

## 2017 级生物工程专业(产业计划)培养方案

### Curriculum for Undergraduate of Biological Engineering Major

#### 一、培养目标

本专业培养思想素质高、基础扎实、实践能力强、工程能力强、具有创新精神的高素质应用型人才，期待毕业生五年左右达到以下目标：

1. 具备扎实的数学、自然科学和工程科学基础知识，良好的人文素养、社会责任感和职业道德；
2. 掌握生物工程专业领域的基础理论和专业知识，掌握生物技术及其产业化的科学原理、工艺技术过程和工程设计等基础理论及其相关实验技能，具有在生物技术与生物医药工程领域从事生物产品的生产、开发和工程设计、质量检测和企业管理等方面的工程实践能力；
3. 具有对生物工程专业文献资料检索、综合的能力，了解本专业和相关专业的科技发展动态，具有一定的科学研究能力及创新意识；
4. 具有良好的表达和沟通能力以及团队合作和组织管理能力；
5. 具有终身学习的意识，具备不断学习和适应发展的能力；
6. 具有国际视野和良好的外语应用能力。

#### I. Training objectives

This curriculum for Biological Engineering talents plans to train undergraduate students to be high-quality application-oriented talents who possess high ideological quality, solid foundation, strong practical ability, strong engineering ability and innovative spirit as well. The graduates were expected to achieve the following goals within five years:

1. Equipped with solid knowledge of mathematics, natural science and Engineering Science; Balanced in their development of good humanities, social responsibility and professional ethics.
2. Master the basic theory and professional knowledge in the professional field of biological engineering; Master the sound knowledge of scientific principle, technique process and engineering design theory about multifarious biological technology and equipped with related practical skills in its industrialization; qualified for research, development and management positions in such fields as biotechnology and biomedical Engineering.
3. Have the ability to search and integrate the literature of the bioengineering specialty; understand the science and technology development of the major and related major, have certain scientific research ability and innovation consciousness.
4. Equipped with good presentation and communication skills, and team work and organizational management skills as well.
5. Equipped with the sense of lifelong learning, possess the ability to learn and adapt to development.
6. Equipped with international vision and good foreign language skills.

## **二、毕业要求**

1. 工程知识：能够将数学、自然科学、工程基础和专业知用于解决生物工程产品的生产、开发和工程设计、质量检测等复杂工程问题。
2. 问题分析：能够应用数学、自然科学和工程科学的基本原理，识别、表

达、并通过文献研究分析生物工程、生物化工等专业领域复杂工程问题，以获得有效结论。

3. 设计/开发解决方案：能够设计针对生物工程专业领域复杂工程问题的解决方案，设计满足特定需求的生物质分离制备工艺、发酵工程设备参数、新型细胞工厂等，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。

4. 实验设计与信息处理：能够基于科学原理并采用科学方法对生物工程技术、生物工程设备等复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。

5. 现代工具的应用：能够针对生物工程专业领域的复杂工程问题，开发、选择与使用恰当的生物技术、资源、现代工程工具和信息技术工具，包括对生物信息学复杂工程问题的预测与模拟，并能够理解其局限性。

6. 工程师社会责任意识：能够基于工程相关背景知识进行合理分析，利用生物科学知识、生物工程应用及生物安全规范来评价生物工程实践和复杂工程问题解决方案对社会、健康、安全、法律以及文化的影响，并理解应承担的责任。

7. 环境和可持续发展：能够理解和评价针对生物工程技术中复杂工程问题的工程实践对环境、社会可持续发展的影响。

8. 职业道德与规范：具有人文社会科学素养、社会责任感，能够在生物工程项目实践中理解并遵守工程职业道德和规范，履行责任。

9. 团队合作：能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色。

10. 沟通：能够就生物工程产品的生产、开发和工程设计、质量检测等复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令，并具备一定的国际视野，能够在跨文化背景下进行沟通和交流。

11. 项目管理：面向生物工程项目的多学科环境，理解、掌握并应用工程管理原理与经济决策方法。

12. 终身学习：具有自主学习和终身学习的意识，有不断学习和适应发展的能力。

## **II.Requirements**

01. Engineering knowledge: have the ability to apply mathematics, natural science, engineering foundation and professional knowledge for solving complicated engineering problems such as production, development, engineering design and quality inspection of bioengineering products and so on.

