

生物工程专业培养方案

Undergraduate Program of Bioengineering Specialty

I. 专业介绍 Introduction

2000 年,西南交通大学在原化学教研室基础上成立西南交通大学生物工程系。2005 年,西南交通大学生物工程系更名为西南交通大学生物工程学院。2008 年 7 月,生物工程学院与药学院合并组建西南交通大学生命科学与工程学院。生物工程专业成立于 2000 年,是学校生命板块和四大行动计划重点建设的本科专业,2010 年被评为四川省本科高校省级特色专业,2019 年进入四川省一流专业建设点。2013 年经国家教育部批准,西南交通大学与美国乔治亚州立大学合作举办生物工程专业本科教育项目(3+1)。本专业为四川及西南各省地方经济和生物工程相关产业发展做出了卓越贡献,是学院“药物与载体材料”单列博士学位点、“药学”与“生物学”一级学科硕士点、“生物工程”专业硕士点的重要生源。

生物工程是应用生物学、化学和工程技术等方法,按需利用、改造和设计生物体的结构与功能,从而经济、有效、规模化地制达各种产产品,是以生物技术为基础,借助工程技术实现产业化为基本任务的工学专业。生物工程的研究对象包括微生物细胞、动物细胞、植物细胞以及生化物质等。本专业不仅涉及生物工程设备、生物生产工艺、工厂设计、自动化控制等宏观工程内容,也涵盖基因、酶、细胞、代谢途径和代谢调控等分子水平微观工程内容。其主要内容可分为基因工程、发酵工程、蛋白质与酶工程、细胞工程和生化工程等部分。生物工程广泛应用于医药、食品、化工、农业、能源、资源和环境等领域,是一个生物学、化学、化工、机械工程、自动化技术、材料科学等多学科交叉的工程专业。

In 2000, Southwest Jiaotong University established the Department of Bioengineering on the basis of the original Chemistry Teaching and Research Office. The Department of Bioengineering of Southwest Jiaotong University was renamed the School of Bioengineering of Southwest Jiaotong University in 2005. In July 2008, the School of Bioengineering and the School of Pharmacy merged to form the School of Life Sciences and Engineering of Southwest Jiaotong University. The undergraduate Bioengineering major was established in 2000, of which the major is the Life Section and the key undergraduate major of “Four Action Plans” of the university. It was selected as the provincial featured undergraduate major/program in Sichuan province in 2010 And the first-class professional construction point of Sichuan province in 2019. In 2013, the Bioengineering major (3 plus 1) cooperated by Southwest Jiaotong University and Georgia State University (USA) was approved by the Ministry of Education. This major has made outstanding contributions to the development of local economy and bioengineering related industries in Sichuan and other southwest provinces, and is an important source of students for doctoral degree in drugs and carrier Materials, the master's degree in the first-level disciplines of "pharmacy" and "biology" and the professional master's degree in "bioengineering".

Bioengineering is an engineering specialty based on biotechnology and the basic task of realizing industrialization by means of biotechnology, using, adapting and designing the structure and function of organisms on demand, so as to produce various products in an economical, efficient and large-scale manner. The research objects of bioengineering include microbial cells,

animal cells, plant cells and biochemical substances. This major and program not only involves bioengineering equipment, biological production process, factory design, automation control and other macro-engineering content, but also covers genes, enzymes, cells, metabolic pathways and metabolic control and other molecular level microengineering. Its main contents can be divided into genetic engineering, fermentation engineering, protein and enzyme engineering, cell engineering and biochemical engineering. Bioengineering is widely used in medicine, food, chemical, agriculture, energy, resources and the environment and other fields, is a multidisciplinary cross-disciplinary engineering disciplines involve in biological, chemical, chemical engineering, mechanical engineering, automation technology, materials science and other specialty.

