UNIVERSIDAD AUTÓNOMA DE BAJA CALIFORNIA

COORDINACIÓN GENERAL DE FORMACIÓN BÁSICA
COORDINACIÓN GENERAL DE FORMACIÓN PROFESIONAL Y VINCULACIÓN UNIVERSITARIA
PROGRAMA DE UNIDAD DE APRENDIZAJE

I. IDENTIFICATION INFORMATION

1. **Academic Unit**: Faculty of Engineering, Architecture and Design, Ensenada
2. **Study Program(s)**: Nanotechnology Engineer
3. **Plan Duration**: 2019-2
4. **Name of Learning Unit**: Digital Electronics for Nanotechnology
5. **Code**: 33555
6. HC: 01 HL: 02 HT: 03 HPC: 00 HCL: 00 HE: 01 CR: 07
7. **Learning stage to which it belongs**: Disciplinary
8. **Character of Learning Unit**: Obligatory
9. **Requirements for enrollment in learning unit**: None

UNIVERSIDAD AUTÓNOMA DE BAJA CALIFORNIA
REGISTRADO
09 NOV 2018
REGISTRADO
COORDINACIÓN GENERAL DE FORMACIÓN BÁSICA

PUA Formulated by: Signature

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UNIVERSIDAD AUTÓNOMA DE BAJA CALIFORNIA
FACULTAD DE INGENIERÍA, ARQUITECTURA Y DISEÑO ENSENADA, B.C.

Date: September 4, 2018

II. GENERAL PURPOSE OF THE COURSE

The purpose of the Digital Electronics learning unit is for the student to use digital design for the development of nanotechnological devices. Its usefulness is that it trains the student in the area of digital electronics to make digital systems that are interconnected to nanotechnological products, with responsibility, dedication and companionship. Regarding its characteristics, it is taught in the disciplinary stage, it is mandatory, it belongs to the area of knowledge of the Sciences of Engineering, its prerequisite is none.

III. COURSE COMPETENCIES

Integrate a digital system, through the use of digital electronics design techniques, to connect it to a nanotechnological product that meets a preset need, with dedication, responsibility and companionship.

IV. EVIDENCE OF PERFORMANCE

Portfolio of evidence that contains the manual of practices correctly filled and the technical report of the digital system.

Functional digital system connected to a nanotechnological product that meets a preset need.

V. DEVELOPMENT BY UNITS

UNIT I.- Numerical systems, numerical and logical operations.

Competency: Identify the types of numerical bases, by means of the principles of the procedures and the rules of the numerical systems, to solve numerical and logical operations, with dedication, responsibility and companionship.

Content: **Duration:** 2 hours

1.1. Number systems.
1.2. Numerical operations.
1.3. Logical operations.

UNIT II.- Transistors and integrated circuits.

Competency: Determine the types of transistors, their operation and connectivity in integrated circuits, through the analysis of the criteria of digital electronics, to explain the operating principles of transistors as binary switches, interconnect them and use integrated circuits, with dedication, responsibility and fellowship.

Content: **Duration:** 2 hours

2.1. Transistors.
2.2. Transistor configurations.
2.3. Transistor connectivity and its analysis.
2.4. Integrated circuits.
2.5. Analysis of the interconnection of the integrated.

UNIT III. - Combination and sequential systems, storage, input and output.

Competency: Describe the functioning of combinatorial and sequential systems, through the criteria of digital electronics, to understand the connection of storage devices, entry and exit, with dedication, responsibility and companionship.

Content: **Duration:** 8 hours

3.1. Combinatorial systems.
- 3.1.1. Analysis of combinatorial systems.
- 3.1.2. Design of combinatorial systems.

3.2. Sequential systems.
- 3.2.1. Types of sequential systems.
- 3.2.2. Analysis of sequential systems.
- 3.2.3. Design of sequential systems.

3.3. Storage devices.
- 3.3.1. Classification of storage devices by their access to information.
- 3.3.2. Types of storage devices for the duration of the information.
- 3.3.3. Technology of storage devices.

3.4. Input and output devices.
- 3.4.1. Digital input and output.
- 3.4.2. Analog input and output.
- 3.4.3. Other input and output devices.

