

Polytechnic Institute of Coimbra (P COIMBRA 02) Coimbra Institute of Engineering - ISEC Mathematics and Physics Department

ECTS CATALOGUE

The main language of instruction at Coimbra Institute of Engineering is Portuguese. The Biomedical Instrumentation Master is taught in Portuguese Language with tutorial support in English (support in English from the teachers out of the classes' hours).

This ECTS catalogue includes subject' contents in English Language. However, this doesn't mean that classes are taught in English. Students can choose subjects from this Catalogue to the study plan proposal (Learning Agreement) to be analyzed carefully by the Departmental Coordinators and to be adjusted, after student's arrival, if necessary.

This ECTS catalogue contains information which is valid for this academic year. ISEC reserves the right to adjust the courses offered during the academic year and is not responsible for typing errors or printing mistakes.

Prof. Luís Castro International Relations Office Coordinator

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Polytechnic Institute of Coimbra (P COIMBRA 02) Coimbra Institute of Engineering - ISEC Mathematics and Physics Department

ECTS CATALOGUE

# **MASTER Biomedical Instrumentation**

| Old<br>Code | New<br>Code | Title - Portuguese   | Title - English   | ECTS | Term   |
|-------------|-------------|--|---|------|--------|
|             |             | 1.º ano / 1 <sup>st</sup> Year                               |   |      |        |
| 664801      | 60013188    | Análise de Dados Biomédicos                                  | Analysis of Biomedical Data                               | 6    | Winter |
| 664802      | 60013199    | Modelos de Apoio à Decisão e ao Diagnóstico                  | Decision Support and Diagnosis Models                     | 6    | Winter |
| 664803      | 60013200    | Instrumentação Ótica para Diagnóstico e Terapêutica          | Optical Instrumentation for Diagnostic and<br>Therapeutic | 6    | Winter |
| 664804      | 60013211    | Aquisição de Dados e Instrumentação Virtual                  | Data Acquisition and Virtual Instrumentation              | 6    | Winter |
| 664805      | 60013222    | Redes de Comunicação em Biomedicina                          | Communication networks in Biomedicine                     | 6    | Winter |
| 664806      | 60013233    | Dosimetria e Proteção das Radiações                          | Radiation Protection and Dosimetry                        | 7    | Spring |
| 664807      | 60013244    | Sistemas de Apoio à Vida                                     | Life Support Systems                                      | 7    | Spring |
| 664808      | 61000324    | Robótica Médica  | Medical Robotics  | 6    | Spring |
| 664809      | 60013267    | Processamento de Sinais e Imagens Biomédicas                 | Biomedical Image and Signal Processing                    | 7    | Spring |
| 664810      | 60013278    | Sistemas de Informação em Saúde                              | Information Systems in Healthcare                         | 3    | Spring |
|             |             |  |   |      |        |
|             |             | 2.º ano / 2 <sup>nd</sup> Year                               |   |      |        |
| 664811      | 61000341    | Tecnologias de Apoio a Pessoas com Necessidades<br>Especiais | Support technologies for people with special needs        | 6    | Winter |
| 664812      | 61000359    | Manutenção de Equipamentos e Instalações                     | Equipment and Facilities Maintenance                      | 6    | Winter |
| 664813      | 61000044    | Projeto  | Project   | 48   | Annual |



Signature of Teacher:

Mestrado em Instrumentação Biomédica (Português)

Master Course in Biomedical Instrumentation (Inglês)

Academic Year: \_2018\_/\_2019\_

## **Program Contents**

| Course Unit D/                 | ATA ACQUISI                  | TION AND VIRTUA  | L INSTRUMENTA            | TION          |                                    |
|--------------------------------|------------------------------|--|--------------------------|---------------|------------------------------------|
| Subject type Spe<br>Sci        | ecialization<br>ences        | Research Ar  | ea Electrical Eng        | ineering      |                                    |
| Year 1 <sup>ST</sup> Semest    | er 1 <sup>st</sup>           |  |                          | ECTS          | 6                                  |
| Working Hours                  |                              |  | Unaccompanied            | Working Hours |                                    |
| Activity Type                  | Working<br>Hours Per<br>Week | Total Hours  | Activity Type            |               | Total Hours                        |
| Theoretical Lectures           | 2                            | 28   | Study                    |               | 55                                 |
| Theoretical-Practical Lectures |                              |  | Works / Group W          | /orks         | 12                                 |
| Practical-Laboratory Lectures  | 2                            | 28   | Project                  |               | 30                                 |
| Tutorial Orientation           |                              |  | Evaluation<br>Additional |               | 3                                  |
| Total of Working Hours         |                              | 156  |                          |               |                                    |
| Lecturer                       |                              |  |                          |               |                                    |
| Activity Type                  |                              | Name   | Q                        | ualifications | Category                           |
| Theoretical Lectures           | Victor Danie<br>Helena Jorg  | l Neto dos Santos<br>e da Silva Marto                        |                          | PhD<br>MSc    | Assistant Prof.<br>Assistant Prof. |
| Theoretical-Practical Lectures |                              |  |                          |               |                                    |
| Practical-Laboratory Lectures  | Victor Danie<br>Helena Jorg  | Victor Daniel Neto dos Santos<br>Helena Jorge da Silva Marto |                          | PhD<br>MSc    | Assistant Prof.<br>Assistant Prof. |
| Tutorial Orientation           |                              |  |                          |               |                                    |
| Responsible(s) Lecturer (s)    | Victor Danie                 | l Neto dos Santos  |                          |               |                                    |

Goals / Skills

The main aims of this course unit are:

- To understand the data acquisition principles including analog-to-digital and digital-analog conversion, signal conditioning and filtering;
- To understand the underling theory of analogue filters including its analysis and design;
- To understand the main features associated with the data acquisition boards;
- To understand the common virtual instrumentation tools;
- Develop applications using LabView for biomedical signals data acquisition purposes.

