



**A) COURSE**

| Course Id: | Course           |
|------------|------------------|
| 5715       | HW-SW INTERFACES |

| Class Hours per Week | Lab hours per week | Complementary practices | Credits | Total hour course |
|----------------------|--------------------|-------------------------|---------|-------------------|
| 3                    | 2                  | 3                       | 8       | 48                |

**B) GENERAL COURSE INFORMATION:**

|  | EE<br>(IEA) | ME<br>(IM) | MME<br>(IMA) | EME<br>(IME) | MTE<br>(IMT)     |
|--|-------------|------------|--------------|--------------|------------------|
| <b>Level:</b>                              |             |            |              |              | VIII             |
| <b>Course Type<br/>(Required/Elective)</b> |             |            |              |              | Required         |
| <b>Prerequisite<br/>Course:</b>            |             |            |              |              | Microcontrollers |
| <b>CACEI<br/>Classification:</b>           |             |            |              |              | IA               |

**C) COURSE OBJECTIVE**

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|---|
| <b>At the end of the course, the student will be capable of:</b>  |
| The student will manage models and simulation of physical variables of interest in transducers and drivers for various purposes of monitoring and control of systems. |

**D) TOPICS (CONTENTS AND METHODOLOGY)**

|                                     |   |                |
|-------------------------------------|---|----------------|
| Introduction to Interfaces          |   | <b>2 Hours</b> |
| Specific Objective:                 | <b>Students will learn the importance of technology interfaces and basic terminology.</b>   |                |
|                                     | <ul style="list-style-type: none"> <li>1.1 Analog and Digital signals</li> <li>1.2 Signal acquisition</li> <li>1.3 Signal processing: Scale, Standardization and Filters</li> </ul> |                |
| <b>Readings and other resources</b> | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646  |                |
| <b>Teaching Methodologies</b>       | Programming examples  |                |
| <b>Learning Activities</b>          | Construction of physical interphases  |                |
| 2. Data Acquisition Systems         |   | <b>4 Hours</b> |



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|--|--|
| <b>Specific Objective:</b>   | Students will learn the various elements of acquisition and transmission of analog and digital data, and forms operation.              |
| 2.1 Introduction to acquisition systems<br>2.2 Transmission of signals by voltage<br>2.3 Transmission of signals by current<br>2.4 Sample and hold process<br>2.5 A / D, D / A, V / F and F / V converters |  |
| <b>Readings and other resources</b>  | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646 |
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| <b>Learning Activities</b>   | Construction of physical interphases   |

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| 3. Parallel Interfaces   |  | <b>4 Hours</b> |
| <b>Specific Objective:</b>   | Understanding how the transfer is made and digitized information received by parallel communication.                                   |                |
| 3.1 Ports of a PC computer<br>3.2 Centronics Parallel Interface<br>3.3 Parallel port registers<br>3.4 Configuration of parallel port |  |                |
| <b>Readings and other resources</b>  | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646 |                |
| <b>Teaching Methodologies</b>  | Programming examples   |                |
| <b>Learning Activities</b>   | Construction of physical interphases   |                |

|                            |   |                |
|----------------------------|---|----------------|
| 4. RS-232 serial interface |   | <b>8 Hours</b> |
| <b>Specific Objective:</b> | The student will understand how it performs serial communication, known formats transmission and develop standardized protocols and applications that use basic serial interfaces |                |



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|--|--|
| 4.1 Introduction to serial digital communication<br>4.2 Protocols<br>4.3 UART and USART Systems<br>4.4 Coupling with MAX 232<br>4.5 Programming<br>4.6 Applications<br>4.7 Communication PC-microcontrollers |  |
| <b>Readings and other resources</b>  | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646 |
| <b>Teaching Methodologies</b>  | Programming examples   |
| <b>Learning Activities</b>   | Construction of physical interphases   |

