Course Syllabus
ECE 524L – FPGA/ASIC Design and Optimization Using VHDL Lab
Department of Electrical & Computer Engineering

1. Course Number and Name: ECE 524Lab – FPGA/ASIC Design and Optimization Using VHDL Lab

2. Credit Units/Contact Hours: 1/3

3. Course Coordinator: Ramin Roosta

4. Text, References & Software

Recommended Text:
1. Ramin Roosta, Shahnam Mirzaei lecture notes,"Xilinx and Actel FPGA architectures" , CSUN.
2. Taher Abbasi et al, "It is the methodology stupid"

Additional References:
1. Volnei A. Pedroni, Circuit Design with VHDL, MIT Press, 2004
2. James R. Armstrong, F. Gail Gary, VHDL Design Representation and Synthesis, Prentice Hall, 2000
3. Charles H. Roth, Digital Systems Design Using VHDL, PWS Publishing Company, 1998

Additional References:
4. Douglas J. Smith, HDL Chip Design, Doone Publications, 1996
5. Kevin Skahill, VHDL for Programmable Logic, Addison-Wesley, 1997

Software:
Xilinx Foundation ISE, Modelsim, Actel Libero, Mentor Graphics Design tools

5. Specific Course Information

a. Course Description

The lab accompanying the course (EE524) covers modeling of digital systems and electronic circuit design hierarchy and the role of methodology in FPGA/ASIC design. Hardware Description Language, VHDL, simulation, and synthesis tools are utilized to elaborate the material covered throughout the course. The lab introduces the systematic top-down design methodology to design complex digital hardware such as FPGAs and ASICs. FPGA and ASIC design flow as well as design optimization techniques are discussed. For FPGAs, Xilinx Virtex and Actel SX architecture are covered. Individual and group projects are assigned to students.

b. Prerequisite by Topic

Students must know conventional techniques in designing digital logic circuits. They must be familiar with a programmable logic devices and their implementation. They are required to know how to use VHDL in design description and Maxplus II software in design simulation and verification (ECE420). Students required to be taking the lecture with the lab (ECE524).

c. Elective Course

Ece Syllabus Vhdl Design Lab Manual

Stephen D. Brown,Zvonko G. Vranesic

Ece Syllabus Vhdl Design Lab Manual:

Science Abstracts ,1995   *Digital Electronics Lab Manual with Vhdl* Scott Stewart,2004-11-30   **Programming Digital Applications W/Able, Vhdl-Lab Manual** Han-Way Huang,2006-07   VHDL for Logic Synthesis Andrew Rushton,1998-07-07 VHDL for Logic Synthesis Second Edition Andrew Rushton TransEDA Limited Southampton UK Very high speed integrated circuit Hardware Description Language VHDL is the worldwide standard for computer aided electronic system design Logic synthesis automates gate level design allowing the designer to concentrate on a rgister transfer level implementation VHDL for Logic Synthesis provides comprehensive coverage of the language and its role in the generation of hardware This enhanced second edition takes a broader view of the use of synthesis and its place in the design cycle Features include Explanation of each aspect of the language in hardware terms and demonstration of the mapping from VHDL to hardware Updated examples using the standard packages numeric_std and std_logic_1164 plus more illustrative models offering further source references for designers Additional chapter on std_logic_arith to aid designers still working with this popular package New focus on libraries and library management covering the contents of the standard library how to use library work and recommendations on code management Extra section detailing how to use assertions to report diagnostics allowing the reader to print signal and variable values to the screen Senior undergraduate and postgraduate students of microelectronics and digital hardware engineers new to language based design methods will appreciate Rushton s informative introduction to VHDL and its use in logic synthesis   *Digital Logic Simulation and CPLD Programming with VHDL* Steve Waterman,2003 For freshman level courses in Introduction to Digital Electronics sophomore level courses in Introduction to Microprocessors and other middle upper level courses in Digital Electronics This lab manual written around software and hardware developments of the past ten years focuses on the fundamentals of digital electronics and use of Max Plus II software by Altera Corporation Lab sequences start with digital gates and logic control circuits progress to MSI devices latches and flip flops and cover clock dependent circuits and LPM_MEGA functions available in the software