The course aims to provide training and specific knowledge in the area of Data Acquisition and Virtual Instrumentation. Students must acquire fundamental knowledge regarding the design, implementation and maintenance of such systems. Furthermore, it is encouraged on students R&D activities, in order to develop new solutions, circuits, programs and applications devoted to the biomedical signals analysis and processing.

#### **Program Contents**

## Virtual Instrumentation:

Introduction to LabVIEW: Virtual instrument (vi) components; programming tools, etc. Implementation of a VI:

• Loops; data structures; subroutines; timing; graphs and charts; error handling techniques. Modular application development – SubVIs

Common Design Techniques and Patterns:

• Sequential programming; state programming; state machines; parallelism. Use of variables:

Local Variables; global variables; functional global variables; race conditions.

Projects in LabVIEW.

Labview Synchronization Tools: Notifiers; queues; semaphores. Event-driven programming. User Interface.

### Data Acquisition:

Basic concepts: sampling; aliasing; quantization; quantization noise; etc.

Digital-analog converter (DAC) and Analog-to-digital converter (ADC)

- Binary-weighted current ladder DACs; R-2R Ladder; Multiplying DACs;
- Flash ADC; successive approximations; counting and integrating ADCs; dual slope ADC, etc.

Signal conditioning

- OPAMPS circuits: inverter; non-inverter; adder; integrator; differentiator; difference, etc.
- Instrumentation amplifier; common and differential gain; CMRR.

Filters

- · Filters types and classification; transfer function;
- analog filters analysis and design; active and passive implementations;
- Introduction to IIR and FIR digital filters; etc.

Data acquisition boards

• Number of digital input channels; resolution; dynamic range; sampling rate; bandwidth, etc.

Electromagnetic compatibility

- · Eddy current; magnetic interference;
- 50 Hz interference suppression including its harmonics.

#### Work Done

Part I – Virtual instrumentation

1) Introduction to the LabView; 2) Sub-VIS and loops; 3) Case, shift register e feedback nodes

4) Data structures; 5) Type definitions; 6) Introduction to signal acquisition with the LabVIEW; 7) Local and global variables;
8) State machine implementation; 9) Local variables usage 10) Race Conditions

Part II - Data Acquisition

- DAC convertors;
  - 2) Signals acquisition using an ADC;
  - 3) Analog filters.

Micro project: Biomedical application developed based in LabVIEW.

#### **Teaching Methodology**

The course unit will be taught through lectures and laboratory classes.

Laboratory classes will take place in a laboratory with computers, data acquisition boards and support software in order to carry out practical assignments' and projects.

#### Bibliography

- Support material, furnished by course units teachers', such as: slides, lab assignments, application notes, texts, papers that are available to the students in the moodle platform;
- National Instruments application notes and others material;
- S. Sumathi; P. Surekha, LabVIEW based advanced instrumentation systems, Springer, 2007.
- John Essik, Hands-on introduction to LabVIEW for scientists end engineers, Oxford University Press, ISBN978-019-537395-0, 2009.
- S. Wolf, R. Smith, Student Reference Manual for electronic Instrumentation laboratories, Prentice-Hall International., ISBN 0-13-117605-6, 2004.
- Robert H. Bishop, LabVIEW 2009 student edition, Pearson Prentice Hall, ISBN 978-0-13-214129-1, 2010
- Joseph D. Bronzino, Medical Devices and Systems: The Biomedical Engineering Handbook: 3rd edition, CRC Press 2006.
- Gary W. Johnson, Richard Jennings, graphical programming, McGraw-Hill, fourth edition ISBN 0-07-145146-3, 2006.
- Leonard Sokoloff, Applications in LabVIEW, Pearson Prentice Hall, 2004.

#### **Evaluation Method**

Formal evaluation exams, laboratory works and a project that should be implemented. Weigh: final written theoretical exam (50%); Laboratory works (25%); Project in labview and hardware (25%).

Approval conditional on obtaining a grade grater or equal than 9.5 values (9.5/20.0) on the final written exam. The laboratorial component grade is subject to the minimum attendance of 75% of the effective number of classes.

#### **Conditions for Exam Admission**

Have access to exam students with a minimum attendance of 75% of the laboratory effective lessons and those that implemented and defended with success the implemented projects.

#### Access Conditions and Attendance Excuse

Accordingly with the applicable regulation.

#### **Conditions for Results Improvement**

Only the theoretical component is subject to improvement, a final written exam.