02. Problem analysis: have the ability to apply basic principles of mathematics, natural science and engineering science, recognize, express, analyze complicated engineering problems in the biological engineering, biochemical engineering fields through literature research and obtain valid conclusions.

03. Design or develop solutions: have the ability to design solutions for complicated engineering problems in the biological engineering field, design biomass separation technology, the parameters for fermentation engineering equipments and the new cell factory to meet the special needs, and reflect innovation consciousness and consider the social, health, safety, law, culture and

environment factors in the process of designing.

04. Experimental design and information processing: have the ability to research on complicated engineering problems such as biological engineering technology and bioengineering equipment based on scientific principles by using scientific methods, including experimental design, analysis and interpretation of data, and reasonable and effective conclusions obtained through information integration.

05. Application of modern tools: have the ability to develop, select and use appropriate technology, biological resources, modern engineering tools and information technology tools for the complicated engineering problems in the biological engineering field, including the prediction and simulation of complicated bioinformatics engineering problems.

06. The sense of social responsibility for engineers: have the ability to reasonably analyze based on engineering-related knowledge and evaluate the impact of biological engineering practice and the solutions for complicated engineering problems according to biological knowledge, application of biological engineering and biological safety standards on society, health, safety, law and culture, and understand the responsibilities.

07. Environment and sustainable development: have the ability to understand and evaluate the impact of engineering practices for those complex engineering biotechnology problems on the environmental and social sustainability.

08. Professional ethics and criteria: have the humanistic community and Science literacy, social responsibility, and have the ability to understand, comply with

the professional ethics and criteria and fulfill their responsibilities when practicing the bioengineering projects.

09. Teamwork: have the ability to take on the roles of individuals, members and leaders in a multidisciplinary team.

10. Communication: have an effective communication and exchanges with the industry peers and the public for the complicated engineering problems such as the production, development, engineering design, quality inspection of bioengineering products, including report writing, manuscript designing and presentation, clear expression or response to instructions, and have a certain international vision and the ability to communicate under the intercultural background.

11. Project management: understanding, mastering and applying the principles of engineering management and making economic decision when facing a multidisciplinary environment for biological engineering projects.

12. Lifelong learning: have the sense of autonomous learning and lifelong learning and have the ability to learn and adapt to development.

#### 附：培养目标实现矩阵

	培养目标 1	培养目标 2	培养目标 3	培养目标 4	培养目标 5	培养目标 6
毕业要求 1	√					
毕业要求 2		√				
毕业要求 3	√	√				
毕业要求 4		√				
毕业要求 5		√				

毕业要求 6	√					
毕业要求 7			√			
毕业要求 8	√					
毕业要求 9				√		
毕业要求 10				√		√
毕业要求 11		√		√		
毕业要求 12					√	

### 三、专业主干课程

有机化学、药物化学、生物化学、微生物学、分子生物学、基因工程、化工原理、发酵工程、酶工程、生物分离工程、生物工程设备。

### III. Core courses

Organic chemistry, Pharmaceutical Chemistry, Biochemistry, Microbiology, Molecular biology, genetic engineering, Chemical engineering principles, Fermentation engineering, Enzyme Engineering, Bio-separation engineering, Bio-engineering equipment.

### 四、基本学制：四年

### IV. Recommended length of the program

Generally, students need 4 years to complete their studies. It is also acceptable to complete all required credits in flexible 3 to 6 years.