Circuit Design and Simulation with VHDL, second edition Volnei A. Pedroni,2010-09-17 A presentation of circuit synthesis and circuit simulation using VHDL including VHDL 2008 with an emphasis on design examples and laboratory exercises This text offers a comprehensive treatment of VHDL and its applications to the design and simulation of real industry standard circuits It focuses on the use of VHDL rather than solely on the language showing why and how certain types of circuits are inferred from the language constructs and how any of the four simulation categories can be implemented It makes a rigorous distinction between VHDL for synthesis and VHDL for simulation The VHDL codes in all design examples are complete and circuit diagrams physical synthesis in FPGAs simulation results and explanatory comments are included with the designs The text reviews fundamental concepts of digital electronics and design and includes a series of appendixes that offer tutorials on important design tools including ISE Quartus II and ModelSim as well as descriptions of programmable

logic devices in which the designs are implemented the DE2 development board standard VHDL packages and other features All four VHDL editions 1987 1993 2002 and 2008 are covered This expanded second edition is the first textbook on VHDL to include a detailed analysis of circuit simulation with VHDL testbenches in all four categories nonautomated fully automated functional and timing simulations accompanied by complete practical examples Chapters 1 9 have been updated with new design examples and new details on such topics as data types and code statements Chapter 10 is entirely new and deals exclusively with simulation Chapters 11 17 are also entirely new presenting extended and advanced designs with theoretical and practical coverage of serial data communications circuits video circuits and other topics There are many more illustrations and the exercises have been updated and their number more than doubled **The Designer's Guide to VHDL** Peter J. Ashenden,2002 Since the publication of the first edition of The Designer s Guide to VHDL in 1996 digital electronic systems have increased exponentially in their complexity product lifetimes have dramatically shrunk and reliability requirements have shot through the roof As a result more and more designers have turned to VHDL to help them dramatically improve productivity as well as the quality of their designs VHDL the IEEE standard hardware description language for describing digital electronic systems allows engineers to describe the structure and specify the function of a digital system as well as simulate and test it before manufacturing In addition designers use VHDL to synthesize a more detailed structure of the design freeing them to concentrate on more strategic design decisions and reduce time to market Adopted by designers around the world the VHDL family of standards have recently been revised to address a range of issues including portability across synthesis tools This best selling comprehensive tutorial for the language and authoritative reference on its use in hardware design at all levels from system to gates has been revised to reflect the new IEEE standard VHDL 2001 Peter Ashenden a member of the IEEE VHDL standards committee presents the entire description language and builds a modeling methodology based on successful software engineering techniques Reviewers on Amazon com have consistently rated the first edition with five stars This second edition updates the first retaining the authors unique ability to teach this complex subject to a broad audience of students and practicing professionals *The Student's Guide to VHDL* Peter J. Ashenden,2008-07-01 The Student s Guide to VHDL is a condensed edition of The Designer s Guide to VHDL the most widely used textbook on VHDL for digital system modeling The Student s Guide is targeted as a supplemental reference book for computer organization and digital design courses Since publication of the first edition of The Student s Guide the IEEE VHDL and related standards have been revised The Designer s Guide has been revised to reflect the changes so it is appropriate that The Student s Guide also be revised In The Student s Guide to VHDL 2nd Edition we have included a design case study illustrating an FPGA based design flow The aim is to show how VHDL modeling fits into a design flow starting from high level design and proceeding through detailed design and verification synthesis FPGA place and route and final timing verification Inclusion of the case study helps to better serve the educational market Currently most college courses do