专业代码: 083001

Program Code: 083001

专业名称: 生物工程

Program Name: Bioengineering

II.培养目标 Objectives

本专业培养适应现代生物工程技术发展以及经济、社会发展需要的人才。具备坚实的生物学和工程学理论基础,具有生物工程专业系统知识和专门技能,具有良好的人文社会科学素养、协作精神、工程职业道德、社会责任感和国际化视野,具备生物工程产业化技术与产品研发、生产与技术管理、工艺与工程设计、经营管理等工作能力和技术创新能力,成为所从事领域的专业技术和管理工作的骨干。

This major trains the students to meet the needs of modern bioengineering technology development and economic and social development. Possess solid theoretical basis of biology and engineering, systematic knowledge and specialized skills in bioengineering, good humanities and social sciences literacy, collaboration spirit, engineering professional ethics, social responsibility and international vision, and working ability of bioengineering industrialization technology and technological innovation ability, such as product research and development, production and technology management, quality management and control, process and engineering design, operation management, etc. The graduates could become the backbone of professional technology and management in the field.

生物工程专业培养目标可分解为: (毕业后五年可达到的职业和专业成就)

培养目标 1: (基本工作能力)能够在独立工作中有效运用自然科学、工程基础技术、生物工程专业知识、以及经济、管理和相关法律法规知识,解决复杂工程问题,能取得相应岗位的资质和职称。

培养目标 2: (合格团队成员)具备全局观和丰富的工程经验,具有从事生产过程的新技术、新工艺的研究与设计、开发与应用的能力,具有一定的创新能力和创业潜力,并能提出独立专业见解。

培养目标 3: (良好的工程技术研发、管理和领导能力)具备从事生物技术与工程及相关领域的技术与产品研发、生产与技术管理、质量管理与控制、工艺与工程设计等工作的

能力。具备工程项目统筹实施能力，能够组织、管理项目工作团队，能够在团队环境中协调组织制定工作计划并有效实施。

培养目标 4:（引领发展潜力）具备专业和国际视野，熟悉行业前沿进展和地方特色，能够应对发展挑战，持续学习，能够为单位的发展做出贡献或成为中坚力量。

Bioengineering professional training objectives can be broken down into: (career and professional achievements that can be achieved five years after graduation)

Training Objective 1: (Basic Work Capability) The graduates can effectively use natural science, basic technology of engineering, bioengineering expertise, as well as economic, management and related knowledge of laws and regulations in independent work, to solve complex engineering problems, can obtain the corresponding position qualifications and titles.

Training Objective 2: (Qualified Team Member) The graduates have a global view and rich engineering experience, have the ability in the production process of new technology, new technology research and design, development and application, with a certain degree of innovation ability and entrepreneurial potential, and can put forward independent professional insights.

Training Objective 3: (Good engineering R&D, management and leadership skills) Ability to engage in technology and product development, production and technical management, quality management and control, process and engineering design in biotechnology and engineering and related fields. Capable of coordinating the implementation of engineering projects, capable of organizing and managing project work teams, coordinating and organizing work plans and implementing effectively in a team environment.

Training Objective 4: (Leading Development Potential) The graduates have a professional and international perspective, which are familiar with the industry's cutting-edge progress and local characteristics, can meet development challenges, continuous learning, can contribute to the development of the unit or become a backbone of it.

III. 专业毕业要求 Graduation Requirements

1.工程知识: 能够将数学、化学、生物学等自然科学和生物工程的基础理论知识用于解决生物资源利用和生物技术应用中的复杂工程问题。

1.1 能够将数学、化学、生物学等自然科学和生物工程的基础理论知识用于复杂生物工程问题的表达和合理描述;

1.2 能够运用专业相关知识和数学模型方法推演、分析和判别专业问题，并能针对具体对象建立数学模型并求解;

1.3 能够运用专业相关知识，比较和优选技术方案，完成系统设计。

2.问题分析: 能够运用自然科学与工程技术的基础理论知识分析和识别生物资源利用和生物技术应用过程中的复杂工程问题，并对其进行有效表述。

2.1 能识别、判断复杂生物工程问题的关键环节和参数；
2.2 能根据专业知识和文献检索认识到解决复杂生物工程问题有多种方案可选择，能合理表达描述；
2.3 能运用专业知识，借助文献研究，分析过程的影响因素，证实解决方案的合理性。

