

COURSE PLAN AND EVALUATION PLAN

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| 1. Course Code: | EC806 | 2. Course Title: | DIGITAL DESIGN USING FPGAS |
| 3. L – T – P: | 2-0-3 | 4. Credits: | 4 |
| 5. Pre-requisite: | Digital Electronics | 6. Teaching Department: | Electronics & Communication Engg. |
| 7. Course Instructor: | Dr SUMAM DAVID S. | | |

8. Objectives of the Course:

At the end of the program the student must be able to

Design digital systems and model using HDL, given a set of specifications

Implement digital systems using FPGAs

9. Course Outcomes

CO1 Design simple digital systems given a set of specifications

CO2 Model digital systems using HDL given a set of specifications

CO3 Appreciate architecture of FPGAs and implement digital sub-systems using FPGAs

CO4 Design and Implement digital system using FPGAs for target application

10. Course Coverage:

Module	Contents	Objectives	Lecture/ Lab	Evaluation
Introduction	Introduction to DSD – Objectives of the course, motivation, course plan, evaluation method, references, Digital implementation options	<ul style="list-style-type: none"> • Appreciate the relevance of the course 	L1	
	Review of combinational and sequential design using SSI & MSI	<ul style="list-style-type: none"> • Review of Digital Electronics 	L2-L5	Design
Digital system modeling	Domains – behavioral, structural, physical, levels of abstraction, Synthesis – high level, RTL level , logic synthesis, Hardware description languages	<ul style="list-style-type: none"> • Appreciate top-down design methodology, need for HDL, and choose level of abstraction for modeling the system 	L6 – L7	Comprehension
Familiarisation to design environment	Introduction to digital system modelling using FPGA Design Environment	<ul style="list-style-type: none"> • Using design tools to describe a digital system using Verilog HDL, simulate its functionality, implement & test the design by downloading to FPGA 	P1	Design
Verilog	Modelling Combinational, Sequential, FSM, Design case studies, styles for synthesis, test benches,	<ul style="list-style-type: none"> • Model a digital system using Verilog HDL 	L8-L15	Design

Programmable ASICs	Architecture of CPLDs and FPGAs, Antifuse, SRAM, EEPROM based technologies, Xilinx, Altera and Actel logic cells, I/O cells, Programmable Interconnect, Dynamic Reconfiguration	<ul style="list-style-type: none"> Appreciate architecture of CPLDs and FPGAs, choose appropriate implementation option for the given specifications 	L16-L20	Analysis
Combinational circuit design	Design of decoders, priority encoders, multiplexers, multi-bit adders and comparators	<ul style="list-style-type: none"> Design, implement & test combinational circuits using FPGAs 	P2-4	Design
Sequential circuit design	Design of counters, shift registers, sequence detectors, implementation of state machines for applications like traffic light control, digital lock, vending machine etc.	<ul style="list-style-type: none"> Design, implement & test simple sequential circuits using FPGAs 	P5-7	Design
Verilog	Design examples	<ul style="list-style-type: none"> Model a digital system using Verilog HDL 	L21-27	Design
RTL Design	Design of arithmetic units (adders, multipliers, MAC unit, division, square root), memory units, simple uP	<ul style="list-style-type: none"> Design, implement and test on FPGAs 	P8-9	Design
Interfacing IO devices	Interfacing IO modules and peripheral devices to FPGA board	<ul style="list-style-type: none"> Design, & interface peripheral devices to the FPGA board 	P8-P9	Design
Embedded systems using FPGAs	Embedded system design concepts, Embedded cores on FPGAs, Issues in embedded system design using FPGAs	<ul style="list-style-type: none"> Appreciate issues in embedded system design using FPGAs 	L28-L32	Analysis
	Implementation of embedded systems on FPGA	<ul style="list-style-type: none"> Implement a simple embedded system on FPGA 	P10	Design
Implementing signal processing applications	Implementing digital filters on FPGA	<ul style="list-style-type: none"> Design and implement digital filters on FPGAs 	P11	Design
Design Project	Implementing a digital system using FPGA board	<ul style="list-style-type: none"> Use FPGA for a signal processing or embedded application 	P10-P14	Design

11. Course web page : Moodle on iris

12. Reference Books

<p>a) Ming Bo Lin, Digital System Designs and Practices using Verilog HDL and FPGAs, Wiley, 2008</p> <p>b) J. Bhaskar, A Verilog HDL Primer, BSP, 2008</p> <p>c) Brown and Vranesic, Fundamentals of Digital logic with Verilog Design, TMH, 2014</p> <p>d) M D Ciletti, Advanced Digital Design with Verilog HDL, Pearson, 2010</p>	<p>e) W.Wolf, FPGA based system design, Pearson, 2005</p> <p>f) Peter Ashenden, Digital Design, An embedded systems approach using Verilog, Elsevier, 2008</p> <p>g) Clive Maxfield, A design warrior's guide to FPGAs, Elsevier, 2004</p> <p>h) https://people.ece.cornell.edu/land/courses/ece5760/FinalProjects/</p>
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EVALUATION PLAN :

Mid semester exam - 20% Quiz & Lab assessment - 25% Design Project - 15 % End semester exam - 40%

Prepared by:

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Approved by

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