Date 09-10-2018 Signature from the lecturer responsible for the course

Victor D. N. SANTOS

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# Signature of Teacher: Maraces

Mestrado - MSc Instrumentação Biomédica

## Mestrado - MSc Biomedical Instrumentation

Academic Year: 2018/2019

## **Program Contents**

#### **Course Unit** OPTICAL INSTRUMENTATION FOR DIAGNOSTICS AND THERAPEUTICS Subject type **Research Area** Physics Year Semester ECTS 6,0 1 1 Working Hours **Unaccompanied Working Hours** Working **Hours Per Total Hours** Activity Type **Total Hours** Activity Type Week 78 **Theoretical Lectures** 2 24 Study 2 28 Works / Group Works 20 **Theoretical-Practical Lectures** Practical-Laboratoty Lectures Project **Tutorial Orientation** Evaluation 3 Seminar 4 Additional **Total of Working Hours** 156 Lecturer **Activity Type** Name Qualifications Category Milton Augusto Morais Sarmento Pato de Theoretical Lectures PhD Adjunct Professor Macedo Milton Augusto Morais Sarmento Pato de PhD Theoretical-Practical Lectures Adjunct Professor Macedo Practical-Laboratoty Lectures **Tutorial Orientation** Seminar Given by companies working on optical instrumentation (hardware/software) and biomedical applications Responsible(s) Lecturer (s) Milton Augusto Morais Sarmento Pato de Macedo Goals / Skills

To get a solid knowledge of elementary concepts of radiometry and photometry

To characterize the main light source types, to describe the operation of a LASER and its biomedical applications.

To describe the principles of optical sensors, the fiber optics operating modes and its biomedical applications.

To characterize the various light detectors types and other optical components of optical instrumentation for biomedical applications.

To depict the main physical phenomena of light – tissue interaction and its biological origin.

To characterize some of the main optical instruments used in diagnostic and therapeutic based on its physical principles, and to describe its operation and composition.

To distinguish the two main therapeutic effects of LASER light and to identify its main medical areas of application.

To enumerate some light applications for diagnostic and therapeutic and to describe commercial products, devices, systems using their data sheets /application notes.

March

**Program Contents** 

Topics:

- 1. Fundamentals of radiometry and photometry
- 2. Light sources
- 3. Fiber optics
- 4. Light detectors
- 5. Main Optical Components of Biomedical Optical Instrumentation
- 6. Light Tissue Interaction
- 7. Optical Instrumentation for Diagnostics and Therapeutics: some examples and its operating principles
- 8. Light Applications for Diagnostics and Therapeutics: study of some specific commercial instrumentation

#### Work Done

Seminar/Webinar: attendance of seminars given by companies in biomedical field, in order to show hardware and/or software instrumentation

<u>Research work:</u> several research areas as fundamental physical operating principles of optical instrumentation, its technological implementation or some new technologies/equipments in te market

<u>Mini-project</u>: project and test of a laboratory assembly. Optical components as light sources and detectors and electronic components are used to implement a system in order verify some theoretical laws as Beer-Lambery law.

#### **Teaching Methodology**

Presentation of theoretical foundations of each topic supported with examples and applications in biomedical engineering field.

Problem solving during the lessons by student groups and with orientation.

Pratical application of theoretical concepts through the development of a mini-project consisting in an laboratory assembly. Research work based on discussion of scientific papers about the state of the art in the field of optical instrumentation for diagnostic and therapeutics or data sheet and application notes of commercial equipment.

Compulsory attendance of seminars about biomedical applications of optical instrumentation.

## Bibliography

- James M. Palmer and Barbara B. Grant, The Art of Radiometry, SPIE Press, USA, 2010
- Barbara B. Grant, Field Guide to Radiometry, SPIE Press, USA, 2011
- Bahaa E. A. Saleh, MC Teich, Fundamentals of photonics, John Wiley & Sons, USA, 1991
- MV Klein, TE Furtak, Optics, John Wiley & Sons, USA, 1986
- FL Pedrotti, LS Pedrotti, Introduction to optics, 2<sup>nd</sup> ed, Prentice-Hall International Inc. USA, 1993
- VS Bagnato, Laser e suas aplicações em Ciência e Tecnologia, Livraria da Física, Brasil,2008
- Rudiger Paschotta, Field Guide to Lasers, SPIE Press, USA, 2008
- Rudiger Paschotta, Field Guide to Optical Fiber Technology, SPIE Press, USA, 2010
- Lihong v Wang, Hsin-I Wu, Biomedical Optics: Principles and Imaging, John Wiley & Sons, USA, 2007
- Rongguang Liang, Optical design for biomedical imaging, SPIE Press, USA, 2010
- R Splinter and B A Hooper, An introduction to biomedical optics, Taylor & Francis, USA, 2007
- David W. Ball, Field Guide to Spectroscopy, SPIE Press, USA, 2006
- Joseph D Bronzino Editor, The Biomedical Engineering Handbook Medical Devices and Systems, 3rd Edition, Taylor & Francis, USA, 2006
- John G Webster Editor, Medical Instrumentation: Application and Design, 4th Edition, John Wiley & Sons, USA, 2010
- J Enderle, S Blanchard, J Bronzino, Introduction to Biomedical Engineering, 2nd Ed., Elsevier Academic Press, USA, 2005
- W Mark Saltzman, Biomedical Engineering Bridging Medicine and Technology, Cambridge University Press, USA 2009
- Valery Tuchin Ed., Handbook of Optical Biomedical Diagnostics, SPIE Press, USA, 2002
- Valery Tuchin, Dictionary of Biomedical Optics and Biophotonics, SPIE Press, USA, 2012
- Savage D. et al.: First Demonstration of Ocular Refractive Change using Blue-IRIS in Live Cats. Investigative Ophtalmology & Visual Sciences, 4603–4612, 2014