3.设计/开发解决方案：能够针对生物资源利用和生物技术应用中的复杂工程问题，设计出合理的解决方案，设计满足特定需求并体现创新意识的系统、单元（部件）或工艺流程，能分析设计方案对社会、健康、安全、法律以及文化的影响。

3.1 能够根据用户需求确定设计目标和方案；
3.2 能够集成单元过程进行工艺流程设计，对流程设计方案进行优化，体现创新意识，并进行单元工艺计算和设备设计计算。
3.3 能够在系统、单元或工艺流程开发和设计中综合考虑社会、健康、安全、法律、文化以及环境问题。

4.研究：能够基于科学的原理和方法，运用现代科学手段、信息技术工具和生物工程专业理论知识进行实验研究，包括设计实验、分析与数据解释，通过信息综合得到合理有效的结论，并优化生物资源利用和生物技术应用的设计方案。

4.1 能够采取正确的实验方法合成、分析和鉴定生物、化学品，熟悉生物、化学品物理化学性质的测定方法；
4.2 能够基于专业理论，根据对象特征，选择研究路线，设计可行的实验方案；
4.3 能够搭建试验装置，采用科学的实验方法，安全地开展试验；
4.4 能够正确采集、整理实验数据，对实验结果进行关联、建模、分析和解释，获取合理有效的结论。

5.使用现代工具：能够针对复杂生物工程问题，开发、选择与使用恰当的技术、资源、现代工程工具和信息技术工具，包括对复杂生物工程问题的预测与模拟，并能够理解其局限性。

5.1 知晓常用现代仪器和制图工具的使用原理，掌握信息检索工具和专业数据库的使用方法。
5.2 能够选择与使用恰当的生物工程相关软件进行工艺设计、工艺流程优化和设备选型等；
5.3 能够针对生物工程领域复杂工程问题，选择和使用恰当的专业软件，进行预测与模拟生物工程专业问题，并理解其局限性。

6.工程与社会：能够基于生物工程相关背景知识进行合理分析，评价专业工程实践和生物相关行业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。

6.1 熟悉生物工程专业领域相关的技术标准、知识产权、产业政策和法律法规，理解本领域相关企业管理体系；
6.2 能识别和分析生物工程新产品、新技术、新工艺的开发和应用以及生物工程项目的

实施对社会、健康、安全、法律以及文化的潜在影响，并理解应承担的责任。

7.环境和可持续发展：能够理解、预估、评价及妥善处理生物工程实践过程中对环境和社会可持续发展的影响；包括对生物工程实践中造成的环境污染的预估、评价、预防及处理，环境污染的生物治理，工程实践涉及到的生物安全、伦理等问题的预判及解决等。

