

## Program

### 2. Doctor of Philosophy Program

#### Prerequisite courses

The following courses are required prerequisites. If a student does not have evidence on their undergraduate transcript that they have received credit for these courses they must take them as part of the Ph.D. curriculum.

- 506401 Cell and Molecular Biology for Bioengineering 3(3-0-6)
- 506402 Physiology for Bioengineering 3(3-0-6)
- 506403 Organic Chemistry and Biochemistry for Bioengineering 3(3-0-6)

#### 2.1 Credits

##### Type 1

- Type 1.1 For master's degree students = 48 credits
- Type 1.2 For bachelor's degree students = 72 credits

##### Type 2

- Type 2.1 For master's degree students = 48 credits
- Type 2.2 For bachelor's degree students = 72 credits

#### 2.2 Course structure

##### 2.2.1 Course structure Type 1.1

<b>Total credits of the program</b>	<b>48</b>	Credits
1) Foundation subjects	<b>(non-credit)</b>	Credits
2) Dissertation	<b>48</b>	Credits

##### 2.2.2 Course structure Type 1.2

<b>Total credits of the program</b>	<b>72</b>	Credits
1) Foundation subjects	<b>(non-credit)</b>	Credits
2) Dissertation	<b>72</b>	Credits

##### 2.2.3 Course structure Type 2.1

<b>Total credits of the program</b>	<b>48</b>	Credits
1) Foundation subjects	<b>3</b>	Credits
- Basic subjects	<b>(non-credit)</b>	Credits
- Required subjects	<b>3</b>	Credits

2) Supporting subject	9	Credits
3) Dissertation	36	Credits

### 2.2.4 Course structure Type 2.2

<b>Total credits of the program</b>	<b>72</b>	Credits
1) Foundation subjects	12	Credits
- Basic subjects	<b>(non-credit)</b>	Credits
- Required subjects	12	Credits
2) Supporting subject	12	Credits
3) Dissertation	48	Credits

### 2.3 Subjects

1. Basic Subjects (Basic Subjects)		<b>Credits</b>
Type 2.1 and Type 2.2		(Lecture - Practical - Self-Study)
506591	Research Methods	1(1-0-2)
Note	All students must attend a seminar organized by the Faculty of Engineering	
2. Required subject		
<u>Type 2.1</u>		
506711	Advanced Topics in Bioengineering	3(3-0-6)
<u>Type 2.2</u>		
506511	Bioengineering and Applications	3(3-0-6)
506512	System Bioengineering	3(3-0-6)
506513	Bioeconomics and Entrepreneurship in Biotechnology	3(3-0-6)
506711	Advanced Topics in Bioengineering	3(3-0-6)
3. Elective subject		
Choose any course not less than nine credits for types 2.1 or 2.2 for the 12 credits selected from any courses. Under the guidance of an advisor or dissertation supervisor.		

Biomaterials Engineering		
506621	Biomaterials Engineering	3(3-0-6)
506622	Design and Applications of Biomaterials	3(3-0-6)
506623	Characterization of Biomaterials	3(3-0-6)
506624	Polymeric Biomaterials	3(3-0-6)
506625	Advanced Bioceramics	3(3-0-6)
506626	Advanced Surface Engineering	3(3-0-6)
506628	Special Topics in Biomaterials Engineering I	3(3-0-6)
506629	Special Topics in Biomaterials Engineering II	3(3-0-6)
Biomedical Engineering		
506631	Modelling in Biomedical Engineering	3(3-0-6)
506632	Biomedical Instrumentation	3(3-0-6)
506633	Metabolic System and Regulation	3(3-0-6)
506634	Design of Medical Devices and Implants	3(3-0-6)
506635	Rehabilitation Engineering and Assistive Technology	3(3-0-6)
506638	Special Topics in Biomedical Engineering I	3(3-0-6)
506639	Special Topics in Biomedical Engineering II	3(3-0-6)
Bioprocess Engineering		
506641	Biochemical Engineering	3(3-0-6)
506642	Bioseparation Engineering	3(3-0-6)
506643	Metabolic Engineering	3(3-0-6)
506644	Biological System Modelling and Controls	3(3-0-6)
506645	Biotransport Phenomena	3(3-0-6)
506646	Biological Reaction Engineering and Bioreactor Design	3(3-0-6)
506647	Enzymatic Engineering	3(3-0-6)
506648	Special Topics in Bioprocess Engineering I	3(3-0-6)
506649	Special Topics in Bioprocess Engineering II	3(3-0-6)