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| <b>5. USB Interfaces</b>  |  | <b>14 Hours</b> |
| <b>Specific Objective:</b>  | Students will develop basic serial interfaces using the USB interface.   |                 |
| 5.1 Introduction to USB<br>5.2 Basis for USB transfer<br>5.3 Types of transfers<br>5.4 Enumeration<br>5.5 Control Transfers<br>5.6 Devices for USB 5.6 interfaces<br>5.7 Host Communication<br>5.8 Device detection |  |                 |
| <b>Readings and other resources</b>   | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646 |                 |
| <b>Teaching Methodologies</b>   | Programming examples   |                 |
| <b>Learning Activities</b>  | Construction of physical interphases   |                 |

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|---|--|----------------|
| <b>6. Design of an acquisition card</b> |  | <b>8 Hours</b> |
| <b>Specific Objective:</b>              | You will meet the criteria in the design of a data acquisition board compute through a practical example |                |



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|--|--|
| 6.1 Requirements Definition            |  |
| 6.2 Communication with computer        |  |
| 6.3 Design of digital inputs / outputs |  |
| 6.4 Design of analog inputs / outputs  |  |
| 6.5 Design of software acquisition     |  |
| <b>Readings and other resources</b>    | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646 |
| <b>Teaching Methodologies</b>          | Programming examples   |
| <b>Learning Activities</b>             | Construction of physical interphases   |

|                                     |  |                |
|-------------------------------------|--|----------------|
| <b>7. Industrial Interfaces</b>     |  | <b>8 Hours</b> |
| <b>Specific Objective:</b>          | Protocols and industrial serial communication formats are analyzed in order to have an overview of the same                            |                |
| 7.1 Transmission standard RS485     |  |                |
| 7.2 Current Loop                    |  |                |
| 7.3 Codes of digital data           |  |                |
| 7.4 HART transmitter                |  |                |
| 7.5 Communication Standard IEEE-488 |  |                |
| 7.6 GPIB                            |  |                |
| <b>Readings and other resources</b> | Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos<br>Dieck Assad, Graciano<br>Ed. Trillas, 2000<br>ISBN 9682460646 |                |
| <b>Teaching Methodologies</b>       | Programming examples   |                |
| <b>Learning Activities</b>          | Construction of physical interphases   |                |

**E) TEACHING AND LEARNING METHODOLOGIES**

- a) Topics Explanations.
- b) Program writing
- c) Making of projects

**F) EVALUATION CRITERIA:**

| Evaluation: | Schedule   | Suggested Form of Evaluation and weighing | Topics        |
|-------------|------------|---|---------------|
| 1st Term    | Session 16 | Exam 85%, Homework 15%,                   | Units 1 and 2 |
| 2nd Term    | Session 32 | Exam 85%, Homework 15%,                   | Units 2 and 3 |



|                     |                       |   |                |
|---------------------|-----------------------|---|----------------|
|                     |                       |   |                |
| 3rd Term            | Session 48            | Exam 85%, Homework 15%,                   | Units 3 and 4  |
| Final evaluation    |                       | 100% (Average of the partial evaluations) |                |
| Other activity:     |                       |   |                |
| Extraordinary exam  | According to schedule | 100% Exam                                 | 100% of topics |
| Title exam          | According to schedule | 100% Exam                                 | 100% of topics |
| Regularization exam | According to schedule | 100% Exam                                 | 100% of topics |

### G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

#### Main Books

Instrumentación, Acondicionamiento Electrónico y Adquisición de Datos  
Dieck Assad, Graciano  
Ed. Trillas, 2000  
ISBN 9682460646



Universidad Autónoma de San Luis Potosí  
College of Engineering  
Mechanical and Electrical Department  
Analytical Program

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Parallel Port Complete  
Axelson, Jan  
Lakeview Research, 1997  
ISBN 0-9650819-1-5

USB Complete, 4<sup>th</sup> Edition  
Axelson, Jan  
Lakeview Research, 2009  
ISBN 978-1931448086

Serial Port Complete, 2<sup>nd</sup> Edition  
Axelson, Jan  
Lakeview Research, 2007  
ISBN 978-1931448062

Universal Serial Bus Specification, ver 2.0  
Compaq Computer Corporation, Hewlett-Packard Company,  
Intel Corporation, Lucent Technologies Inc, Microsoft Corporation,  
NEC Corporation, Koninklijke Philips Electronics N.V.  
USB Implementers Forum, Inc., 2007

#### **Complementary Books**

**Internet Links**  
<http://www.usb.org>