**LAB 3 PLAN AND RUBRIC**

**Date:** 24 April 2020

**Subject:** Computer Systems Design

**Topic:** Integration of programmable cores in computer system

**Objectives:**

* Students can implement embedded processor cores in computer system designs
* Students can integrate custom IP in computer system designs
* Students can integrate custom logic with embedded processor cores using system bus interface
* Students can build and implement embedded software for custom designs
* Students understand how to use Xilinx Vivado Design Suite to implement and debug processor-enabled designs

**PLANNING**

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| timing | activities | resources | aim of activity |
| 10 min | **Introduction.** Outline the lab. | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Prepare the students to the lab |
| 5 min | **Practice.** Understanding the task variant | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Understand the lab variant and discuss it with the instructors. |
| 20 min | **Practice.** Designing FPGA system with embedded processor core | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of adding programmable processor cores in computer system designs |
| 10 min | **Practice.** Implementation of FPGA design with embedded processor core | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of using Xilinx Vivado Design Suite to implement processor-enabled computer system design |
| According to the schedule | **Break** | | |
| 20 min | **Practice.** Developing custom software for embedded processor core | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of building embedded software using Vivado Design Suite |
| 5 min | **Practice.** Implementation and testing of FPGA design with custom software for embedded processor core | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of implementation of system with embedded software using Vivado Design Suite |
| 20 min | **Practice.** Checking the results   1. Demonstration of the results to the instructors 2. Getting questions from the instructors | - | Checking the students results and grading.  Giving the questions and the practical task for understanding. It is needed to evaluate the students results. |
| According to the schedule | **Break** | | |
| 20 min | **Practice.** Integration of pipelined implementation of custom hardware with embedded processor core using system bus interface | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of integration of hardware blocks using system bus interface |
| 15 min | **Practice.** Writing the software driver for custom hardware block | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of writing the software drivers for custom hardware blocks |
| 10 min | **Practice.** Uploading and debugging processor-enabled design with pipelined implementation of hardware design on FPGA board | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Developing the skill of uploading and debugging processor-enabled design with custom hardware blocks |
| According to the schedule | **Break** | | |
| 10 min | **Practice.** Integration of multi-cycle implementation of custom hardware with embedded processor core (auxiliary task) | Study guide  (The section with Lab3 Task and Lab 3 Guide) | Strengthening the skill of integration of hardware blocks using system bus interface |
| 20 min | **Evaluation.** Checking the task for understanding | - | Checking the task for understanding and grading |
| 15 min | **Conclusion part.** Summarization of the lab | Study guide  (The section with Lab 3) | Summarize the main points of the lab. Structuring of the given knowledge and trained skills. |

**RUBRIC**

The rubric of the lab is focused on the overall performance, and it enables overall judgement of the student work. The result grade is depended on the result of practice part, the answers on the questions about the obtained results and the results of the task for understanding given after practical part. For the lab the students can get maximum 10 points.

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| Grade, points | Description |
| 0-5 | Students have partially completed the practical task |
| 6 | Students have successfully completed the practical task |
| 8 | Students have successfully completed the practical task and correctly answered the questions |
| 10 | Students have successfully completed the practical task, correctly answered the questions and done the auxiliary task |