SYLLABUS

1. **Course name:** Digital Systems Lab
2. **Course code:** PRDI320263
3. **Credits: 2** (0/6/12)
   Duration: 15 weeks (90h main course and 180h self-study)
4. **Instructors:**
   1- Nguyen Truong Duy, MEng
   2- Hà A Thổi, Eng
   3- Nguyen Duy Thao, MEng
   4- Phạm Tỷ Phú, MEng
   5- Vo Duc Dung, MEng
5. **Course conditions**
   Prerequisites: Digital Systems
   Corequisites: N/A
6. **Course description**

This course instructs students how to use devices and practise digital electronic circuits on them such as logic gates, Flip-Flops, counters, shift registers, combinational and sequential circuits, memory, DAC, ADC. In addition, the students learn how to work in groups, use datasheets in English, write weekly reports and pre-preparation.

7. **Course Goals**

Goals	***Goal description*** *(This course provides students:)*	**ELOs**
G1	Basic knowledge and assembly techniques of digital electronic circuits.	01 (M)
G2	An ability to analyze and test assembly of digital electronic circuits.	02 (H)
G3	An ability to use the tools of modern technology to perform the exercises	03 (H)
G4	An ability to read materials of digital ICs in English.	05 (M)
G5	An ability to use digital theory and procedures to solve practical exercises	07 (L)
G6	An ability to calculate, design and perform digital electronic circuits.	11 (H)

*** Note: High: H; Medium: M; Low: L**

8. **Course Learning Outcomes (CLOs)**

CLOs		***Description*** *(After completing this course, students can have:)*	**Outcome**
	G1.1	An ability of using the digital kits and circuits assembly on them.	01
	G1.2	Understanding symbols, logic functions, truth tables of logic gates and Flip-Flops.	01

G2	G2.1	An ability of analyzing and rectifying circuit errors during the circuit assembly of logic gates and Flip-Flops.	02
	G2.2	An ability of analyzing and rectifying circuit errors during the circuit assembly of digital ICs combined with logic gates and Flip-Flops.	02
	G3.1	Simulation of combinational logic, sequential, DAC and ADC circuits using Proteus software.	03
	G3.2	Simulation of EPROM applications using Proteus and related software.	03
G4	G4.1	An ability of using datasheets of digital ICs.	05
G5	G5.1	Understanding steps to work out combinational logic and sequential circuits	07
	G6.1	Understanding how to design and assembly of combinational logic and sequential circuits.	11
	G6.2	An ability of circuit design and applications of digital ICs (4017, 74164, 74194, 7490, 74247, 74192, 74151, 4040, 4020, …)	11
	G6.3	Designs of circuits using ICs such as memory, DAC and ADC.	11

9. Study materials

- Textbooks:

[1] Nguyen Đinh Phu, Nguyen Truong Duy *Giao trinh thuc hanh ky thuat so*, ĐH SPKT, 2016.

- References:

[2] Nguyen Huu Phuong, *Mach so*, NXB thống kê, 2004.

[3] Ronald J. Tocci, *Digital systems,* tenth edition, Prentice Hall, 2010

[4] Digital ICs datasheets.

10. Student Assessments

- Grading points: 10

- Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Excercises					**20**
Excercise 01	Read the IC-4027 datasheet and design MOD counters using IC-4027	Week 2	Homework	G1.2 G4.1 G5.1 G6.1	4
Excercise 02	Design the circuits of shift register, IC-74LS164	Week 4	Homework	G3.1 G4.1 G6.2	4
Excercise 03	Design of the minute counters with BCD counter using IC-74LS90.	Week 6	Homework	G3.1 G6.2	4
Excercise 04	Design of the up/down counters using IC-74LS192	Week 8	Homework	G3.1 G6.2	4
Excercise	Design of the MOD counters using	Week 10	Homework	G3.1	4

