



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicacion

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000977 - Advance Methods In Biomedical Images

DEGREE PROGRAMME

09AU - Master Universitario en Ingeniería Biomedica

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	93000977 - Advance Methods In Biomedical Images
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	09AU - Master Universitario en Ingenieria Biomedica
Centre	09 - Escuela Tecnica Superior de Ingenieros de Telecomunicacion
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Maria Jesus Ledesma Carbayo	C-201	mariajesus.ledesma@upm.es	W - 13:00 - 14:00
Andres De Santos Lleo (Subject coordinator)	C-227	andres.santos@upm.es	Sin horario. Se puede acordar cita por email: andres@die.upm.es

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.3. External faculty

Name and surname	Email	Institution
Juan Enrique Ortuno Fisac	juanen@die.upm.es	CIBER-BBN

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Imágenes MÉdicas

3.2. Other recommended learning outcomes

- Basic knowledge of Matlab programming

4. Skills and learning outcomes *

4.1. Skills to be learned

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

4.2. Learning outcomes

RA120 - RA17_EN - Ability to analyze and apply current techniques and methods of biomedical image analysis for the design of new advanced processing medical imaging systems.

RA121 - RA32_EN - Analysis and application of advanced medical imaging diagnostic techniques with special emphasis in cardiovascular and neurological fields. Theoretical and practical work will be approached.

RA77 - Be able to analyze and apply current methods and techniques in image processing for the analysis and design of advanced systems of generation and processing of biomedical images.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

In this subject concepts related to medical imaging acquisition techniques as well as processing in current advanced systems will be studied. The different trends in medical imaging use as well as the incorporation of medical imaging in the diagnostic and therapeutic scenarios will be presented. The students will understand advanced methods of medical image processing (such as segmentation of medical imaging, registration, etc...) and will solve specific problems with such methods.

5.2. Syllabus

1. New diagnostic imaging techniques: Introduction to medical imaging acquisition and processing.
2. Molecular imaging
3. Ultrasound advanced techniques
4. Magnetic Resonance Imaging 1: Fast sequences and functional imaging
5. Magnetic Resonance Imaging 2. Diffusion, perfusion and spectroscopy
6. Optical Imaging
7. Neuroimaging
8. Cardiovascular Imaging
9. Advanced methods for medical imaging segmentation
10. Registration of biomedical imaging

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Tema 1 Duration: 02:00 Lecture			
2	Tema 2 Duration: 02:00 Lecture			
3	Tema 3 Duration: 02:00 Lecture			Home Exercise Individual work Continuous assessment Not Presential Duration: 02:00
4	Tema 4 Duration: 02:00 Lecture			
5	TEMA 5 Duration: 02:00 Lecture			Home Exercise Individual work Continuous assessment Not Presential Duration: 02:00
6	TEMA 6 Duration: 02:00 Lecture			
7	TEMA 7 Duration: 02:00 Lecture			
8	TEMA 8 Duration: 02:00 Lecture			
9	TEMA 9 Duration: 02:00 Lecture			Segmentation practical work Individual work Continuous assessment and final examination Not Presential Duration: 03:00
10	TEMA 9 Duration: 02:00 Lecture			
11		Practica segmentación Duration: 04:00 Laboratory assignments		
12	TEMA 10 Duration: 02:00 Lecture			Registration Practical Work Individual work Continuous assessment and final examination Not Presential Duration: 03:00

13	TEMA 10 Duration: 01:00 Lecture	Practica Registro Duration: 04:00 Laboratory assignments		
14	Visita o Seminario Duration: 02:00 Additional activities			
15				Team Work presentation and report Group presentation Continuous assessment and final examination Presential Duration: 04:00
16				
17				Final Examination. Written test Final examination Presential Duration: 03:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
3	Home Exercise	Individual work	No Presential	02:00	5%	/ 10	
5	Home Exercise	Individual work	No Presential	02:00	5%	/ 10	
9	Segmentation practical work	Individual work	No Presential	03:00	20%	/ 10	CB07
12	Registration Practical Work	Individual work	No Presential	03:00	20%	/ 10	CB07
15	Team Work presentation and report	Group presentation	Face-to-face	04:00	50%	/ 10	CB09

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
9	Segmentation practical work	Individual work	No Presential	03:00	20%	/ 10	CB07
12	Registration Practical Work	Individual work	No Presential	03:00	20%	/ 10	CB07
15	Team Work presentation and report	Group presentation	Face-to-face	04:00	50%	/ 10	CB09
17	Final Examination.	Written test	Face-to-face	03:00	10%	/ 10	CB07 CB09

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Segmentation practical work	Individual work	Face-to-face	00:00	20%	/ 10	CB07
Registration Practical Work	Individual work	Face-to-face	00:00	20%	/ 10	CB07

Team Work presentation and report	Group work	Face-to-face	00:00	50%	/ 10	CB09
Final Examination	Written test	Face-to-face	00:00	10%	/ 10	CB07 CB09

7.2. Assessment criteria

"Students will be qualified through continuous evaluation by default. According to the Normativa de Evaluación del Aprendizaje de la Universidad Politécnica de Madrid, students willing to renounce to continuous evaluation must send an email to the coordinator before the end of the 4th week of the semester.

Evaluation will assess if students have acquired all the competences of the subject. Thus, evaluation through final assessment will be carried out considering all the evaluation techniques used in continuous evaluation (EX, ET, TG, etc.), and will be celebrated in the exam period approved by Junta de Escuela for the current academic semester and year. Evaluation activities that assess learning outcomes that cannot be evaluated through a single exam can be carried out along the semester. Extraordinary examination will be carried out exclusively by the final assessment method."

CONTINUOUS EVALUATION

The main items of evaluation will be:

- 50% for the evaluation of exercises and practical work (mainly segmentation and registration).
- 50% for the presentation and written report of topic related to advanced biomedical imaging.

All the students should be present and participate during the oral presentations.

FINAL ASSESSMENT FOR BOTH ORDINARY AND EXTRAORDINARY EXAMINATION PERIODS

The main items of evaluation will be:

- 10 % Written exam about the contents of the topic.
- 40% for the evaluation of exercises and practical work (mainly segmentation and registration).
- 50 % for the presentation and written report of topic related to advanced biomedical imaging.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Presented material during the lectures	Others	Available in moodle
Suetens P. "Fundamentals of Medical Imaging". 2nd ed. Cambridge Univ. Press. 2009.	Bibliography	
Phelps M.E. "Molecular Imaging and Its Biological Applications". Springer, 2004	Bibliography	
Prince J.L., Links J.M. "Medical Imaging Signals and Systems". Pearson, 2013	Bibliography	

9. Other information

9.1. Other information about the subject

This course is related with United Nations' Sustainable Development Goals, in particular with goal 3: ensure healthy lives and promote well-being for all at all ages.