Bioelectronics, Bioimaging and Bioinformatics		
506651	Advanced Mathematics for Bioengineering	3(3-0-6)
506652	Algorithms for Functional Genomics	3(3-0-6)
506653	Computational Biology and Bioinformatics	3(3-0-6)
506654	Machine Learning	3(3-0-6)
506655	Signals and Systems	3(3-0-6)
506656	Statistical Signal Processing in Biomedical Engineering	3(3-0-6)
506657	Digital Image Processing	3(3-0-6)
506658	Special Topics in Bioelectronics, Bioimaging and Bioinformatics I	3(3-0-6)
506659	Special Topics in Bioelectronics, Bioimaging and Bioinformatics II	3(3-0-6)
Biopharmaceutical Engineering		
506661	Pharmaceutical Process Design	3(3-0-6)
506662	Pharmaceutical Kinetics, Thermodynamics and Transport Processes	3(3-0-6)
506663	Pharmaceutical Materials and Pharmaceutical Organic Nanotechnology	3(3-0-6)
506664	Nanotechnology-based Drug Design and Delivery	3(3-0-6)
506665	Structure and Function of Drugs	3(3-0-6)
506666	Chemical Tools for Assessing Biological Function	3(3-0-6)
506668	Special Topics in Biopharmaceutical Engineering I	3(3-0-6)
506669	Special Topics in Biopharmaceutical Engineering II	3(3-0-6)
Stem Cell and Biomolecular Engineering		
506671	Molecular and Genetic Engineering	3(3-0-6)
506672	Protein Engineering	3(3-0-6)
506673	Cell and Protein Interaction	3(3-0-6)
506674	Tissue Engineering and Stem Cell Processing	3(3-0-6)
506675	Tissue, Cellular and Molecular Basis of Disease	3(3-0-6)

506676	Stem Cells in Organogenesis, Carcinogenesis and Atherogenesis	3(3-0-6)
506678	Special Topics in Stem Cell and Biomolecular Engineering I	3(3-0-6)
506679	Special Topics in Stem Cell and Biomolecular Engineering II	3(3-0-6)
If necessary, students can choose courses from other institutions. Not more than three credits of electives with the approval of the Faculty of Engineering		
4.Dissertation		
506898	Dissertation	48(0-0-144)
506899	Dissertation	72(0-0-216)
506998	Dissertation	36(0-0-108)
506999	Dissertation	48(0-0-144)

## 2.4 Education programs. Doctor of Philosophy Program

### Type 1.1

<b>The first semester</b>		
506591	Research Methods	Non-credit
506898	Dissertation	3(0-0-9)
	Credits	<u>3</u>
<b>The first semester</b>		
506898	Dissertation	9(0-0-27)
	Credits	<u>9</u>
<b>The second semester</b>		
506898	Dissertation	9(0-0-27)
	Credits	<u>9</u>
<b>The second semester</b>		
506898	Dissertation	9(0-0-27)
	Credits	<u>9</u>
<b>The third semester</b>		
506898	Dissertation	9(0-0-27)
	Credits	<u>9</u>

The third semester		
506898	Dissertation	9(0-0-27)
		Credits 9
		Total 48 Credits

Type 1.2

The first semester		
506591	Research Methods	Non-credit
506898	Dissertation	9(0-0-27)
		Credits 9
The first semester		
506898	Dissertation	9(0-0-27)
		Credits 9
The second semester		
506898	Dissertation	9(0-0-27)
		Credits 9
The second semester		
506898	Dissertation	9(0-0-27)
		Credits 9
The third semester		
506898	Dissertation	9(0-0-27)
		Credits 9
The third semester		
506898	Dissertation	9(0-0-27)
		Credits 9
The fourth semester		
506898	Dissertation	9(0-0-27)
		Credits 9
The fourth semester		
506898	Dissertation	9(0-0-27)
		Credits 9
		Total 72 Credits

## Type 2.1

The first semester		
506591	Research Methods	Non-credit
506711	Advanced Topics in Bioengineering	3(3-0-6)
506xxx	Elective Course I	3(3-0-6)
		Credits <u>6</u>
The first semester		
506xxx	Elective Course II	3(3-0-6)
506xxx	Elective Course III	3(3-0-6)
		Credits <u>6</u>
The second semester		
506998	Dissertation	9(0-0-18)
		Credits <u>9</u>
The second semester		
506998	Dissertation	9(0-0-18)
		Credits <u>9</u>
The third semester		
506998	Dissertation	9(0-0-18)
		Credits <u>9</u>
The third semester		
506998	Dissertation	9(0-0-18)
		Credits <u>9</u>
		<b>Total</b> <u>48</u> Credits

## Type 2.2

The first semester		
506591	Research Methods	Non-credit
506511	Bioengineering and Applications	3(3-0-6)
506512	System Bioengineering	3(3-0-6)
506513	Bioeconomics and Entrepreneurship in Biotechnology	3(3-0-6)
		Credits <u>9</u>

The first semester		
506xxx	Elective Course I	3(3-0-6)
506xxx	Elective Course II	3(3-0-6)
506xx	Elective Course III	3(3-0-6)
		Credits <u>9</u>
The second semester		
506711	Advanced Topics in Bioengineering	3(3-0-6)
506999	Dissertation	3(0-0-9)
506xxx	Elective Course IV	3(3-0-6)
		Credits <u>9</u>
The second semester		
506999	Dissertation	9(0-0-18)
		Credits <u>9</u>
The third semester		
506999	Dissertation	9(0-0-18)
		Credits <u>9</u>
The third semester		
506999	Dissertation	9(0-0-18)
		Credits <u>9</u>
The fourth semester		
506999	Dissertation	9(0-0-18)
		Credits <u>9</u>
The fourth semester		
506999	Dissertation	9(0-0-18)
		Credits <u>9</u>
		<b>Total</b> <u>72</u> Credits