05	4040 and 4020 ICs.			G6.2	
Exams					**50**
Exam 01	Design and assembly circuits on digital kits, as required.	Week 5	Digital kit	G1.1 G1.2 G2.1 G5.1 G6.1	20
Exam 02	Design and assembly circuits on the digital kits, as required.	Week 10	Digital kit	G1.2 G2.2 G6.2	20
eEam 03	Simulation of EPROM, ADC and DAC circuits using PC.	Week 13	Computer	G3.1 G3.2 G6.3	10
Final exam					**30**
Final Exam	Design and assembly circuits on the digital kits, as required.	Week 15	Digital kit	G1.1 G1.2 G2.2 G5.1 G6.2	

11. Course details:

Weeks	Contents	CLOs
	Chapter 1: **< HOW TO USE THE DIGITAL KITS>** *(0/3/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 1.1 Introduction of digital kits. 1.2 Test methods of digital kit modules **Teaching methods**: + Traditional lectures + Tutorials and sample manipulation	G1.1
	B/ **Self-study contents**: *(6)* + Review the basic knowledge about digital systems	G1.2
	Chapter 2: **< LOGIC GATES AND APPLICATION CIRCUITS >** *(0/3/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 2.1 Tested the logic gates 2.2 The oscillator circuits using logic gates **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G2.1 G6.1
	B/ **Self-study contents**: *(6)* + Design of the control circuits of automatic doors	G5.1 G6.1

	+ Design of the control circuits of staircase light. + Prepare the next lessons	
	Chapter 3: **< FLIP-FLOPS AND APPLICATION CIRCUITS >** *(0/6/12)*	
	A/ **Contents and teaching methods***:(6)* **Contents:** 3.1 SR latch circuits 3.2 JK Flip-Flop 74LS112 3.3 Design and assembly test of the asynchronous counters 3.4 Design and assembly test of the synchronous counters 3.5 Shift registers and ring counters using D Flip-Flop 3.6 Flip-Flop conversion circuits **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G1.2 G2.1 G5.1 G6.1
	B/ **Self- study contents**: *(12)* + Design of synchronous BCD up/down counter + Prepare the next lessons	G3.1 G5.1 G6.1
	Chapter 4: **< RING COUNTER >** *(0/6/12)*	
	A/ **Contents and teaching methods***: (6)* **Contents:** 4.1 Assembly test the Jonhson counters using 4017 ICs 4.2 N states counter 4.3 IC 4017 application circuits **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G2.2 G4.1 G6.2
	B/ **Self- study contents**: *(12)* + Design of traffic light control circuit using the 4017 and logic gate ICs + Prepare the next lessons	G5.1 G6.2
	Chapter 5: **< SHIFT REGISTERS >** *(0/12/24)*	
	A/ **Contents and teaching methods***: (12)* **Contents:** 5.1 Assembly test shift registers using 74LS164 ICs 5.2 Application circuits using 74LS164 ICs 5.3 Assembly test multi-funtion shift registers using 74LS194 ICs 5.2 Application circuits using 74LS194 ICs **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation **Test 1**	G2.2 G3.1 G4.1 G6.2

	***B/* Self- study contents**: *(24)* + Design of shifting circuits on 16 single leds in two modes: 1 led on 2 led off interleaved shift, 2 led on 1 led off interleaved shift. Use the 1 button to swich between the tow modes.	G6.2
	***Chapter 6* < COUNTERS>** *(0/6/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 6.1 Assembly test BCD counters using 74LS90 ICs 6.2 Assembly test MOD 12 counters using 74LS92 ICs 6.3 Assembly test binary counters using 74LS93 ICs **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G2.2 G4.1 G6.2
	***B/* Self- study contents**: *(12)* + Design of minute and hour counters for digital clock	G6.2
	***Chapter 7:* < BCD-TO-SEVEN-SEGMENT DECODERS/DRIVERS>** *(0/6/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 7.1 Assembly test BCD to 7 segment decoders/drivers for common Anode display use 74LS247 ICs 7.2 Assembly test BCD to 7 segment decoders/drivers for common Cathode display use 4511 ICs 7.3 BCD counter circuits with 7 segment led display and button control of run/stop. **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G2.2 G4.1
	***B/* Self- study contents**: *(12)* + Design of BCD counter with three 7-segment led display and delete 0 meaningless digits.	G6.2
	***Chapter 8:* < SYNCHRONOUS UP/DOWN DECADE COUNTER >** *(0/6/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 8.1 Assembly test 74LS192 (40192) ICs 8.2 Application circuits using 74LS192 ICs **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G2.2 G4.1 G6.2
	***B/* Self- study contents**: *(12)* + Analysis of the operation of product counting circuits	G2.2
	***Chapter 9:* < ADDER, COPARATOR, AND ENCODER >** *(0/12/24)*	