- Lee T. et al.: Focal Laser Ablation for Localized Prostate Cancer: Principles, Clinical Trials, and Our Initial Experience. Reviews in Urology 16(2), 55–66, 2014
- Milton Macedo, PowerPoint presentations, ISEC
- Milton Macedo, theretical-practical exercises, ISEC
- Specifications of commercial equipment/componentsl
- Scientific papers

#### **Evaluation Method**

<u>Research work (20%)</u>: written report made by a group of 2 or 3 students where capacity of synthesis is valued. It is also made a 10 minutes (max.) oral presentation to the other colleagues. <u>Mini-project (20%)</u>: written report made by a group of 2 or 3 students exposing the goals of the work, the system

implemented and the result achieved. It is also made a 10 minutes (max.) oral presentation to the other colleagues. <u>Seminar/Webinar (10%):</u> short report (1-2 pages) of one of the seminar attended by the students.

A minimum mark of 6/20 is demanded for the sum of the three works. Students covered by the status of worker-student (Lei n°7/2009, Lei n°105/2009 e Lei n° 35/2014), in case it is impossible for them to attend all seminars that will occur, a webinar (seminar via web) will be used.

Final exam (50%): A minimum mark of 6/20 is demanded

### **Conditions for Exam Admission**

In accordance with current laws in ISEC.

Access Conditions and Attendance Excuse

NA

**Conditions for Results Improvement** 

In accordance with current laws in ISEC.

Date 15/10/2018 Signature from the lecturer responsible for the course



Signature of Teacher:

Mestrado - MsC Instrumentação Biomédica\_ (Português)

Mestrado - MsC Biomedical Engineering \_\_ (Ingês)

Academic Year: \_2018\_/\_2019\_\_

| Course Unit DECISION SUPPORT AND DIAGNOSIS MODELS   |             |                              |                         |                     |                  |               |
|---|-------------|------------------------------|-------------------------|---------------------|------------------|---------------|
| Subject type  | Mathe       | ematics                      | Research Area           | Mathematic          | cs               |               |
| Year 1  | Semester    | 1                            |                         |                     | ECTS             | 6             |
| Working Hours   |             |                              |                         | Unaccompani         | ed Working Hours |               |
| Activity Type   |             | Working<br>Hours Per<br>Week | Total Hours             | Activity Type       |                  | Total Hours   |
| Theoretical Lecture   | es          | 2                            | 26                      | Study               |                  | 96            |
| Theoretical-Practic   | al Lectures | 2                            | 28                      | Works / Group Works |                  |               |
| Practical-Laborator   | ty Lectures |                              |                         | Project             |                  |               |
| Tutorial Orientation  | ו           |                              |                         | Evaluation          |                  | 4             |
| Seminar   |             |                              | 2                       | Additional          |                  |               |
| Total of Working Hours  |             |                              | 156                     |                     |                  |               |
| Lecturer  |             |                              |                         |                     |                  |               |
| Activity Type   |             |                              | Name                    |                     | Qualifications   | Category      |
| Theoretical Lecture   | es          | Deolinda Ma                  | ria Lopes Dias Rasteiro | )                   | Doutoramento     | Prof. Adjunto |
| Theoretical-Practic   | al Lectures | Deolinda Ma                  | ria Lopes Dias Rasteiro | )                   | Doutoramento     | Prof. Adjunto |
| Practical-Laborator   | ty Lectures |                              |                         |                     |                  | Prof. Adjunto |
| Tutorial OrientationSomeone Invited by the Physics/MathematicsSeminarDepartment or by the teacher |             |                              |                         |                     |                  |               |
| Responsible(s) Lo   | ecturer (s) | Deolinda Ma                  | ria Lopes Dias Rasteiro | )                   |                  |               |

#### Goals / Skills

Present the potential of decision support methods and diagnosis in the context of Control, Operations Research, Diagnosis and Management, with particular emphasis on the formulation of decision problems within the Biomedical Engineering and particularly useful tools to optimize solutions.

Through the problem formulation / modeling students, based on skills acquired in different modules of the syllabus, will be able to solve the potential problems using the methods that decision support and management and operational research potentiate. Students also gain knowledge that they will be indispensable for understanding the last two chapters. There are databases with vast amounts of information; the use of data mining goes from the display of information to the forecast. We highlight the application in medicine, the diagnostic phase to identify the best therapies, the search for new forms of treatment. With the acquisition of knowledge contained in Chapters IV and V students will be better able to provide, with more certainty, useful information for a diagnosis / treatment. This information will be based, for example, on a function that needs to be determined, which makes the mapping of data into predefined classes (e.g. diagnosis of a given disease from a set of symptoms).

#### **Program Contents**

Network Optimization; Linear and Non Linear Programming; Support Vector machines; Data Mining

#### Work Done

Report with oral discussion of a proposed project by the course's teachers (may be in a group - maximum of 3 students) - Rating 5 values;

#### Teaching Methododoly

Mainly expositive (theoretical part) although students solve practical by themselves with guidance from the lecturer.

#### Bibliography

L. Valadares Tavares, "Operational Research", 1996, McGraw Hill.

F. Hillier, G. Lieberman, "Introduction to Operations Research," 2004, McGraw Hill.

• Carlos Henggeler Antunes, Luís Valadares Tavares, (coordinators), Cases of Application of Operations Research, Mc Graw-Hill, 2000.

