**Key Terms**

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| [Compile](JavaScript:HHCTRL.TextPopup(Compile,MyFont,9,9,-1,-1)) | [JEDEC](JavaScript:HHCTRL.TextPopup(JEDEC,MyFont,9,9,-1,-1)) | [PLD](JavaScript:HHCTRL.TextPopup(PLD,MyFont,9,9,-1,-1)) |
| [GAL](JavaScript:HHCTRL.TextPopup(GAL,MyFont,9,9,-1,-1)) | [PAL](JavaScript:HHCTRL.TextPopup(PAL,MyFont,9,9,-1,-1)) |  |

**Key Questions**

1.      What is a PLD and what are the advantages of using them?

**Activities**

Day 1:

         Teacher will present to the class, in either oral or written form, the Lesson Key Question.

         Teacher will present a lesson on PLDs.

         Students will start activity 3.4.1..

Day 2:

         Teacher will review Activity 3.4.1 with students.

         Students will begin Activity 3.4.2.

Day 3:

         Students will complete Activity 3.4.2, including breadboarding and testing the circuit.

Days 4 :

      Teacher will review Activity 3.4.2 with students to ensure understanding.

       Teacher will assignactivity 3.4.3 (Note to the teacher: The problems in Activity 5.3C are listed in order of difficulty – from easy to hard. It is not necessary that students do ALL the problems in the Activity, though they should do a range of levels of difficulty. Which problems students do is left for you to decide.)

Day 5-6:

* Students will work on Activity 3.4.4

**Resources**

PowerPoints

[Programmable Logic Devices](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\DE\Digital%20Curriculum%2006_07.chm::/Lesson%205_3--PLD's.ppt)

Word Documents

[Activity 3.4.1 – Introduction to PLDs](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\DE\Digital%20Curriculum%2006_07.chm::/Activity%205_3A%20Intro%20PLDs.doc)

[Activity 3.4.2 – A Basic Problem](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\DE\Digital%20Curriculum%2006_07.chm::/Activity%205_3B%20Basic%20Problem.doc)

[Activity 3.4.3 – Additional Problems](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\DE\Digital%20Curriculum%2006_07.chm::/Activity%205_3C%20Problems.doc)

[Activity 3.4.4 – PLD DesignProblems](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\DE\Digital%20Curriculum%2006_07.chm::/Activity%205_3C%20Problems.doc)