### 五、授予学位：工学学士

### V. Degree: Bachelor of Engineering

学生修满所规定的最低毕业学分，符合武汉科技大学授予学士学位规定，授予工学学士学位。

## 六、毕业学分要求：174 学分

课程类型	学分要求	课程类型	学分要求	
1、通识教育平台课程	38	3、专业课程模块	57	
必修课程	34	必修课程	30	
选修课程 *	4	选修课程	专业方向课程	9
2、学科基础平台课程	53.5		专业选修课程	18 (32)
必修课程	46.5	4、实践教学模块	19.5	
选修课程	7 (19)	5、素质拓展模块	6	

\*通识教育选修课 4 学分包括：人文社科类 1 学分、艺术体育类 1 学分、自然科学类 1 学分、经济管理类 1 学分

## VI. Credits required for graduation: 174 credits

Type of courses	Academic credits	Type of courses	Academic credits	
1.Courses of general education	38	3. Specialized Courses	57	
Required courses	34	Core specialized courses	30	
Elective courses	4	Elective courses	Directional specialized courses	9
2. General disciplinary courses	53.5		Elective specialized courses	18 (32)
Required courses	46.5	4.Practicum and internship courses	19.5	
Elective courses	7 (19)	5. Quality development courses	6	



## 毕业要求实现矩阵

## VII. Graduation Realization Matrix

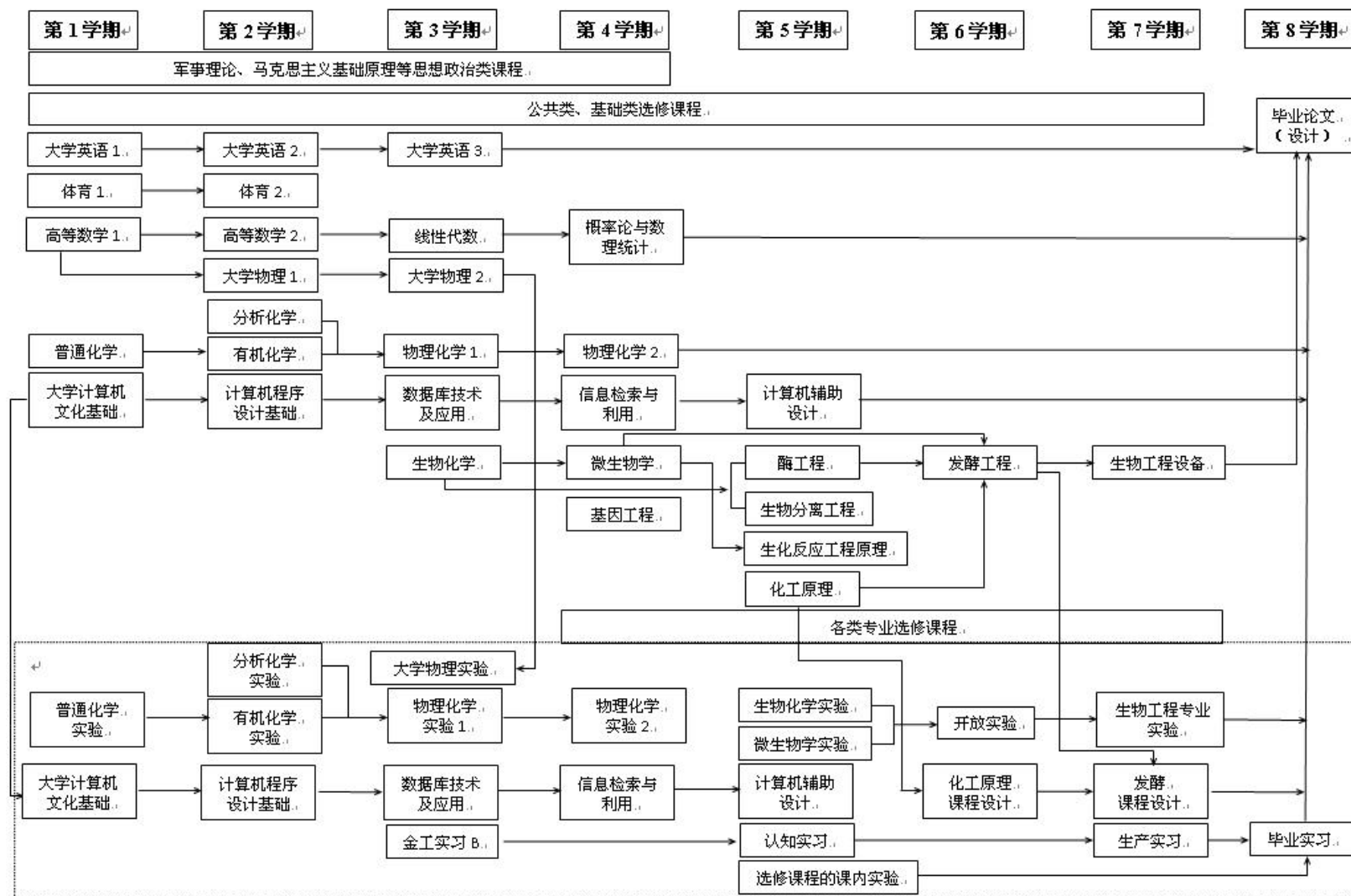
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课程名称	生物工程专业毕业要求											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
生物催化与代谢工程	√						√					
生物制药技术	√						√					
生物制药工艺学	√											
药剂学	√											
生物转化	√						√					
生物炼制	√						√					
制药过程与工艺	√						√					
食品工艺学	√											
药物化学	√											
分子生物学	√											
细胞生物学	√											
波谱分析	√	√										
生物统计学	√				√							
生物信息学	√				√							
专业英语	√	√	√									√
细胞工程	√											
环境生物技术	√						√					
免疫学基础	√	√										
生物能源	√	√					√					
传递过程基础	√	√										
现代分析与测试技术	√	√										
开放实验	√		√	√		√		√	√	√		√
企业文化学习											√	√
天然产物化学	√	√										
金工实习	√	√				√		√		√		√

