


**COURSE SYLLABUS  
(ELECTRICAL & ELECTRONICS ENGINEERING PROGRAM)**

<b>FACULTY OF ENGINEERING</b> DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING UNIVERSITI PERTAHANAN NASIONAL MALAYSIA  <b>NAME DAN COURSE CODE :</b> DIGITAL SYSTEM DESIGN, EEE 2243		<b>M/S : 1 / 6</b>
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<b>Lecture Hours</b> : 3 hrs x 14 weeks <b>Credit</b> : 3  <b>LECTURER:</b> MUHAZAM BIN MUSTAPHA Bistari 08-R-16   muhazam@upnm.edu.my	<b>Revision</b> : A  <b>Date of Issue</b> : 1 February 2011  <b>Last Amendment</b> : -  <b>Edition</b> : 1  <b>Procedure No</b> : PK(0).UPNM.AKAD.01
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**PRE REQUISITE : EEE 1213**

**SYNOPSIS:**


This course will cover the principles of digital system design. It builds on logic design principles learned in earlier course, digital electronics. This course demonstrates how digital design and rapid prototyping have been facilitated by FPGAs and hardware description languages. The content of this course includes Combinational and Sequential Logic, Finite State Machine, Register Transfer Level (RTL) design, design flow, high level design, hardware design language, FPGAs and some advanced topics in HDL.

**REFERENCES :**

1. Frank Vahid, *Digital Design*, John Wiley, 2007
2. Stephen Brown & Zvonko Vranesic, *Fundamental of Digital Logic with Verilog Design*, 3<sup>rd</sup> Edition, McGraw Hill, 2009
3. John F. Wakerly, *Digital Design Principles and Practice*, 3<sup>rd</sup> Edition, Prentice Hall, 2000
4. Mohamed Khalil Mohd Hani, *Stater's Guide to Digital System VHDL and Verilog Design*, 2<sup>nd</sup> Edition, Pearson Prentice Hall, 2009
5. Roth & John, *Digital System Design using VHDL*, 2<sup>nd</sup> Edition, Mason Thomson, 2007

Prepared by :  Name: <b>Muhazam Mustapha</b>  Signature :  Date :	Certified by :  Name: <b>Nik Ghazali Nik Daud</b> Head of Department  Signature :  Date :
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**OBJECTIVE:**

This course is to prepare the students with the ability to design digital circuit at high level view, i.e. using an HDL. They are to be given case studies and design assignments to be done at such high level approach. Some basic experience of rapid prototype design will also be given as FPGA design including the skill of report writing.


**COURSE OUTCOME :**

<b>CO1</b>	Able to analyze and design a digital system at HDL and RTL level with Verilog
<b>CO2</b>	Have sound awareness about currently available technology in digital system design
<b>CO3</b>	Have sufficient understanding about digital system problems and the solution, and able to explain them

**LESSON PLAN :**


WEEK	LECTURE	TOPIC / CONTENT	REMARK
1 - 2	1	<b>Combinational Logic Recap:</b> Boolean algebra, truth table, canonical forms, FPGA circuits	
3	2	<b>Sequential Logic Recap:</b> Flip-flops, trigger modes, clocking modes, timing diagram, setup and hold time, set and reset, brief idea on FSM	
4	3	<b>Verilog Combinational:</b> Need for HDL, Verilog kick start, constant, operators, boolean algebra style approach, behavioral style approach, Quartus II demos on half-adder	
MID SEMESTER BREAK			
5	4	<b>Verilog Sequential:</b> Finite state machines, controller design process, demos on oscillators, bouncer, counter, boolean algebra and behavioral style	Quiz 1
6	5	<b>Simple Design Case Studies:</b> multiplexer, decoder, Flight attendant call button, Secure car key, sequence generator	Assignment 1 Commencement
7 – 8	6	<b>Datapath Component:</b> Verilog structured style approach, registers, adder, comparator, shifter, counter, timer, multiplier, subtractor, ALU, register file	Quiz 2
9 – 10	7	<b>RTL Design:</b> High level state machines, RTL design process, examples	Quiz 3 Assignment 2 Commencement
11	8	<b>Advanced Design Considerations:</b> Timing consideration: static & dynamic timing, flop-based design, setup & hold, design window Power consideration: why low power, types of power, dynamic power, short-circuit power, glitch power, leakage power, temperature, static power, power reduction strategies	Quiz 4
12	9	<b>Advanced Topics – Physical Implementation:</b> Types of ICs, FPGA, 74 series, PLD, ASIC	Quiz 5
13	10	<b>Advanced Topics – Programmable Controller:</b> Programmable Controller: basic architecture, 3 and 6 instruction processor, assembly language	Test Covers up to Chapter 8
14		<b>Revision:</b>	
<b>FINAL EXAMINATION (50 %)</b>			
<b>FINAL BREAK SEMESTER 1</b>			

