



POLITÉCNICA

INTERNATIONAL
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LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicacion

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000970 - Entrepreneurship And Innovation In Biomedical Engineering

DEGREE PROGRAMME

09AU - Master Universitario en Ingeniería Biomedica

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	93000970 - Entrepreneurship And Innovation In Biomedical Engineering
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
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 *
Angel Hernandez Garcia (Subject coordinator)	A-127	angel.hernandez@upm.es	Sin horario. Appointment by e-mail.

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

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Foundations of Business Management

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

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

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

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

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE-MIB02 - Analizar los procesos organizativos y de dirección de las empresas de ingeniería biomédica para aplicar herramientas de gestión en las distintas áreas funcionales de la misma.

CG-MIB01 - Resolver problemas e integrar conocimiento en temas nuevos o escasamente definidos y en entornos multidisciplinares del área de la Ingeniería Biomédica

CG-MIB02 - Analizar y aplicar la reglamentación correspondiente a la sensibilidad social y ética en los ámbitos de operación que pueden darse en Ingeniería Biomédica

CG-MIB03 - Utilizar la filosofía, el método científico y el método experimental para la búsqueda de innovación, la curiosidad científica y el desarrollo de actitudes creativas

CG-MIB04 - Utilizar las tecnologías de la información y la comunicación para la búsqueda de información, datos bibliográficos y adquisición de nuevo conocimiento para la formación permanente y el trabajo autónomo

CG-MIB05 - Utilizar técnicas de expresión oral y escrita para comunicar trabajos y conclusiones a comunidades de iguales o divulgación científica, elaboración de artículos, manuales de estilo y herramientas de edición para fomentar la capacidad de comunicación y disseminación de resultados

CG-MIB06 - Aplicar técnicas de trabajo colaborativo en equipos multidisciplinares internacionales y liderazgo, así como utilizar métodos para asumir la responsabilidad de orientar y dirigir trabajos científicos en el ámbito de la ingeniería Biomédica

CG-MIB07 - Utilizar la lengua inglesa como herramienta de trabajo

4.2. Learning outcomes

RA88 - EN_RA22 - Learning and applying the tools to generate business models from the analysis of the current state of the technology

RA85 - EN_RA9 - Performing individual and team work by searching information sources, critical discussion and presenting the results in oral presentations

RA81 - EN_RA2 - Applying terminology commonly used in business environments

RA90 - EN_RA23 - Being able to develop a business plan

RA84 - EN_RA42 - Being comfortable with a hospital or a medical technology company context, using the competences acquired in the master's degree

RA80 - EN_RA11 - Presenting the project in written, oral and public form

* 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

The main objective of the course is to provide the knowledge and tools to better understand the process of creating a new technology-based venture (innovation-driven start-up), from the business idea to business plan development and running the business. This involves the following:

- Understanding the main concepts related to technology ventures management.
- Understanding and applying the main tools for business model generation.
- Developing the ability to search, analyze and combine business and technology information to build a business plan.

5.2. Syllabus

1. Introduction to entrepreneurship: main concepts about technology new ventures.
2. Business model generation.
 - 2.1. Business model canvas.
3. Establishing the business idea.
4. Customer analysis
 - 4.1. Market segmentation. Beachhead market selection. End user profile.
 - 4.2. Total Addressable Market (TAM) analysis. Improving end user profile.
5. Value proposition.
 - 5.1. Full Life Cycle. Product specification. Quantifying the value proposition. Competitive analysis.
6. Product acquisition: understanding customers' decision process.
7. Business model.
 - 7.1. Business model design. Lifetime Value of a Customer. Cost of Customer Acquisition.
8. Product design: defining the Minimum Viable Business Product.
9. Scaling the business.

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	<p>Course presentation Duration: 00:45 Lecture</p> <p>Team formation Duration: 00:30 Additional activities</p> <p>1. Introduction to entrepreneurship: main concepts about technology new ventures. Duration: 00:45 Lecture</p> <p>2. Business model generation Duration: 01:00 Lecture</p> <p>2. Business model generation Duration: 01:00 Cooperative activities</p>			
2	<p>2. Business model generation Duration: 01:00 Lecture</p> <p>2. Business model generation Duration: 01:00 Cooperative activities</p> <p>3. Establishing the business idea. Duration: 01:00 Lecture</p> <p>4. Customer analysis. Duration: 01:00 Lecture</p>			
3	<p>3. Establishing the business idea. Duration: 01:50 Cooperative activities</p> <p>4. Customer analysis. Duration: 01:00 Lecture</p> <p>4. Customer analysis. Duration: 01:00 Cooperative activities</p>			<p>Test 1 Online test Continuous assessment Presential Duration: 00:10</p>

4	<p>5. Value proposition Duration: 01:00 Lecture</p> <p>5. Value proposition Duration: 01:00 Cooperative activities</p> <p>6. Product acquisition Duration: 01:00 Lecture</p> <p>6. Product acquisition Duration: 01:00 Cooperative activities</p>			<p>Test 2 Online test Continuous assessment Presential Duration: 00:10</p>
5	<p>7. Business model. Duration: 01:00 Lecture</p> <p>7. Business model. Duration: 01:00 Cooperative activities</p>			<p>Intermediate presentation Group presentation Continuous assessment Presential Duration: 02:00</p>
6	<p>7. Business model. Duration: 01:00 Lecture</p> <p>7. Business model. Duration: 01:00 Cooperative activities</p> <p>8. Product design. Duration: 01:00 Lecture</p> <p>9. Scaling the business. Duration: 01:00 Lecture</p>			<p>Test 3 Online test Continuous assessment Presential Duration: 00:10</p>
7	<p>Final presentation Duration: 02:00 Additional activities</p>			<p>Cases and reports Individual work Final examination Not Presential Duration: 00:00</p> <p>Final presentation Group presentation Continuous assessment Presential Duration: 02:00</p> <p>Final presentation Group work Continuous assessment Not Presential Duration: 00:10</p>
8				<p>Attendance and participation Other assessment Continuous assessment Presential Duration: 00:00</p>