7.1 能理解环境保护和社会可持续发展的必要性和现实意义，熟悉环境保护的法律法规；

7.2 能理解、预估、评价及妥善处理生产过程中各工艺流程和造成的环境污染对环境和社会可持续发展的影响，并能进行预防和实施环境污染的生物治理；

7.3 能够预判和解决生物工程产品使用周期中可能对人类和环境造成的生物安全、隐患以及伦理等方面的问题。

8.职业规范：具有人文社会科学素养、社会责任感，能够在工程实践中理解并遵守生物工程职业道德和规范，履行责任。

8.1 理解社会主义核心价值观，了解国情，维护国家利益，具有推动民族复兴和社会进步的责任感；

8.2 清楚身心健康对于自身职业发展的重要性，能够拥有健康的体质、良好的心理素质和社会责任感，尊重生命，具有人文修养；

8.3 理解诚实公正，诚信守则的工程职业道德和规范，理解生物工程行业工程师对公众的安全、健康和福祉，能够在工程实践中自觉履行责任。

9.个人和团队：能够在多学科背景下的团队中承担个体、团队成员以及责任人的角色。

9.1 能够初步了解与生物工程实践相关的其他学科知识，能与其他学科的团队共享信息；

9.2 能倾听他人意见，寻求有效合作的切入点，能在团队中独立和合作开展工作；

9.3 积极参与组织、协调和指挥团队开展工作。

10.沟通：能够就复杂生物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。

10.1 能够就复杂生物工程问题以口头、文稿和图表等形式准确表达自己的观点和工作成果，回应质疑，理解与业界同行和社会工作交流的差异性；

10.2 关注全球性问题，理解和尊重世界不同文化的差异性和多样性，理解生物工程领域的国际发展趋势和研究热点；

10.3 具备跨文化交流的语言和书面表达能力；能就专业问题在跨文化背景下进行沟通和交流。

11.项目管理：能够理解和掌握工程管理原理与经济决策方法，并应用于生物工程实践项目的运营及管理。

11.1 能够理解生物工程相关企业的管理架构、原理和经济决策方法，掌握工程经济学方面的基本知识和经济决策方法；

11.2 能够在多学科环境中根据复杂生物工程项目特征选择恰当的项目管理方法和经济决策方法，应用于生物产品开发、工艺设计和流程优化等工作。

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，能及时了解生物工程最新理论、技术和国际前沿动态。

12.1 能理解生物工程技术环境的多样化，能及时了解生物工程领域最新理论、技术、国际前沿动态和具备识别新研究方向的能力；

12.2 具有批判性思维，能理性分析、判断、归纳和提出问题，能进行自我评价，并以此作为追踪个人发展需要和成就的主要手段。

1. Engineering knowledge: The basic theoretical knowledge of natural sciences and biological engineering such as mathematics, chemistry, and biology can be used to solve complex engineering problems in the use of biological resources and biotechnology applications.

1.1 Ability to apply basic theoretical knowledge of natural sciences and biological engineering such as mathematics, chemistry, and biology to the expression and rational description of complex biological engineering problems;

1.2 Ability to use professional knowledge and mathematical model methods to deduce, analyze and identify professional problems, and to establish and solve mathematical models for specific objects;

1.3 Able to apply professional knowledge, compare and optimize technical solutions to complete system design.

2. Problem Analysis: Able to use the basic theoretical knowledge of natural science and engineering technology to analyze and identify complex engineering problems in the process of biological resource utilization and biotechnology application, and effectively express it.

2.1 Identify and judge the key links and parameters of complex biological engineering problems;

2.2 Recognize that there are many options for solving complex bioengineering problems based on professional knowledge and literature search, and can reasonably express the description;

2.3 Ability to use professional knowledge and analyze the influencing factors of the process with the help of literature research to confirm the rationality of the solution.

3. Design/Development Solutions: Able to design reasonable solutions to complex engineering problems in the use of biological resources and biotechnology applications, design systems, units (components) that meet specific needs and reflect innovation awareness. Can analyze the impact of the design plan on society, health, safety, law and culture.

3.1 The ability to determine design objectives and programs according to user needs;

3.2 Ability to integrate unit processes for process flow design, optimize process design schemes, reflect innovation awareness, and perform unit process calculations and equipment design calculations;

3.3 Having the ability to consider social, health, safety, legal, cultural and environmental factors in bioengineering units, process flows, drug design and drug development.

4. Research: Able to conduct experimental research based on scientific principles and methods, using modern scientific means, information technology tools and biological engineering

professional theoretical knowledge, including designing experiments, analysis and data interpretation, obtaining reasonable and effective conclusions through information synthesis, and optimizing the use of biological resources and design solutions for biotechnology applications.

4.1 Can take the correct experimental methods to synthesize, analyze and identify biological, chemical, familiar with biological, chemical physical and chemical properties of the measurement methods;

4.2 Can choose the research route based on professional theory, according to the characteristics of the object, and design feasible experimental program;

4.3 Can build a test device, using scientific experimental methods, safely carry out the test;

4.4 Can correctly collect and organize experimental data, correlate, model, analyze and interpret the experimental results, and obtain reasonable and effective conclusions.