• EQVMartins, MMBPascoal, DMLDRasteiro, JLESantos. The Optimal Path Problem, Operational Research, Vol 19, No 1, June 1999, pp. 43-60.

LORRAINE, A. C., CARVALHO, A. C. P. L. of. Introduction to Support Vector Machines. São Carlos - SP, April 2003.

Hand, D., Mannil, H., Smyth, P., "Principles of Data Mining '. MIT Press. 2001. ISBN 026208290X.

Course Notes TM Enterprise Miner: Applying Data Mining Techniques, SAS Institute.

• Support material prepared by the teachers responsible for the course (texts and practical exercises).

#### **Evaluation Method**

The problems formulation / modeling have a strong component in the evaluation since from it depends a consistent resolution and consequent decision-making and analysis.

Assessment method:

• Report with oral discussion of a proposed project by the course's teachers (may be in a group - maximum of 3 students) - Rating 5 values;

• Two written tests during the semester. 1<sup>st</sup> test will be on December, 13 and the 2<sup>nd</sup> test will be on January, 24<sup>th</sup>. In case of failure students may also be assessed by a written exam - 15 Rating values.

#### **Conditions for Exam Admission**

To be a course student.

#### Access Conditions and Attendance Excuse

To be a course student.

#### **Conditions for Results Improvement**

Be enrolled in the exam whenever improvement results are permitted.

Date

15.10.2018

| Signature from the le | ecturer respons | ible for the course | $\bigcirc$ |
|-----------------------|-----------------|---------------------|------------|
| Dednob                | Maria           | Lopes Dios          | Kastens    |



| Lecturer's signature:      | prima Giura  |
|----------------------------|--------------|
| Mestrado - MsC Instrumenta | ão biomédica |

## Mestrado - MsC Biomedical Instrumentation

Academic Year: 2018/2019

**Program Contents** 

| Course Unit                   | ANALYSIS OF                  | BIOMEDICAL DA       | TA                |                     |                      |
|-------------------------------|------------------------------|---------------------|-------------------|---------------------|----------------------|
| Subject type B                | asic sciences                | Research /          | <b>Area</b> Mathe | matics              |                      |
| Year 1st                      | Semester                     | 1st                 | 2                 | EC                  | CTS 6                |
| Working Hours                 |                              |                     | Unaccom           | panied Working Hour | s                    |
| Activity Type                 | Working<br>Hours Per<br>Week | Total Hours         | Activity Ty       | /pe                 | Total Hours          |
| Theoretical Lectures          | 2                            | 28                  | Study             |                     | 75                   |
| Theoretical-Practical Lecture | es 2                         | 28                  | Works / G         | roup Works          | 15                   |
| Practical-Laboratoty Lecture  | s                            |                     | Project           |                     |                      |
| Tutorial Orientation          |                              |                     | Evaluation        | 1                   | 3                    |
|                               |                              |                     | Additional        |                     | 7                    |
| Total of Working Hours 15     | 56                           |                     |                   | -                   |                      |
| Lecturer                      |                              |                     |                   |                     |                      |
| Activity Type                 |                              | Name                |                   | Qualifications      | Category             |
| Theoretical Lectures          | Maria Filon                  | nena Palmeira de Ar | raújo Canova      | Master of Science   | Prof.<br>Coordenador |
| Theoretical-Practical Lecture | es Maria Filon               | nena Palmeira de Ar | raújo Canova      | Master of Science   | Prof.<br>Coordenador |
| Practical-Laboratoty Lecture  | S                            |                     |                   |                     |                      |

**Tutorial Orientation** 

Responsible(s) Lecturer (s)

Maria Filomena Palmeira de Araújo Canova

**Goals / Skills** The main goal is to present statistical methods applied to health sciences, with emphasis on statistical modeling and survival analysis. Students should be able to understand and apply statistical techniques to biomedical data analysis, using statistical software in order to support clinical research.

## Program Contents

Introduction. Study design on health research. Descriptive and analytical studies.

Diagnostic tests and clinical trial measurements.

Statistical tests. Statistical modeling. Regression.

Longitudinal studies. Survival analysis.

Software for statistical analysis.

#### Work Done

Carrying out a written work including an oral presentation of statistical analysis of data related to health sciences.

#### **Teaching Methododoly**

The teaching methodologies are predominantly, the expository method in the theoretical lectures and, in the theoretical practical lectures, the resolution and discussion of application exercises using statistical software when appropriate.

#### Bibliography

Chen D., Peace K. E., Clinical Trial Data Analysis Using R, 2010, Chapman & Hall/CRC Press.

Giolo S.R., Colosimo E. A., Análise de Sobrevivência Aplicada, 2006, Ed. Edgard Blucher

Gouveia de Oliveira, A. Bioestatística descodificada - Bioestatística, Epidemiologia e Investigação. 2ª edição 2014, Lidel.

Klein J. P., Houwelingen H., Ibrahim J., Handbook of Survival Analysis, 2016, Chapman & Hall/CRC

Marôco J., Análise Estatística com o SPSS Statistics, 7ª edição 2018, Report Number

Riffenburgh R., Statistics in Medicine, 3rd edition, 2012, Academic Press

Wayne W. D., Biostatistics: A Foundation for Analysis in the Health Sciences, 10 th edition, 2013, Wiley.

Zar J. H., Biostatistical Analysis, 5th edition, Northern Illinois University 2010, Pearson.

