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| **1- Identification of the Education Offer** |

***Level* : Master**

***Field :*** *Biomedical engineering*

***Branch* :** *Biomedical engineering*

***Speciality* :** *Electronics and Biomedical Maintenance*

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| **2- Educational Establishment :** |

***Faculty/Institute:*** *Technology*

***Department:*** *Biomedical engineering departement.*

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| **3- External partners** |

* Tlemcen University Hospital Center.
* Regional Hospital of Oran. • Public Hospital Establishment - Oued Rhiou.
* Public Hospital Establishment - Mazouna.
* Public Hospital Establishment - Mohammed Boudiaf.
* Public Hospital Establishment - Hammam Bouhdjar.
* National Agency for the Promotion and Development of Technological Parks.
* SARL Aures Medical Equipment Company.
* Directorate of Vocational Training and Education of the Tlemcen Province.

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| **4- Context and objectives of the training:** |

This specialization aims to train future researchers in the field of Biomedical Instrumentation and the development of new systems for diagnosis assistance and therapy. It encompasses mastering various modalities of medical instrumentation and imaging, as well as implementing signal and image processing techniques to solve problems related to the biomedical field.

It enables the mastery of selecting, managing, and utilizing instrumentation for medical equipment and hospital biomedical techniques. Additionally, it enables the ability to lead innovative projects through the creation and development of specialized companies in the field of biomedical engineering.

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| **5- Facilities, Equipment and Laboratoires** |

**Laboratory No. 01:** Physiological and Electrophysiological Measurements

**Capacity :** 15 students.

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| **N°** | **Equipement name** | **Number** | **Observations** |
| 01 | Electrocardiogram Electrodes | 12 |  |
| 02 | Electroencephalogram Electrodes | 06 |  |
| 03 | Electromyogram Electrodes | 06 |  |
| 04 | Phywe Biological Amplifier | 03 |  |
| 05 | CassyBio Interface Card | 03 |  |
| 06 | Pressure Sensor | 03 |  |
| 07 | Blood Pressure Cuff | 03 |  |
| 08 | Phonocardiogram Sensor | 02 |  |
| 09 | Neuronal Activity Simulator | 01 |  |
| 10 | PC (Personal Computer) | 04 |  |
| 11 | Cassybio Interface and Measurement Software | 01 |  |
| 12 | Memory Oscilloscope | 02 |  |
| 13 | DC Power Supply | 05 |  |
| 14 | Photoplethysmogram Measurement Card | 01 |  |
| 15 | Spirometry Sensor | 02 |  |
| 16 | Disposable Tips | 200 |  |
| 17 | Skin Resistance Measurement Sensor | 04 |  |
| 18 | Blood Pressure Monitor | 02 |  |
| 19 | Dual Trace Oscilloscope | 02 |  |

**Laboratory No. 02:** Design and Prototype Construction

**Capacity :** 15 students

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| --- | --- | --- | --- |
| **N°** | **Equipement name** | **Number** | **Observations** |
| 01 | 1000-Hole Test Plates | 20 |  |
| 02 | Dual DC Power Supplies | 10 |  |
| 03 | Dual Trace Oscilloscopes | 06 |  |
| 04 | Dual Trace Memory Oscilloscopes | 04 |  |
| 05 | Function Generators | 04 |  |
| 06 | Métrix (Ammeters-Voltmeters-Ohmmeters) | 10 |  |
| 07 | Soldering Iron | 20 |  |
| 08 | Desoldering Pumps | 20 |  |

**Laboratory No. 03:** Electrical and Electronic Measurements

**Capacity :** 15 students.

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| --- | --- | --- | --- |
| **N°** | **Equipement name** | **Number** | **Observations** |
| 01 | Dual Trace Oscilloscope | 05 |  |
| 02 | Memory Oscilloscope | 02 |  |
| 03 | Dual DC Power Supply | 05 |  |
| 04 | Function Generators | 04 |  |
| 05 | Métrix (Ammeters-Voltmeters-Ohmmeters) | 05 |  |
| 06 | Galvanometer | 01 |  |
| 07 | Ultrasonic Measurement Bench | 01 |  |
| 08 | Temperature Measurement Bench | 01 |  |
| 09 | Position Measurement Bench | 01 |  |
| 10 | Pressure Measurement Bench | 01 |  |

**Laboratory No. 04:** Signal and Image Acquisition and Processing

**Capacity :** 15 students

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| --- | --- | --- | --- |
| **N°** | **Equipement name** | **Number** | **Observations** |
| 01 | Mx Digital Acquisition Cards | 02 |  |
| 02 | Mx Analog Acquisition Cards | 02 |  |
| 03 | Optoelectronic Sensors (LED + Photodiode) | 04 |  |
| 04 | Ultrasonic Sensors | 04 |  |
| 05 | Memory Oscilloscope | 01 |  |
| 06 | Dual DC Power Supply | 02 |  |
| 07 | PC | 08 |  |
| 08 | Software (MATLAB, C++, JAVA, etc.) | 08 |  |
| 09 | Database of Electrophysiological Signals | 01 |  |
| 10 | Database of Medical Images | 01 |  |

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| **6- Profiles and Competencies Targeted** |

The skill set acquired by students in this program allows them to pursue managerial positions in the design, distribution, and maintenance of biomedical equipment. Moreover, students can aspire to become Hospital Biomedical Engineers. These engineers are responsible for the implementation, maintenance, and compliance of diagnostic and therapeutic equipment in clinical settings. They must also be familiar with the challenges and techniques related to procurement, distribution, management, compliance maintenance, and equipment vigilance.