5. Use of Modern Tools: Able to develop, select and use appropriate technologies, resources, modern engineering tools and information technology tools for complex bioengineering problems, including prediction and simulation of complex bioengineering problems, and understand their limitations.

5.1 Be able to use information resources and literature retrieval tools to understand the leading trends in the field of bioengineering;

5.2 Having the ability to select and use appropriate bioengineering related software for bioengineering process design, process optimization, and equipment selection.

5.3 Having the ability to predict and simulate bioengineering professional problems and understand the limitations of specific bioengineering processes with the help of bioengineering related software.

6. Engineering and Society: Able to conduct reasonable analysis based on bioengineering related background knowledge, evaluate the impact of professional engineering practices and complex engineering problem solutions on bio-related industries on society, health, safety, law and culture, and understand the responsibilities that should be assumed.

6.1 Be familiar with the relevant technical standards, intellectual property rights, industrial policies and laws and regulations in the field of bioengineering, and understand the relevant enterprise management system in this field;

6.2 Can identify and analyze the potential impact of the development and application of new bioengineering products, new technologies, new processes, and the implementation of bioengineering projects on society, health, safety, law, and culture, and understand the responsibilities that should be assumed.

7. Environment and Sustainable Development: Able to understand, estimate, evaluate and properly handle the impact on the environmental and social sustainable development in the process of bioengineering practice; including the prediction, evaluation, prevention and treatment of environmental pollution caused by bioengineering practice, biological treatment of environmental pollution. Predicting and solving biosafety and ethics issues involved in engineering practice.

7.1 Understand the need and practical significance of environmental protection and sustainable social development, familiar with the laws and regulations of environmental protection;

7.2 Can understand, estimate, evaluate and properly handle the impact of various

technological processes and environmental pollution caused by the production process on the environmental and social sustainable development, and be able to prevent and implement biological treatment of environmental pollution;

7.3 Able to predict and resolve biosafety, hidden dangers and ethical issues that may cause humans and the environment during the life cycle of bioengineered products.

8. Professional Norms: With humanities and social sciences literacy and social responsibility, he can understand and abide by bioengineering professional ethics and norms in engineering practice, and fulfill his responsibilities.

8.1 Understand the core values of socialism, understand the national conditions, safeguard the national interests, and have a sense of responsibility to promote national rejuvenation and social progress;

8.2 Clearly the importance of physical and mental health for their own career development, can have a healthy physique, good psychological quality and social responsibility, respect for life, with human istically;

8.3 Understand the engineering professional ethics and norms of honesty, fairness and integrity, and understand the safety, health and well-being of engineers in the bioengineering industry, and be able to fulfill their responsibilities in engineering practice.

9. Individuals and Teams: Able to assume the role of individuals, team members, and responsible persons in a multidisciplinary team.

9.1 Able to initially understand the knowledge of other disciplines related to bioengineering practice, and share information with team members of other disciplines

9.2 Can listen to others' opinions, seek the entry point for effective cooperation, and work independently and cooperatively in the team;

9.3 Actively participate in organizing, coordinating and directing teams to carry out work.

10. Communication: Ability to communicate effectively with industry peers and the public on complex bioengineering issues, including writing reports and design documents, making statements, making clear statements or responding to instructions, and having a certain international perspective to communicate and communicate in a cross-cultural context.

10.1 Be able to express views and work results accurately in the form of oral, document and chart symbiotic issues, respond to questions, and understand the differences in communication with industry peers and social work;

10.2 Focus on global issues, understand and respect the differences and diversity of different cultures in the world, and understand international trends and research hotspots in the field of bioengineering;

10.3 Have the language and written ability to communicate across cultural exchanges, and be able to communicate and communicate in a cross-cultural context on professional issues.

11. Project Management: Able to understand and master engineering management principles and economic decision-making methods, and apply to the operation and management of biological engineering practice projects.

11.1 Can understand the management structure, principles and economic decision-making methods of bioengineering-related enterprises, master the basic knowledge of engineering economics and economic decision-making methods.

11.2 Ability to select appropriate project management methods and economic

decision-making methods based on the characteristics of complex bioengineering projects in a multi-disciplinary environment, applied to biological product development, process design, and process optimization.