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<b>LEARNING LOAD</b>		
<b>NO</b>	<b>TEACHING AND LEARNING ACTIVITIES</b>	<b>HOURS</b>
1	Lectures and Tutorials	42
2	Individual & Group Assignments: <ul style="list-style-type: none"> <li>• Assignment assessment and answering problems</li> </ul>	30
3	Individual / Group Learning: <ul style="list-style-type: none"> <li>• Preparation before lectures including reading modules and notes</li> <li>• Preparation after lectures includes updating notes, reading additional references, discussion with peers and lecturers</li> <li>• Revision for test and final exam</li> </ul>	43
4	Test	2
5	Final Exam	3
<b>TOTAL HOURS</b>		<b>120</b>
Course Credit 'Digital System Design' 120 hours / 40 hours = 3 credit		
<b>METHODOLOGY :</b>		
Lectures and tutorials		
<b>COURSE EVALUATION :</b>		
1.	Quizzes 1-5	10 %
2.	Assignment 1 & 2	20 %
3.	Test	20 %
4.	Final Exam	50%
<b>Total</b>		<b>100%</b>
<b>Rules &amp; Regulation :</b>		
Refer to <i>Peraturan Akademik UPNM</i>		

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**RELATIONSHIP BETWEEN PROGRAMME OUTCOME (PO)  
With COURSE LEARNING OUTCOME (CO)**

No	COURSE OUTCOME (CO)	Relationship Between C.O and P.O. (Includes 8 domains in MQF)									Delivery	Assessment
		P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9		
CO1	Able to analyze and design a digital system at HDL and RTL level with Verilog	3		3							Lecture, Tutorial	Test / assignment / exam
CO2	Have sound awareness about currently available technology in digital system design				3						Lecture, Tutorial	Test / Quiz / exam
CO3	Have sufficient understanding about digital system problems and the solution, and able to explain them				3						Lecture, Tutorial	Test / Quiz / exam


**RELATIONSHIP BETWEEN (CO) AND GENERIC / SOFT SKILLS**

Generic / Soft Skill	C O 1	C O 2	C O 3	Evaluation
Communication				
Critical Thinking & Problem Solving	3	3	3	Test / assignment / exam
Team Work				
Life-long Learning & Information Management	1	1	1	Test / assignment / exam
Entrepreneurship				
Ethics & Professional Morale				
Leadership				
Environmental Awareness				

**Legend:**

- 1: Knowledge
- 2: Moderate
- 3: Important/Relevant


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**EXAMPLES OF EVALUATION (RUBRIK) :**

COURSE OUTCOME (CO)	A (5)	B (4)	C (3)	D (2)	E (1)
Understand the engineering profession as well as the interaction between various engineering disciplines.	Solve problems with less than 20% error	Solve problems with less than 35% error	Solve problems with less than 50% error	Solve problems with more than 60% error	Solve problems with more than 70% error
Understand the engineering fundamentals & elements.	Solve problems with less than 20% error	Solve problems with less than 35% error	Solve problems with less than 50% error	Solve problems with more than 60% error	Solve problems with more than 70% error
Understand the procedure for approaching an engineering problem, determining the necessary data and method of solution and presenting results.	Solve problems with less than 20% error	Solve problems with less than 35% error	Solve problems with less than 50% error	Solve problems with more than 60% error	Solve problems with more than 70% error
Enhance the ability to use software application for the analysis and presentation of engineering data.	Solve problems with less than 20% error	Solve problems with less than 35% error	Solve problems with less than 50% error	Solve problems with more than 60% error	Solve problems with more than 70% error

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**NOTE: PROGRAMME OUTCOME (PO) FOR DEFENCE HUMAN RESOURCE MANAGEMENT**

MQF has established that Outcome Based Learning emphasizes the development on student's competency in multiple learning environments using the following 8 domains:

- i. Knowledge
- ii. Practical
- iii. Leadership
- iv. Ethics and Professionalism
- v. Environment Awareness
- vi. Entrepreneurship
- vii. Communication
- viii. Life-long Learning

<b>PO1</b>	Be able to integrate and design systems and components systematically to fulfill the requirements while taking into considerations of any economical, social, ethical, health, safety and sustainability and environmental issues in Electrical & Electronic Engineering.
<b>PO2</b>	Be able to use and gather facts in mathematics and sciences, and also in fundamental and specific knowledge in solving complex engineering problems.
<b>PO3</b>	Be able to analyze complex problems, to include designing experiments, analysis and interpretation of data and synthesizing information in arriving to sound conclusion.
<b>PO4</b>	Realize the need of lifelong learning, seeking new knowledge and skills, and innovative knowledge analysis.
<b>PO5</b>	Be able to establish cultural and personality sensitivity climates that enable effective communications and improve interactions with subordinates, team members, peers, and general public.
<b>PO6</b>	Be able to demonstrate the understanding of their roles and responsibilities, as leaders or team members in protecting public well being by taking collaborative actions in multi-disciplined teams.
<b>PO7</b>	Possess strong spiritual values and decorum, act ethically and demonstrating sensitiveness towards safety and the environment in executing duties.
<b>PO8</b>	Be able to demonstrate the understanding of the elements in project management, assets management and public policies, administrations, business and entrepreneurship.
<b>PO9</b>	Be able to demonstrate the understanding about military organizations, equipment, and current issues.

END