课程名称	生物工程专业毕业要求											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
认识实习	√	√				√		√		√		√
生产实习	√	√				√		√		√		√
毕业实习	√	√				√		√		√		√
毕业设计(论文)	√	√	√	√	√	√		√		√		√

## 八、课程修读进程表



## IX. Offered Course and Distribution of Academic Credits

## IX. Offered Course and Distribution of Academic Credits

课程类型		课程性质	课程编码	课程名称	学分	合计	课内学时			实践学时	学期	先修课程/备注		
							讲课	实验	上机					
平台	通识教育平台课程	必修	0601009	思想道德修养与法律基础 Moral Cultivation and Basics of Law	2	32	32	0	0	0	1			
			0606007	中国近现代史纲要 An Outline of Modern and Contemporary History of China	2	32	26	0	0	0	1			
			0605009	马克思主义基本原理 Fundamentals of Marxism	2	32	32	0	0	0	2			
			0603016	毛泽东思想与中国特色社会主义理论体系概论 Theoretical system of socialism with Chinese characteristics	3	48	48	0	0	0	2			
			1303601	大学计算机文化基础 A Cultural Basis of College Computer Science A	3	48	30	0	18	0	1			
			1401604	大学综合英语（一） College English (I)	4	64	64	0	0	0	1			
			1401605	大学综合英语（二） College English (II)	4	64	64	0	0	0	2			
			1401606	大学综合英语（三） College English (III)	4	64	64	0	0	0	3			
			1501882	体育(一) Physical Education(I)	1	26	26	0	0	0	1			
			1501883	体育(二) Physical Education(II)	1	34	34	0	0	0	2			
			2501004	大学生心理健康教育 Mental Health Education	1	16	16	0	0	0	1			
			2501003	职业生涯规划与就业指导 Career Plan and Vocational Guidance	1	16	16	0	0	0	6			
			2501001	军事理论与训练 Military Theory and Training	3	3周	0	0	0	3周	1			
			2501002	公益劳动 Community Service	1	16	0	0	0	16	1-4	分散进行		
		0601016	形势与政策 World Affairs and State Policy	2	32	32	0	0	0	1-7	分散进行			
		选修		人文社科类 1 学分 Humanity and Social Science 1 Academic Credits										
				经济管理类 2 学分 Economic and Management 2 Academic Credits										
	自然科学类 0 学分 Natural Science 0 Academic Credits													