UNIT IV. - Processors.

Competency: Define the stages and functionality of a processor and the types of programming, with the criteria of the technology of processors, for the connection to a nanotechnological device, with dedication, responsibility and companionship.

Content: **Duration:** 4 hours

4.1. Types of processors.
4.2. Parts of the processors and their operation.
4.3. Basic programming of the processor.
4.4. Technological trends of processors.

VI. STRUCTURE OF PRACTICES				
Practice No.	**Proficiency**	**Description**	**Support materials**	**Time**
UNITY I	**Numerical systems, numerical and logical operations.**			
1	Resolve changes of numerical bases in numerical and logical operations, with the application of the criteria of the numerical systems, to execute digital operations, with dedication, responsibility and companionship.	Change numbers to different bases: decimal, binary, hexadecimal. Perform numerical and logical operations in binary.	Exercises for changing numerical bases. Exercises for numerical and logical oppression. Class documents, specialized databases and the internet. Videos. Computer. Projection cannon.	6
UNITY II	**Transistors and integrated circuits.**			
2	Calculate the components of the transistor and its interconnection, with the criteria of digital electronics, to make the transistors behave as binary switches, interconnect them and use integrated circuits, with dedication, responsibility and companionship.	Calculate the components so that the transistor behaves as a binary switch. Calculate the interconnection of transistors as switches. Calculate the connectivity of integrated circuits.	Transistor data sheets. Data sheets of integrated circuits. Class documents, specialized databases and the internet. Videos. Computer. Projection cannon.	6
UNITY III	**Combination and sequential systems, storage, input and output.**			

3	Design combinatorial and sequential systems, through the design criteria of digital electronics, to connect them to storage devices, entry and exit, with dedication, responsibility and companionship.	Design combinatorial and sequential systems. Describe the operation and connection of the storage devices, input and output.	Integrated circuits data sheets that are applied in combinatorial and sequential systems. Data sheets of storage devices, input and output. Class documents, specialized databases and the internet. Videos. Computer. Projection cannon.	24
UNITY IV	**Processors.**			
4	Draw the diagram to connect a nanotechnological device to a processor, by applying the connectivity criteria of digital electronics, to program it according to a pre-established need, with dedication, responsibility and companionship.	Elaborate the connectivity diagram of a processor to a nanotechnological device. Perform the flow diagram of the processor program. Prepare the technical report of the digital system.	Processor data sheets. Characteristics of the nanotechnological device. Digital diagram design programs. Programs of design of flow diagrams. Class documents, specialized databases and the internet. Videos. Computer. Projection cannon.	12

VI. STRUCTURE OF LABORATORY PRACTICES				
Practice No.	**Proficiency**	**Description**	**Support materials**	**Time**
UNITY I	**Numerical systems, numerical and logical operations.**			
1	Wiring circuits that change bases, numerical and logical operations, with the application of the criteria of the numerical systems and the interconnection of circuits, for the solution of digital operations, with dedication, responsibility and teamwork.	In digital practice manual: 1. Change numbers to different bases: decimal, binary, hexadecimal. 2. Perform the numerical and logical operations. 3. Fill the required. Wiring the circuits to make base changes, numerical and logical operations in binary.	Manual of digital practices. Protoboard Digital circuits that change base. Digital circuits of arithmetic and logic operations. LEDs Resistances Microswitch Wire. Power supply. Multimeter. Computer. Projection cannon.	4
UNITY II	**Transistors and integrated circuits.**			
2	Connect components to the transistor and interconnect them, with the criteria of digital electronics, to check the calculations of the components of the transistors and behave as binary switches, interconnect them and use integrated circuits, with dedication, responsibility and companionship.	In practice manual perform the calculations of the components so that the transistor behaves as a binary switch. Wiring a transistor with its components to work as a binary switch. In the practice manual, elaborate the calculations of the interconnection of transistors as switches. Wiring several transistors as switches. Fill the integrated circuits connectivity calculation section in the practice manual. Wiring several integrated circuits and that their operation is	Manual of digital practices. Transistor data sheets. Data sheets of integrated circuits. Protoboard Transistors Integrated circuits. Resistances LEDs Microswitch Wire. Power supply. Multimeter. Computer. Projection cannon.	4