12. Lifelong Learning: Have the consciousness of self-learning and lifelong learning, have the ability of continuous learning and adapt to development, and be able to keep abreast of the latest theories, technologies and international cutting-edge developments in bioengineering.

12.1 Can understand the diversification of bioengineering technology environment, be able to keep abreast of the latest theories, technologies, international frontier developments in the field of bioengineering and have the ability to identify new research directions

12.2 Have critical thinking, be able to reasonably analyze, judge, generalize and ask questions, and be able to make self-evaluations, and use this as the main means of tracking personal development needs and achievements.

IV.学制与学位 Duration and Degree

学制：四年

Duration: 4 years

学位：工学学士

Degree: Bachelor of Engineering

V.主干学科与主干课程 Main Subject and Main Course

主干学科：生物学，生物工程与技术，化学工程与技术

Main Subject:Biology, Chemistry, Chemical Engineering and Technology.

主干课程：1. 学科基础与专业基础课：普通生物学、微生物学、生物化学、细胞生物学、遗传学等；2.专业课：基因工程、发酵工程、化工原理、生物反应工程、生物分离工程和生物工程设备等。

Main Course:1.Basic Subject Course and Professional Basic Course: General Biology, Microbiology, Biochemistry, Cell Biology, and Genetics; 2.Specialized Course: Genetic Engineering, Fermentation Engineering, Chemical Principles, Bioreaction Engineering, Bioseparation Engineering, and Bioengineering Equipment.

VI.毕业学分基本要求 Basic Requirements of Credits for Graduation

课程体系 Curriculum System	学分要求 Credits Requirements						小计 Subtotal
	必修 Compulsory		限修 Distributional Electives		选修 Free Electives		
	理论 Theory	实践 Practice	理论 Theory	实践 Practice	理论 Theory	实践 Practice	

公共基础课程 Public Basic Courses	思想政治类 Ideological Politics Courses	15	2					17
	军事类 Military Courses	2	2					4
	外语类 Foreign Language Courses	6		2				8
	体育类 Physical Education Courses		4					4
通识教育课程 General Education Courses	核心通识课 Core General Education Courses			4				4
	新生研讨课 Freshman Seminar	2						2
学科与专业基础课程（含实验） Discipline and Specialty Foundational Courses (Including Experiment)	数学与自然科学基础课 Foundational Courses on Mathematics and Natural Science	27	1					28
	专业基础课 Professional Foundational Courses	24	7	5				36
专业课程（含实验） Specialized Courses (Including Experiment)	专业核心课程 Specialized Core Course	28.5	5.5					34
	专业限修课程 Specialized Restricted Courses			2				2
实习实践教学 Practice Courses	基本技能训练、实习实训、综合课程设计、社会与文化素质实践、毕业实习与毕业设计 Basic Skills Training, Practical Training, Integrated Curriculum Design, Social and Cultural Quality Practice, Graduation Internship and Graduation Design		21					21
多元化课程 Diversified Courses	跨学科课程、美育专业类课程、学科竞赛类课程、其它个性化选修课程等 Interdisciplinary Courses, Aesthetic Education Courses, Subject Competition Courses, other Personalized Elective Courses, etc					4		4

创新创业实践 Innovation and Entrepreneurship Practice	创新创业训练计划项目、个性化实验、学科竞赛、创新讲座等 Innovation and Entrepreneurship Training Program, Personalized Experiments, Subject Competition, Innovation Lectures, etc		2					2
必修环节 A Compulsory Part	大学生综合素质提升、学生体质达标测评 Comprehensive Quality Improvement Courses for College Students, Assessment of Students' Physical Fitness							0
总 计 Total								166