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| **7- Development Prospects and Employability** |

* Biomedical Engineer in public healthcare institutions (hospitals) or private healthcare facilities (clinics).
* Technical Sales Engineer for medical equipment.
* Research and Development (R&D) work in biomedical instrumentation.
* After-sales Service Engineer for medical instrumentation.
* Creation and development of specialized companies in the field of biomedical instrumentation.

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| **8- Organisation of the Semesters Teaching** |

**Semester 1 :**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Teaching Unit | Module | Credits | Coefficient | Weekly time volume | | | semster time volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation Mode | |
| Title | **Courses** | **GW** | **PW** | Continuous Assessment | **Examen** |
| UE Fondamental  Code : UEF 1.1.1  Credits : 8  Coefficients : 4 | Biomedical sensors and associated electronics | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| Microprocessors and microcontrollers | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| UE Fondamentale  Code : UEF 1.1.2  Credits : 10  Coefficients : 5 | Microtechnology and microsystems | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| Image processing | 3 | 1,5 | 1h30 | 1h30 |  | 33h45 | 41h15 | 40% | 60% |
| Advanced signal processing | 3 | 1,5 | 1h30 |  | 33h45 | 41h15 | 40% | 60% |
| UE Méthodologique  Code : UEM 1.1  Credits : 9  Coefficients : 5 | Image processing lab | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Lab: Electrophysiological Signal Processing Technical | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Lab: Microprocessors and Microcontrollers | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Lab : Measurements on Sensors | 3 | 2 | 1h30 |  | 1h00 | 37h30 | 37h30 | 40% | 60% |
| UE Découverte  Code : UED 1.1  Credits : 2  Coefficients : 2 | Hospital Management and Career Requirements | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| Pathological Anatomy and Physiology | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| UE Transversale  Code : UET 1.1  Credits : 1  Coefficients : 1 | English and Terminology | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| **Total semester 1** |  | **30** | **17** | **13h30** | **6h00** | **5h30** | **375h00** | **375h00** |  |  |

**Semester 2**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Teaching Unit | Module | Credits | Coefficient | Weekly time volume | | | semster time volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation Mode | |
| Title | **Courses** | **GW** | **PW** | Continuous Assessment | **Examen** |
| UE Fondamentale  Code : UEF 1.2.1  Credits : 10  Coefficients : 5 | Techniques and Maintenance Management in Biomedical Instrumentation | 6 | 3 | 3h00 | 1h30 |  | 67h30 | 82h30 | 40% | 60% |
| Prototyping of Medical Devices | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| UE Fondamentale  Code : UEF 1.2.2  Crédits : 8  Coefficients : 4 | Biophysics and Nuclear Medicine | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| Biomechanics | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| UE Méthodologique  Code : UEM 1.2  Crédits : 9  Coefficients : 5 | Lab: Prototyping and Maintenance of Medical | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Examples: Programming Interfaces | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Devices Instrumentation, Techniques, and Methods in the Medical Laboratory | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Modeling of Medical Devices | 3 | 2 | 1h30 |  | 1h00 | 37h30 | 37h30 | 40% | 60% |
| UE Découverte  Code : UED 1.2  Crédits : 2  Coefficients : 2 | Programming Languages | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| Biomaterials and Nanotechnologies for Medical Instrumentation | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| UE Transversale  Code : UET 1.2  Crédits : 1  Coefficients : 1 | Compliance with Standards and Ethical Integrity Rules | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| **Total semester 2** |  | 30 | 17 | 13h30 | 6h00 | 5h30 | 375h00 | 375h00 |  |  |

**Semester 3**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Teaching Unit | Module | Credits | Coefficient | Weekly time volume | | | semster time volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation Mode | |
| Title | **Courses** | **GW** | **PW** | Continuous Assessment | **Exam** |
| UE Fondamentale  Code : UEF 1.3.1  Credits : 8  Coefficients : 4 | Techniques and Instrumentation of Functional | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| Explorations Techniques and Instrumentation of Medical Imaging | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| UE Fondamentale  Code : UEF 1.3.2  Credits : 10  Coefficients : 5 | Techniques and Instrumentation of Therapy and Prosthetics | 4 | 2 | 1h30 | 1h30 |  | 45h00 | 55h00 | 40% | 60% |
| Instrumentation and Systems for Medical Gas Delivery | 3 | 1,5 | 1h30 | 1h30 |  | 45h00 | 30h00 | 40% | 60% |
| Biocensors | 3 | 1,5 | 1h30 |  | 22h30 | 52h30 |  | 100% |
| UE Méthodologique  Code : UEM 1.3  Credits : 9  Coefficients : 5 | Internship at Hospital/Company | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Mini- project in Measurements and Testing in Functional Explorations | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 100% |  |
| Standards and Safety in the Medical Environment: | 2 | 1 |  |  | 1h30 | 22h30 | 27h30 | 40% | 60% |
| Instrumentation Marketing and Innovation Management | 3 | 2 | 1h30 |  | 1h00 | 37h30 | 37h30 | 40% | 60% |
| UE Transversale  Code : UED 1.3  Credits : 2  Coefficients : 2 | Rehabilitation Instrumentation and Assistive Technologies | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 | 40% | 60% |
| Learning for Medical Devices and Data | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 | 40% | 60% |
| UE Découverte  Code : UET 1.3  Credits : 1  Coefficients : 1 | Literature Review Synthesis Project | 1 | 1 | 1h30 |  |  | 22h30 | 02h30 |  | 100% |
| **Total semester 3** |  | 30 | 17 | 13h30 | 6h00 | 5h30 | 375h00 | 375h00 |  |  |