		according to the calculated.		
UNITY III	**Combination and sequential systems, storage, input and output.**			
3	Wire combinatorial and sequential systems, when applying the criteria of digital electronics design, to store binary data and can enter and exit digital systems, with dedication, responsibility and companionship.	With the manual of practices design combinatorial and sequential systems. Wire the combinatorial and sequential systems designed. Review the data sheets of storage devices, input and output. Connect the storage devices, input and output, prove their correct operation. Interconnect the combinatorial and sequential systems to the storage, input and output devices.	Manual of digital practices. Data sheets of integrated circuits for combinatorial and sequential systems. Data sheets of storage devices, input and output. Integrated circuits for combinatorial and sequential systems. Storage devices, input and output. Protoboard Resistances LEDs Microswitch Wire. Power supply. Multimeter. Computer. Projection cannon.	16
UNITY IV	**Processors.**			
4	Connecting a nanotechnological device to a processor with its respective programming, from a design, so that it meets a pre-established need, with dedication, responsibility and companionship.	Connect a processor to a nanotechnological device. Schedule the processor. Test its operation. Document the practice manual. Prepare the technical report of the digital system.	Processor data sheets. Software to program the processor. Characteristics of the nanotechnological device. The processor Nanotechnological device Protoboard Resistances Wire. Power supply. Multimeter. Computer.	8

			Projection cannon.	

VII. WORK METHOD

Framing: The first day of class the teacher must establish the work form, evaluation criteria, quality of academic work, rights and obligations teacher-student.

Teaching activities:
To expose the characteristics of the devices to work and to ask the students of the informative searches of the subject.
Direct the design of the digital systems in the workshops and supervise the correct interconnection of the circuits in the laboratory to avoid damaging them and to function correctly.
Review the completion of the practice manual.
Review the progress of the technical report.

Students activities:
Revisar las características de los dispositivos a trabajar y complementar con búsquedas informativas del tema.
En los talleres diseñar de los sistemas digitales y conectarlos correctamente en el laboratorio para evitar dañarlos y que funcionen correctamente.
Llenar del manual de prácticas.
Elaborar el reporte técnico.

VIII. EVALUATION CRITERIA

The evaluation will be carried out permanently during the development of the learning unit as follows:

Accreditation criterion

- 80% attendance to have the right to ordinary exam and 70% attendance to be entitled to extraordinary examination according to the School Statute articles 70 and 71.
- Scaled from 0 to 100, with a minimum approval of 60.

Evaluation Criterion

Partial exams 3

- 3 exams 30%
- Evidence of performance: Practical manual and technical report..... 40%
- Evidence of performance: Functional digital system connected to a nanotechnological producto……. 30%

Total……...……..……...100%

IX. BIBLIOGRAPHY

Required	Suggested
Baldo M. (2010). Introduction to Nanoelectronics. MIT OpenCourseWarw Publication. USA. Obtenido de http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-701-introduction-to-nanoelectronics-spring-2010/readings/MIT6_701S10_notes.pdf Chamorro G. M. (2008). Planteamiento de una metodología de análisis de dispositivos electrónicos mediante nanotecnología (tesis). Obtenido de http://bibdigital.epn.edu.ec/bitstream/15000/1093/1/CD-1935.pdf González G. (2017). Electrónica digital. España: Marcombo. Hermosa A. (2010). Electrónica digital fundamental y programable. España: Marcombo. Tokheim R. L. (2014). Digital electronics: principles and applications (8 ed). Estados Unidos: McGraw Hill. Vázquez J. (2017). Circuitos lógicos digitales. España: Marcombo.	Julían P. (2015). Circuitos integrados digitales CMOS. España: Marcombo. Mandano E. y Martín J. L. (2015). Sistemas electrónicos digitales. España: Marcombo.

IX. PROFESSOR PROFILE

The teacher preferably having a graduate degree in electronics, computer science, mechatronics or related to the learning unit. The teaching experience consists of having taught subjects related to the learning unit. The qualities are tolerant, empathetic, prudent.