VII.课程设置细化表 Course Programs Table

公共基础课程 Public Basic Courses 共 33 学分，其中必修 31 学分，限修 2 学分，选修 0 学分 A total credits of 33, including 31 for compulsory courses, 2 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class Practice Credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
思想政治类 Ideological Politics Courses	思想道德与法治 Ideological and Moral Education and the Rule of Law	必修 Compulsory	3	0.4	第 1 学期 1St Semester	马克思主义学院 School of Marxism	6.2, 8.1 8.2, 8.3	
	中国近现代史纲要 Conspectus of Chinese Modern History	必修 Compulsory	3	0.4	第 2 学期 2Nd Semester	马克思主义学院 School of Marxism	8.1	
	马克思主义基本原理 The Basic Principles of Marxism	必修 Compulsory	3	0.4	第 3 学期 3Rd Semester	马克思主义学院 School of Marxism	8.1, 12.2	
	毛泽东思想和中国特色社会主义理论体系概论 Introduction to Mao Zedong Thought and Theoretical System of Socialism with Chinese Characteristics	必修 Compulsory	3	0.4	第 5 学期 5Th Semester	马克思主义学院 School of Marxism	8.1, 12.2	
	习近平新时代中国特色社会主义思想概论 Outline of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	必修 Compulsory	3	0.4	第 6 学期 6Th Semester	马克思主义学院 School of Marxism	8.1, 12.2	

思想政治类 Ideological Politics Courses	形势与政策 I Situation and Policy I	必修 Compulsory	0	0	第 1 学期 1St Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 II Situation and Policy II	必修 Compulsory	0	0	第 2 学期 2Nd Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 III Situation and Policy III	必修 Compulsory	0	0	第 3 学期 3Rd Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 IV Situation and Policy IV	必修 Compulsory	0	0	第 4 学期 4Th Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 V Situation and Policy V	必修 Compulsory	0	0	第 5 学期 5Th Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 VI Situation and Policy VI	必修 Compulsory	0	0	第 6 学期 6Th Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 VII Situation and Policy VII	必修 Compulsory	0	0	第 7 学期 7Th Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
	形势与政策 VIII Situation and Policy VIII	必修 Compulsory	2	0	第 8 学期 8Th Semester	马克思主义 学院 School of Marxism	8.1, 12.2	
军事类 Military Courses	军事理论 Military Theories	必修 Compulsory	2	0	第 1 学期 1St Semester	武装部 Security Office	8.1	
	军事技能 Military Skills	必修 Compulsory	2	2	短 1 学期 Short Semester 1	武装部 Security Office	8.1, 9.3	
外语类 Foreign Language Courses	英语 I College English I	必修 Compulsory	2	0	第 1 学期 1St Semester	外国语学院 School of Foreign languages	10.2, 10.3	
	英语 II College English II	必修 Compulsory	2	0	第 2 学期 2Nd Semester	外国语学院 School of Foreign languages	10.2, 10.3	
	通用学术英语 English for General Academic Purposes	必修 Compulsory	2	0	第 3 学期 3Rd Semester	外国语学院 School of Foreign languages	10.2, 10.3	
	职场英语 Workplace English	限修 Distributional Elective	2	0	第 4 学期 4Th Semester	外国语学院 School of Foreign languages	10.2, 10.3	限选 1 门, 2 学分 Limited to 1 course, 2 credits
	交际与文化视听说 Viewing, Listening & Speaking in English --Communication & Culture							
	语言、文化与翻译 Language, Culture and Translation							
	英语公共演讲 Public Speaking in English							