Notes from lectures and Worksheets in moodle isec

#### **Evaluation Method**

Continuous assessment consists of a report with oral discussion of a proposed project, rating 6 values (30%) and a final exam, rating 14 values (70%). The final grade is the sum of the work grade with the exam grade. The student is approved if he has a final grade of at least 10, provided that the exam grade is equal to, or greater than 7 values.

Alternatively, the assessment is made through a final examination (20 values/100%).

The student is approved if he has a final grade of at least 10.

#### **Conditions for Exam Admission**

Access to the exam is allowed to all students enrolled in the Course Unit

#### **Access Conditions and Attendance Excuse**

Not applicable.

#### **Conditions for Results Improvement**

In accordance with the legislation in force.

Date

#### Signature from the lecturer responsible for the course

08.09.2018

AVOMENAEANJO GNOVA



Mestrado - MSc em Instrumentação Biomédica - 6648 (Português)

Instituto Superior de Engenharia de Coimbra www.isec.pt

Mestrado - MSc in Biomedical Instrumentation - 6648 (Ingês) Academic Year: 2018 / 2019

## **Program Contents**

| Course Unit   | 664812 - MAINT   | ENANCE OF EQU   | JIPMENT AND FA                 | ACILITIES              |                   |
|---|--|---|--------------------------------|------------------------|-------------------|
| Subject type  | Specialty Sciences   | Research A  | rea Electric                   | AL ENGINEERIN          | G                 |
| Year 2 Sen  | nester 1   |   |                                | ECTS                   | <b>6</b> 6        |
| Working Hours   |  |   | Unaccompani                    | ed Working Hou         | rs                |
| Activity Type   | Working<br>Hours Per<br>Week   | Total Hours   | Activity Type                  |                        | Total Hours       |
| Theoretical Lectures<br>Theoretical-Practical Lect  | 2<br>ures  | 28  | Study<br>Works / Group         | Works                  | 38<br>60          |
| Practical-Laboratoty Lectu<br>Tutorial Orientation<br>Seminar   | ires 2   | 26  | Evaluation<br>Additional       |                        | 2                 |
| Total of Working Hours  |  | 156   |                                |                        |                   |
| Lecturer  |  |   |                                |                        |                   |
| Activity Type   |  | Name  |                                | Qualifications         | Category          |
| Theoretical Lectures  | Iná  | ácio Sousa Adelino F  | onseca                         | PhD                    | Professor Adjunto |
| Theoretical-Practical Lect<br>Practical-Laboratoty Lect<br>Tutorial Orientation   | ures Iná   | cio Sousa Adelino F   | onseca                         | PhD                    | Professor Adjunto |
| Seminar   |  | To define   |                                |                        |                   |
| Responsible(s) Lecture  | r <b>(s)</b> Inácio Sous   | a Adelino Fonseca   |                                |                        |                   |
| Goals / Skills  |  |   |                                |                        |                   |
| Understand and impleme<br>Perform diagnostic audits<br>Know how to organize an<br>Develop and implement n<br>Perform internal and subd<br>Apply techniques of fault<br>Evaluate maintenance co<br>Develop and monitor mai | nt techniques of orga<br>of the maintenance<br>equipment park;<br>maintenance plans for<br>contracted work mana<br>diagnosis;<br>sts and maintenance<br>intenance control indi | nization and manag<br>status;<br>r machines and equi<br>agement;<br>times;<br>cators; | ement of an industri<br>pment; | al maintenance d       | epartment;        |
| Program Contents  |  |   |                                |                        |                   |
| Theory of reliability (distri<br>Corrective, periodic and p<br>Maintenance planning.<br>Inspection equipment (no  | butions, series and p<br>predictive maintenand<br>ise, vibration, thermo   | arallel circuits, analy<br>ce.<br>ography and tribolog                                | vsis of main samples<br>y).    | s reliability indicato | ors).             |

Quality of power supply. Electrical protection systems / devices.

Signature of Teacher: \_\_\_\_\_

Systems of uninterrupted supply of electrical energy.

Basic techniques for diagnosing faults in the sources of electrical equipment.

Maintenance of structured cabling networks (ethernet networks)

Maintenance of electrical and computer equipment.

Seminar: to be held on one of the contents described above.

#### Work Done

Several themes to choose from, developed in Matlab (choose one and only one option):

- Development of time series analysis algorithms for predictive maintenance / energy consumption;
- Development of comparison analysis of patterns applied to instrumented predictive maintenance signals;
- Development of algorithms for determination of statistical parameters of reliability;
- Development of an application using IoT;
- Theme proposed by the student if there is agreement with the teacher;
- Theme proposed by the teacher if there is agreement with the student;
- General work (compulsory for all students)

Use of Maintenance software - to create a fleet of equipment and maintenance management - Work orders, plans, etc. - 3 values to 4 values.

Works available per statement - Each work 1.5 values to 2 values.

#### **Teaching Methododoly**

#### Theoretical classes

Exposition of theoretical concepts.

Presentation and analysis of examples, stimulating discussion of solutions with students throughout the class. Laboratory classes

The understanding of the acquired knowledge is promoted through the analysis, discussion and realization of practical examples in the laboratory.