9				
10				
11				
12				
13				
14				
15				
16				
17				Final exam 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	Test 1	Online test	Face-to-face	00:10	10%	0 / 10	CG-MIB04 CG-MIB07 CB06
4	Test 2	Online test	Face-to-face	00:10	10%	0 / 10	CG-MIB04 CG-MIB07 CB06
5	Intermediate presentation	Group presentation	Face-to-face	02:00	15%	3 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09 CB10 CE-MIB02
6	Test 3	Online test	Face-to-face	00:10	10%	0 / 10	CG-MIB04 CG-MIB07 CB06
7	Final presentation	Group presentation	Face-to-face	02:00	25%	5 / 10	CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09 CB10 CE-MIB02 CG-MIB04
7	Final presentation	Group work	No Presential	00:10	20%	5 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09

							CB10 CE-MIB02
8	Attendance and participation	Other assessment	Face-to-face	00:00	10%	0 / 10	CG-MIB05 CG-MIB07

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Cases and reports	Individual work	No Presential	00:00	%	5 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09 CB10 CE-MIB02
17	Final exam	Written test	Face-to-face	03:00	100%	5 / 10	CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09 CB10 CE-MIB02

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Cases and reports	Individual work	Face-to-face	00:00	%	5 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09

						CB10 CE-MIB02
Final exam	Written test	Face-to-face	03:00	100%	5 / 10	CG-MIB03 CG-MIB04 CG-MIB05 CG-MIB06 CG-MIB07 CG-MIB01 CB06 CB07 CB09 CB10 CE-MIB02

7.2. Assessment criteria

Due to the course methodology, **students will be graded through continuous assessment by default. Students who will not be able to attend the lessons are strongly advised against enrolling in this course.** Nonetheless, students who wish to renounce continuous assessment and opt for final exam assessment (comprising one or more course assignments or deliverables) must inform the course coordinator in writing, using the corresponding link in the course page in Moodle-UPM, before the end of the third week of the course. Additionally, at the same time, students who opt-out of continuous assessment must contact the course coordinator to be informed about the content and schedule of the alternative assignments.

In order to qualify for continuous assessment, students must attend at least 80% of the sessions.

Continuous assessment includes the following assignments and final grade weights:

- Tests: 30%
- Intermediate presentation: 15%
- Final presentation: 45% (deliverable document: 20%; presentation: 25%)

- Active participation in class: 10%

The evaluation will assess the competence level achieved by students. Therefore, students renouncing to continuous assessment and opting for final exam will be subject to all the assessment techniques used in continuous assessment (EX, ET, TG, etc.). The final exam will take place in the time and place approved by "Junta

de Escuela" for the current academic semester and year. Evaluation assignments assessing learning outcomes that may not be assessed through a single exam can be completed and delivered during the semester following the instructions given by the course coordinator.

If a student opts for final exam assessment, the process will be as follows:

- The student must comply with the schedule of deliverables appointed by the course coordinator, and obtain a grade equal to or higher than 5.0 points. If any of the deliverables receives grades lower than 5.0 points, the final grade will be the average of those deliverables.
- If all the deliverables receive a grade equal to or higher than 5.0 points, the final exam will include questions about both theoretical and practical concepts seen in the course and developed in the deliverables. The final grade will then be calculated only upon the final exam score.

Assesment of the extraordinary final exam will follow the final exam assessment option only. In this case, the student must contact the course coordinator at least two weeks before the official examination date approved by "Junta de Escuela" because the deliverables must be sent at least one week before the examination date.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Aulet, B. (2013). Disciplined entrepreneurship: 24 steps to a successful startup. John Wiley & Sons. Hoboken, New Jersey	Bibliography	Course textbook

http://moodle.upm.es/titulaciones/oficiales	Web resource	Materials made by the course instructors: presentations, documents, cases, etc.
Aulet, B. (2017). Disciplined entrepreneurship workbook John Wiley & Sons. Hoboken, New Jersey	Bibliography	Course workbook
Lee, J. S. (2010). Biomedical engineering entrepreneurship. World Scientific. Chicago	Bibliography	Supplementary bibliography

9. Other information

9.1. Other information about the subject

- Communications between the instructor and students: In order to facilitate the communication with the instructors, and whenever the questions or doubts cannot be solved during the class, e-mail will be the preferred way to direct any inquiry, question or doubt about the course to the instructors. Additionally, office hours and meetings will also be requested by e-mail.
- Supporting tools and technologies: Certain tasks and activities may require the use of Moodle, Zoom or Microsoft Teams. If there is a mandate or recommendation for the use of other digital tools from the authorities (University, State), the information about the alternative means of communication/assessment/teaching will be communicated to the students in advance
- Sustainable development goals: the course aims to foster awareness and knowledge about the Sustainable Development Goals through the development and presentation of projects that motivate students to work on different solutions from a biomedical engineering perspective. More specifically, the course will contribute to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship (SDG 4.4)