学科基础平台课程			艺术体育类 1 学分 Artistic and Sports 1 Academic Credits								
	必修	0702603	高等数学 B(一) Advanced Mathematics B (I)	4	64	64	0	0	0	1	
		0702604	高等数学 B(二) Advanced Mathematics B (II)	5	80	80	0	0	0	2	
		0703605	大学物理 B(一) College Physics B(I)	2.5	40	40	0	0	0	2	
		0703606	大学物理 B (二) College Physics B(II)	2	32	32	0	0	0	3	
		0703607	大学物理实验 B Experiments in College Physics B	1.5	24	0	24	0	0	3	
		1303604	计算机程序设计基础(C) Basics of Computer Programming(C)	4	64	40	0	24	0	2	
		0302609	工程制图 B Engineering Drawing B	3	48	40	0	8	0	2	
		2204012	生物化学 Biochemistry	4	64	64	0	0	0	3	
		2204035	生物化学实验 Biochemical Experiments	1.5	24	0	24	0	0	5	
		2206681	分析化学 B Pharmaceutical Chemistry	2	32	32	0	0	0	2	
		2206682	分析化学实验 B	1.5	24	0	24	0	0	2	
		2206006	普通化学 General Chemistry	2	32	32	0	0	0	1	
		2206631	普通化学实验 Experiments in General Chemistry	1	16	0	16	0	0	1	
		2206671	有机化学 A Organic Chemistry A	4	64	64	0	0	0	2	
		2206672	有机化学实验 A Organic Chemical Experiment A	2.5	40	0	40	0	0	2	
		2206675	物理化学 B(一) Physical Chemistry B(I)	2	32	32	0	0	0	3	
		2206676	物理化学 B(二) Physical Chemistry B(II)	1.5	24	24	0	0	0	4	
		2206677	物理化学实验 B(一) Experiments in Physical Chemistry B(I)	1.5	24	0	24	0	0	3	
		2206678	物理化学实验 B(二) Experiments in Physical Chemistry B(II)	1	16	0	16	0	0	4	
	选修	0401001	电工技术 Electrotechnics	2	32	24	8	0	0	3	
		0502004	管理学原理 Principles of Management	2	32	32	0	0	0	4	
		0702026	线性代数 Linear Algebra	2	32	32	0	0	0	3	

模块	专业 课程 模块	专业 核心 课程	必修	0702003	概率论与数理统计 B Probability Theory and Mathematical Statistics B	2.5	40	40	0	0	0	4	
				1601004	信息检索与利用 Information Retrieval	1	16	8	0	8	0	4	
				1303605	数据库技术及应用 Database technology and Application	3	48	24	0	24	0	3	
				2202056	现代分析与测试技术 Modern Analysis and Testing Technologies	2	32	32	0	0	0	7	
				2202081	计算机辅助设计 Computer Aided Design	2.5	40	20	0	20	0	5	
				0108025	技术经济与投资分析 Resources and Environmental Economics	2	32	32	0	0	0	3	
	专业 课程 模块	专业 核心 课程	必修	2204017	微生物学 Microbiology	3	48	48	0	0	0	4	
				2204044	微生物学实验 Microbiological Experiments	1	16	0	16	0	0	5	
				2203003	化工原理 Principles of Chemical Engineering	5	80	68	12	0	0	5	
				2204007	基因工程 Gene Engineering	2	32	32	0	0	0	4	
				2204003	发酵工程 Fermentation Engineering	3	48	48	0	0	0	6	微生物 学
				2204010	生物分离工程 Bio-separation Engineering	3	48	48	0	0	0	5	
				2204040	生物工程专业实验 Bioengineering Professional Experiment	6	96	0	96	0	0	7	发酵工 程, 生 物分离 工程
				2204008	酶工程 Enzyme Engineering	2	32	32	0	0	0	5	生物化 学
				2204045	生物工程设备 Biochemical Engineering Equipments	2	32	32	0	0	0	7	研讨课
				2204046	生化反应工程原理 Biochemical Reaction Engineering Principle	3	48	48	0	0	0	5	微生物 学
	专业 方向 课程	选修		方向一	生物制药工程方向								
				2204062	生物催化与代谢工程 Bio-catalysis and Metabolic Engineering	3	48	48	0	0	0	6	酶工程
				2204048	生物制药技术 Biopharmaceutical Manufacturing Technologies	2	32	32	0	0	0	6	
				2204057	生物制药工艺学 Biopharmaceutical Technology	2	32	32	0	0	0	6	
				2204058	药剂学 Pharmaceutics	2	32	32	0	0	0	6	