#### Bibliography

- Material in electronic format, in the moodle platform, from slides, Excel sheets, and Maintenance Management software.
- "Maintenance Lean", by João Paulo Pinto, 2013, Publisher: Lidel, ISBN: 978-972-757-877-1
- "Support for the Maintenance Decision in the Management of Physical Assets", Rui Assis, 2010 Publisher: Lidel, ISBN: 978-989-752-112-6
- "An Introduction to Maintenance", by Luís Andrade Ferreira, Publisher: Publindústria, Porto, 1998, ISBN: 972-95794-4-X
- "Maintenance Focusing on Reliability", by Rui Assis, Publisher: Lidel, 1997, ISBN: 972-757-037-2
- "Maintenance Management Of Equipment, Facilities And Buildings", José Paulo Saraiva Cabral, Publisher: Lidel, 2013
- "Asset maintenance engineering methodologies", José M.Torres Farinha CRC Press Taylor & Francis Group, 2018
- Supporting texts prepared by the Teacher.

#### **Evaluation Method**

Written exam quoted for 12 values. Minimum of 30% in the Written Exam. Practical assignments for 8 values.

#### **Conditions for Exam Admission**

At least 75% of laboratory classes

#### Access Conditions and Attendance Excuse

For students under the Worker-Student Statute, and for components with compulsory attendance and distributed assessment, it may be agreed upon by the teacher responsible for the curricular unit and the student, adjustments to the functioning of these components.

In this case, during the first two teaching weeks, the students must indicate to their respective teacher their status as student worker, establishing immediately how to adjust the functioning of the referred components. The presentation of the employer's work time or other relevant information may be required.

#### Conditions for Results Improvement

In accordance with the legislation in force.

Date

15/10/2018

Signature from the lecturer responsible for the course Ifonxc-



Signature of Teacher:

Mestrado - MsC em Instrumentação Biomédica

## Mestrado - MsC in Biomedical Instrumentation

Academic Year: 2018/2019

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ECTS

#### **Course Unit** SUPPORT TECHNOLOGY FOR PERSONS WITH SPECIAL NEEDS

Subject type

**Research Area** 

2<sup>nd</sup> 1<sup>st</sup> Year Semester

Working Hours

| Working Hours                  |                              | Unaccompanied Working Hours |                     |             |
|--------------------------------|------------------------------|-----------------------------|---------------------|-------------|
| Activity Type                  | Working<br>Hours Per<br>Week | Total Hours                 | Activity Type       | Total Hours |
| Theoretical Lectures           | 1                            | 14                          | Study               | 15          |
| Theoretical-Practical Lectures |                              |                             | Works / Group Works | 15          |
| Practical-Laboratoty Lectures  | 3                            | 40                          | Project             | 70          |
| Tutorial Orientation           |                              |                             | Evaluation          |             |
| Seminar                        |                              | 2                           | Additional          |             |

**Total of Working Hours** 

Lecturer

| Activity Type                  | Name   | Qualifications           | Category           |
|--------------------------------|--|--------------------------|--------------------|
| Theoretical Lectures           | Frederico Miguel do Céu Marques dos Santos   | PhD                      | Adjunct Prof.      |
| Theoretical-Practical Lectures | an ann a chuire ann a tha na <del>a</del> annan a na bha na chuirean <b>-</b> ann an <b>-</b> ann an - ann an - ann an Annana. |                          |                    |
| Practical-Laboratoty Lectures  | Marco José da Silva  | MSc                      | Assistant          |
| Tutorial Orientation           |  |                          |                    |
| Seminar                        | will be assured by a professional with branch of a   | ctivity related to the ( | CU scientific area |

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will be assured by a professional with branch of activity related to the CU scientific area

Responsible(s) Lecturer (s)

Frederico Miguel do Céu Marques dos Santos

Goals / Skills

• The vast majority of people with special needs are affected to a greater or lesser extent in four main areas: Communication, Mobility, Handling and Guidance.

· In-depth knowledge of the use of assistive technologies presupposes, on the one hand, the understanding of its more technical aspects (technical components), and on the other a deep knowledge of the human being that will use the technology (human components) as well as the needs presented by the physical and economic environment in which it is inserted (socioeconomic components).

## **Program Contents**

- 1. Communication
  - Interpersonal communication
    - · Synthesized speech
    - · Hearing aids
    - Amplifiers
    - · Smartphone-based communication media
  - Computer access
    - Control interfaces

- Mice and Emulators
- Touch screens
- Pointers (head and mouth)
- Eye Trackers
- 2. Mobility
  - Electrical Mobility
    - Wheelchair
    - Electronic walking sticks
    - Control interfaces

Accessibility

- Home automation adapted
- Public transport
  - Intelligent information systems for the blind
- 3. Handling
  - Control of environment
    - Control units
    - Home automation adapted
    - User Control Interfaces
  - Robotics
    - Adapted equipment
- 4. Orientation
  - Navigation and orientation systems
    - Ultrasound
    - Sound guides
    - Environment adapters

Positioning

- · GPS and GSM localization
- RFID signaling and identification
- · Monitoring and emergency calls

### Work Done

Group projects (up to 2 studends) with 1 semester of duration

### **Teaching Methododoly**

- Theoretical: expository
- · Practices: group Project

## Bibliography

- Classroom presentations
- Reports of group work from previous years
- · information related to projects to be made available in moodle

### **Evaluation Method**

The evaluation is composed of two components:

• Theoretical component: Report, presentation and discussion of an scientific work from an international journal or international conference, with less than 2 years of publication, with engineering solutions to support people with special needs. This work has a final weight of 7 values, with a minimum of 3.5 values

• Laboratory project: Preparation, execution and report of a laboratory project with report, presentation and final discussion. This work has a final weight of 13 values, with a minimum of 6.5 values

### **Conditions for Exam Admission**

Have attended at least 2/3 of classes

### Access Conditions and Attendance Excuse

Not applicable

#### **Conditions for Results Improvement**

Students who meet the conditions established in the REACTA

Date

Signature from the lecturer responsible for the course

15-10-2018

Frelen Myl It.