not formally address the details of design flow Students may be given informal guidance on how to proceed with lab projects In many cases it is left to students to work it out for themselves The case study in The Student s Guide provides a reference design flow that can be adapted to a variety of lab projects *Circuit Design with VHDL, third edition* Volnei A. Pedroni,2020-04-14 A completely updated and expanded comprehensive treatment of VHDL and its applications to the design and simulation of real industry standard circuits This comprehensive treatment of VHDL and its applications to the design and simulation of real industry standard circuits has been completely updated and expanded for the third edition New features include all VHDL 2008 constructs an extensive review of digital circuits RTL analysis and an unequaled collection of VHDL examples and exercises The book focuses on the use of VHDL rather than solely on the language with an emphasis on design examples and laboratory exercises The third edition begins with a detailed review of digital circuits combinatorial sequential state machines and FPGAs thus providing a self contained single reference for the teaching of digital circuit design with VHDL In its coverage of VHDL 2008 it makes a clear distinction between VHDL for synthesis and VHDL for simulation The text offers complete VHDL codes in examples as well as simulation results and comments The significantly expanded examples and exercises include many not previously published with multiple physical demonstrations meant to inspire and motivate students The book is suitable for undergraduate and graduate students in VHDL and digital circuit design and can be used as a professional reference for VHDL practitioners It can also serve as a text for digital VLSI in house or academic courses *PLD Based Design with VHDL* Vaibbhav Taraate,2017-01-13 This book covers basic fundamentals of logic design and advanced RTL design concepts using VHDL The book is organized to describe both simple and complex RTL design scenarios using VHDL It gives practical information on the issues in ASIC prototyping using FPGAs design challenges and how to overcome practical issues and concerns It describes how to write an efficient RTL code using VHDL and how to improve the design performance The design guidelines by using VHDL are also explained with the practical examples in this book The book also covers the ALTERA and XILINX FPGA architecture and the design flow for the PLDs The contents of this book will be useful to students researchers and professionals working in hardware design and optimization The book can also be used as a text for graduate and professional development courses **ECE 311 and ECE 316 Lab Manual** Wayne M. Hope,1999 <u>VHDL Programming Fundamentals</u> Prasun Barua, VHDL Programming Fundamentals is a comprehensive guide designed for both beginners and intermediate learners who wish to learn the art of hardware description and digital design using VHDL VHSIC Hardware Description Language This book provides a structured and in depth approach to understanding the core concepts and advanced techniques used in VHDL programming Throughout this book you will learn how to write efficient reusable and scalable VHDL code for a wide range of digital systems From basic syntax and data types to advanced features like generics configurations assertions and testbenches each chapter is packed with clear explanations practical examples and exercises that will reinforce your understanding Key Features Clear and Concise Explanations Each

concept is explained in detail with examples making it easy to understand and apply Hands on Examples The book includes real world examples to help you develop a strong practical understanding of VHDL programming Exercises with Solutions At the end of each chapter you will find exercises to test your knowledge with solutions provided to guide your learning Advanced Topics Learn advanced VHDL features such as parameterized designs error checking with assertions and writing robust testbenches for functional verification Whether you are a student new to digital design or a professional looking to refine your VHDL skills VHDL Programming Fundamentals is the essential resource for developing your expertise in hardware design By the end of this book you will be well equipped to design complex digital systems and implement them using VHDL **The Designer's Guide to VHDL** Peter J. Ashenden,2010-10-07 VHDL the IEEE standard hardware description language for describing digital electronic systems has recently been revised The Designer s Guide to VHDL has become a standard in the industry for learning the features of VHDL and using it to verify hardware designs This third edition is the first comprehensive book on the market to address the new features of VHDL 2008 First comprehensive book on VHDL to incorporate all new features of VHDL 2008 the latest release of the VHDL standard Helps readers get up to speed quickly with new features of the new standard Presents a structured guide to the modeling facilities offered by VHDL Shows how VHDL functions to help design digital systems Includes extensive case studies and source code used to develop testbenches and case study examples Helps readers gain maximum facility with VHDL for design of digital systems **The System Designer's Guide to VHDL-AMS** Peter J. Ashenden,Gregory D. Peterson,Darrell A. Teegarden,2002-09-10 The demand is exploding for complete integrated systems that sense process manipulate and control complex entities such as sound images text motion and environmental conditions These systems from hand held devices to automotive sub systems to aerospace vehicles employ electronics to manage and adapt to a world that is predominantly neither digital nor electronic To respond to this design challenge the industry has developed and standardized VHDL AMS a unified design language for modeling digital analog mixed signal and mixed technology systems VHDL AMS extends VHDL to bring the successful HDL modeling methodology of digital electronic systems design to these new design disciplines Gregory Peterson and Darrell Teegarden join best selling author Peter Ashenden in teaching designers how to use VHDL AMS to model these complex systems This comprehensive tutorial and reference provides detailed descriptions of both the syntax and semantics of the language and of successful modeling techniques It assumes no previous knowledge of VHDL but instead teaches VHDL and VHDL AMS in an integrated fashion just as it would be used by designers of these complex integrated systems Explores the design of an electric powered unmanned aerial vehicle system UAV in five separate case studies to illustrate mixed signal mixed technology power systems communication systems and full system modeling **Digital System Design Using VHDL** Rishabh Anand,2023 The book covers the complete syllabus of subject as suggested by most of the universities in India Generic VHDL code is taught and used through out the book so that different companies VHDL tools can be used if