9, 10	***A/* Contents and teaching methods***: (12)* **Contents:** 9.1 Assembly test 4 BIT binary adder using 74LS283 ICs 9.2 Assembly test 4 BIT comparator using 74LS85 ICs 9.3 Assembly test 10-to-4-lines encoder using 74LS148 ICs 9.4 Design of application circuits. **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation **Test 2**	G2.2 G4.1 G6.1
	***B/* Self- study contents**: *(24)* + Design of binary subtractor and multiplier.	G6.1
	***Chapter 10* < MULTIPLEXER, BINARY COUNTER AND DECODER >** *(0/6/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 10.1 Assembly test 8-chanel multiplexer using 74LS151 ICs 10.2 Assembly test 12 BIT binary counters and design MOD counters using 4040 ICs. 10.3 Assembly test 14 BIT binary counters and design MOD counters using 4020 ICs. 10.4 Assembly test 14 Stage Counter/Devider and Oscillator using 4060 ICs 10.5 Assembly test BCD counters using 4518 ICs 10.6 Assembly test 3-to-8-lines decoder using 74LS138 ICs 10.7 Assembly test 2-to-4-lines decoder using 74LS139 ICs **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G2.2 G4.1 G6.2
	***B/* Self- study contents**: *(12)* + Design of multi-frequencies oscillator with button selection of frequency output. + Complete the questions and prepare the next contents.	G6.2
	***Chapter 11:* < MEMORYS >** *(0/12/24)*	
	A/* Contents and teaching methods: (12)* **Contents:** 11.1 Assembly test EEPROM memory using 28C64 ICs 11.2 Assembly test RAM memory using 6264 ICs 11.3 Simulation of EPROM applications on the computer. **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation **Test 3**	G3.2 G6.3

	***B/* Self- study contents**: *(24)* + Used computer simulation EPROM to scan 7-segment led and matrix led.	G6.3
	***Chapter 12:* < DIGITAL OSCILLATORS AND TIMERS >** *(0/6/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 12.1 Assembly test the timer using 74LS123 ICs 12.2 Assembly test the NE555 ICs 12.3 Design and assembly test the oscillator and timer using NE555 ICs. **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G4.1 G6.2
	***B/* Self- study contents**: *(12)* + Design of 1Hz pulse generator circuits using NE555 ICs	G6.2
	***Chapter 13:* < DIGITAL ANALOG CONVERSION >** *(0/6/12)*	
	A/* Contents and teaching methods: (6)* **Contents:** 13.1 Assembly test ADC converter using 0809 ICs 13.2 Assembly test DAC converter using 0808 ICs 13.3 Simulation of ADC and DAC applications on the computer **Teaching methods**: + Theoretical lectures + Tutorials and sample manipulation	G3.1 G4.1
	***B/* Self- study contents**: *(12)* + Design of temperature measurement circuits with 7-segment display.	G6.3

1. Learning ethics:

- Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get zero point

2. First approved date: August 01 2012

3. Approval level:

Dean **Department** **Instructor**

4. Syllabus updated process

1st time: Updated content dated	Instructors

2st time: Updated content dated	Head of department