				方向二	工业生物技术方向								
				2204063	生物转化 Biotransformation	2	32	32	0	0	0	6	酶工程
				2204612	生物炼制 Bio-refineries	2	32	32	0	0	0	6	
				2204025	制药过程与工艺 Pharmaceutical Process and Technology	2	32	32	0	0	0	6	
				2204064	食品工艺学 Food Technology	3	48	48	0	0	0	6	
		专业 任选 课程	选修	2204020	药物化学 Pharmaceutical Chemistry	3	48	48	0	0	0	4	
				2204041	分子生物学 Molecular Biology	2	32	32	0	0	0	4	生物化学
				2204019	细胞生物学 Cell Biology	2	32	32	0	0	0	4	
				2202002	波谱分析 Spectroscopic Analysis	2	32	32	0	0	0	5	
				2204014	生物统计学 Biostatistics	2	32	32	0	0	0	5	
				2204023	生物信息学 Bioinformatics	2	32	22	0	10	0	5	
				2204032	专业英语 Specialized English	2	32	32	0	0	0	5	
				2204049	食品生物加工技术 Food Bio-processing Technology	3	48	48	0	0	0	6	
				2204018	细胞工程 Cell Engineering	2	32	32	0	0	0	5	
				2204051	环境生物技术 Environmental Biotechnology	2	32	32	0	0	0	6	
				2204052	免疫学基础 Immunology Foundation	2	32	32	0	0	0	5	
				2204055	生物能源 Bio-energy	2	32	32	0	0	0	6	
				2203001	传递过程基础 Fundamentals of Transfer Process	2	3	32	0	0	0	6	
				2204054	开放实验 Opening Experiments	1	16	0	16	0	0	6	
				2204059	企业文化学习 Company Culture Learning	1	2周	0	0	0	2周	7	
				2206067	天然产物化学 Natural Product Chemistry	2	32	32	0	0	0	4	
				1701005	金工实习 B Metalworking Practice B	1.5	48	0	0	0	48	3	
				2202052	认识实习 Introductory Practice	2	2周	0	0	0	2周	5	
				2204043	发酵工程课程设计 Course Project of Fermentation Engineering	1	2周	0	0	0	2周	7	

	实践教学模块	必修	2203004	化工原理课程设计 Course Project in Principles of Chemical Engineering	1	2周	0	0	0	2周	6	
			2204031	生产实习 Production Practice	4	4周	0	0	0	4周	7	
			2204097	毕业实习 Pre-graduation Practice Experience	2	2周	0	0	0	2周	8	
			2202098	毕业设计(论文) Pre-graduation Internship	8	14周	0	0	0	14周	8	
	素质拓展模块	必修		创新教育 3 学分 Innovation Education 3 Academic Credits								
			第二课堂 3 学分 Second Classroom 3 Academic Credits									

## 十、教学进程安排表

学期	周 次																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	♀	♀	☉/★	★	★	□	□	□	□	□	□	□	□	□	□	□	□	□	□	●								
2	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	●										
3	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	●								
4	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	●									
5	+	+	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	●									
6	×	×	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	●								
7	/	/	/	/	×	×	□	□	□	□	□	□	□	□	□	□	□	□	□	●								
8	#	#	※	※	※	※	※	※	※	※	※	※	※	※	※	※	√	+										

符号说明:

- 1、♀ 入学前机动 2、☉ 入学教育 3、★ 军训 4、□ 理论教学 5、√ 机动时间 6、● 考试 7、× 课程设计 8、E 专业实验或实习 9、— 假期  
 10、▲ 学年论文 11、G 技能训练 12、※ 毕业设计(论文) 13、+ 毕业鉴定 14、# 毕业实习 15、S 写生 16、/ 生产实习(金工实习)  
 17、T 教材教法 18、☆ 教育实习 19、○ 技能教育实习 20、◎ 专题讲座 21、◆ 公益劳动 22、△ 社会调查 23、+ 认识实习