desired Moving from the unknown in a logical manner Subject matter in each chapter develops systematically from inceptions Large number of carefully selected worked examples in sufficient details No other reference is required Ideally suited for self study   Introduction to VHDL ,1997   **Fundamentals of Digital Logic with VHDL Design** Stephen D. Brown,Zvonko G. Vranesic,2023 Fundamentals of Digital Logic with VHDL Design 4th Edition is intended for an introductory course in digital logic design which is a basic course in most electrical and computer engineering programs A successful designer of digital logic circuits needs a good understanding of basic concepts and a firm grasp of computer aided design CAD tools   **Introduction to VHDL** R.D. Hunter,T. T. Johnson,1996 Covers all aspects of the VHDL language   **Digital Design** M. Morris R. Mano,Michael D. Ciletti,2017-02-27 For introductory courses on digital design in an Electrical Engineering Computer Engineering or Computer Science department A clear and accessible approach to the basic tools concepts and applications of digital design A modern update to a classic authoritative text Digital Design 5th Edition teaches the fundamental concepts of digital design in a clear accessible manner The text presents the basic tools for the design of digital circuits and provides procedures suitable for a variety of digital applications Like the previous editions this edition of Digital Design supports a multimodal approach to learning with a focus on digital design regardless of language Recognizing that three public domain languages Verilog VHDL and SystemVerilog all play a role in design flows for today s digital devices the 5th Edition offers parallel tracks of presentation of multiple languages but allows concentration on a single chosen language   **IEEE Standard VHDL** IEEE. Computer society. Design automation technical committee,1988

The book delves into Ece Syllabus Vhdl Design Lab Manual. Ece Syllabus Vhdl Design Lab Manual is a vital topic that must be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Ece Syllabus Vhdl Design Lab Manual, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:

    - Chapter 1: Introduction to Ece Syllabus Vhdl Design Lab Manual
    - Chapter 2: Essential Elements of Ece Syllabus Vhdl Design Lab Manual
    - Chapter 3: Ece Syllabus Vhdl Design Lab Manual in Everyday Life
    - Chapter 4: Ece Syllabus Vhdl Design Lab Manual in Specific Contexts
    - Chapter 5: Conclusion

2. In chapter 1, the author will provide an overview of Ece Syllabus Vhdl Design Lab Manual. This chapter will explore what Ece Syllabus Vhdl Design Lab Manual is, why Ece Syllabus Vhdl Design Lab Manual is vital, and how to effectively learn about Ece Syllabus Vhdl Design Lab Manual.
3. In chapter 2, the author will delve into the foundational concepts of Ece Syllabus Vhdl Design Lab Manual. The second chapter will elucidate the essential principles that must be understood to grasp Ece Syllabus Vhdl Design Lab Manual in its entirety.
4. In chapter 3, the author will examine the practical applications of Ece Syllabus Vhdl Design Lab Manual in daily life. The third chapter will showcase real-world examples of how Ece Syllabus Vhdl Design Lab Manual can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Ece Syllabus Vhdl Design Lab Manual in specific contexts. This chapter will explore how Ece Syllabus Vhdl Design Lab Manual is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, the author will draw a conclusion about Ece Syllabus Vhdl Design Lab Manual. This chapter will summarize the key points that have been discussed throughout the book.
   The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Ece Syllabus Vhdl Design Lab Manual.

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Ece Syllabus Vhdl Design Lab Manual Introduction

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