#### Mestrado - MsC Instrumentação Biomédica

## Mestrado - MsC Biomedical Instrumentation

Academic Year: 2018/2019

## **Program Contents**

| Course Unit COMMUNICATION NETWORKS IN BIOMEDICINE                                   |        |                              |                   |                  |                                    |                   |
|---|--------|------------------------------|-------------------|------------------|------------------------------------|-------------------|
| Subject type  | Comp   | uter Networks                | Research          | n Area           | Electrical and Electror            | nics Engineering  |
| Year 1 Sen  | nester | 1                            |                   |                  | EC                                 | <b>TS</b> 6       |
| Working Hours   |        |                              |                   | Una              | accompanied Working He             | ours              |
| Activity Type   |        | Working<br>Hours Per<br>Week | Total Hours       | Act              | ivity Type                         | Total Hours       |
| Theoretical Lectures<br>Theoretical-Practical Lecture<br>Practical-Laboratoty Lectu | ures   | 2                            | 28<br>26          | Stu<br>Wo<br>Pro | ldy<br>Irks / Group Works<br>viect | 64<br>34          |
| Tutorial Orientation  |        | 2                            | 2                 | Eva              | aluation                           | 2                 |
| Total of Working Hours  |        | L                            | 156               |                  |                                    |                   |
| Lecturer  |        |                              |                   |                  |                                    |                   |
| Activity Type   |        |                              | Name              |                  | Qualifications                     | s Category        |
| Theoretical Lect <mark>ures</mark>  |        | João Ca                      | rlos Ramos Perd   | iaoto            | MSc                                | Invited Professor |
| Theoretical-Practical Lect  |        | João Carlos Ramos Perdigoto  |                   | MSc              | Invited Professor                  |                   |
| Seminar<br>Tutorial Orientation   | 103    | Invited pro                  | fessional from th | nis cientific    | area                               |                   |
| Responsible(s) Lecturer   | ' (s)  | João Carlos F                | Ramos Perdigoto   | •                |                                    |                   |

Goals / Skills

To know and understand the technologies available in the market.

To choose, design, implement and maintain small communication networks, using commercially available equipment.

To choose, design, implement and maintain wireless network communication systems using commercially available equipment.

To understand and perform troubleshooting in local networks.

To understand and perform troubleshooting in wireless sensor networks.

## **Program Contents**

Power budget in guided and wireless transmission systems. Introduction to communication networks. Standardization. OSI model. Ethernet networks technology and equipment. TCP / IP protocols. Configuration of wired and wireless networks with TCP / IP. Wireless sensor networks. Energy budget of wireless sensor networks. Applications of wireless sensor networks: the Zigbee protocol. Introduction to RFID applications. Biomedical applications of networks: body networks. Tracking systems in Hospitals. Presentations about Wireless Sensor Networks

## Work Done

Understand, analyze and plan local TCP / IP networks using network simulator software and experimental setup configurations;

Plan and implement a wireless sensor network.

Configure and use various network applications.

Develop and deploy network applications.

## **Teaching Methododoly**

Classes will be taught in both theoretical and laboratory classes. Theoretical classes will be expositive and will be used examples and guidance for laboratory classes. External entities (companies or consultants) may be invited to present topics in seminars or the seminars will be presented by the students, after previous research, followed by an open discussion on the subject.

## Bibliography

Guang-Zhong Yang, "Body Sensor Networks", Springer-Verlag, 2014 Reynders, D., Mackay, S., Wright, E., "Practical Industrial Data Communications", Newnes Publications, 2003 E. Monteiro, F. Boavida, "Engenharia de redes informáticas", FCA - Editora de Informática, 2011 Lammle, Todd, "CCNA Cisco certified network associate: study guide", Sybex, 2011 Spurgeon, C., "Ethernet: the definitive guide", O'Reilly, 2014 Geier, Jim, "Wireless Lans: implementing interoperable networks", MacMillan, 2002 Faludi, R, "Building Wireless Sensor Networks: with ZigBee, XBee, Arduino, and Processing", O'Reilly, 2011 Elhoseny, M, Hassanien, A., "Dynamic Wireless Sensor Networks: New Directions for Smart Technologies", Springer, 2018

## Evaluation Method

Final exam. Laboratory work and reporting.

Synthesis text on the topics covered in the program and / or related content, with individual presentation during the contact hours.

Approval for the UC is dependent on obtaining a minimum of 10 (of 20) values, taking into account the following weights:

- a) Final exam 14 (at least 6);
- b) Laboratory work and report 4 (at least 2);
- c) Synthesis text 2 (delivered up to January 2, 2019)

## **Conditions for Exam Admission**

Regular attendance of laboratory classes with a maximum of 2 classes missed.

## Access Conditions and Attendance Excuse

In accordance with the academic regulations and applicable laws.

**Conditions for Results Improvement** 

In accordance with the academic regulations and applicable laws.

Date

Signature from the lecturer responsible for the course

15-October-2018