体育类 Physical Education Courses	体育 I Physical Education I	必修 Compulsory	1	1	第 1 学期 1St Semester	体育部 Dept. of Physical Education	9.2, 9.3	
	体育 II Physical Education II	必修 Compulsory	1	1	第 2 学期 2Nd Semester	体育部 Dept. of Physical Education	9.2, 9.3	
	体育 III Physical Education III	必修 Compulsory	0.5	0.5	第 3 学期 3Rd Semester	体育部 Dept. of Physical Education	9.2, 9.3	
	体育 IV Physical Education IV	必修 Compulsory	0.5	0.5	第 4 学期 4Th Semester	体育部 Dept. of Physical Education	9.2, 9.3	
	体育健康课程 I Diversified Physical Education Courses I	必修 Compulsory	0.5	0.5	第 5 学期 5Th Semester	体育部 Dept. of Physical Education	9.2, 9.3	
	体育健康课程 II Diversified Physical Education Courses II	必修 Compulsory	0.5	0.5	第 6 学期 6Th Semester	体育部 Dept. of Physical Education	9.2, 9.3	
通识教育课程 General Education Courses 共 6 学分，其中必修 2 学分，限修 4 学分，选修 0 学分 A total credits of 6, including 2 for compulsory courses, 4 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
核心通识课 Core General Education	“历史、文化与人文情怀”模块 History, Culture and Humanities Module	限修 Distributional Elective	4	0	2-8 学期 2-8 Semester		6.2, 7.1 8.1, 10.2	每个模块最多选修一门课程，原则上不选本学院所开设的课程。 One course from each module at most. No course offered by School of Life Science and Engineering
	“哲学智慧与批判性思维”模块 Philosophical Wisdom and Critical Thinking Module						9.1, 12.2	
	“社会科学与伦理责任”模块 Social Science and Responsibility Ethics Module						6.2, 8.1 8.2, 8.3	
	“艺术体验与审美修养”模块 Artistic Experience and Aesthetic Accomplishment Module						8.2	
新生研讨课 Freshman Seminar	遗传密码-生命与自然 Genetic Code-Life and Nature	必修 Compulsory	2	0	第 1 学期 1St Semester	生命科学与工程学院 School of Life Science and Engineering	5.1, 12.1 12.2	

学科与专业基础课程（含实验） Discipline and Specialty foundational Courses (Including Experiment) 共 64 学分，其中必修 59 学分，限修 5 学分，选修 0 学分 A total credits of 64, including 59 for compulsory courses, 5 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
数学与自然科学 基础课 Foundational Courses on Mathematics and Natural Science	微积分 Calculus	必修 Compulsory	5	0	第 1 学期 1St Semester	数学学院 School of Mathematics	1.1, 1.2	
	线性代数 B Linear algebra B	必修 Compulsory	3	0	第 1 学期 1St Semester	数学学院 School of Mathematics	1.1, 1.2 2.2	
	概率论与数理统计 Probability and Statistics	必修 Compulsory	3	0	第 2 学期 2Nd Semester	数学学院 School of Mathematics	1.1, 1.2	
	计算方法 Computational Methods	必修 Compulsory	2	0	第 4 学期 4Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.1, 1.2 1.3	
	大学物理 BI College Physics BI	必修 Compulsory	3	0	第 2 学期 2Nd Semester	物理科学与技术学院 School of Physical Science and Technology	1.1	
	大学物理实验 I College Physics Experiment I	必修 Compulsory	1	1	第 2 学期 2Nd semester	物理科学与技术学院 School of Physical Science and Technology	4.2, 4.3 4.4	
	大学物理 BII College Physics BII	必修 Compulsory	3	0	第 3 学期 3Rd Semester	物理科学与技术学院 School of Physical Science and Technology	1.1	
	大学物理实验 II College Physics Experiment II	必修 Compulsory	1	1	第 3 学期 3Rd semester	物理科学与技术学院 School of Physical Science and Technology	4.2, 4.3 4.4	
	电工与电子技术基础 Electrical and electronics	必修 Compulsory	2	0	第 3 学期 3Rd Semester	电气工程学院 School of Electrical Engineering	1.1, 1.2	

数学与自然科学 基础课 Foundational Courses on Mathematics and Natural Science	计算机程序设计基础 Fundamentals of Computer Programming	必修 Compulsory	3	1	第 2 学期 2Nd Semester	计算机与人工智能学院 School of Computing and Artificial Intelligence	5.2, 5.3	
	计算机辅助设计 Computer aided design	必修 Compulsory	2	0	第 4 学期 4Th Semester	生命科学与工程学院 School of Life Science and Engineering	5.1, 5.2	
专业基础课 Professional Foundational Courses	无机与分析化学 Inorganic& Analytic Chemistry	必修 Compulsory	4	0	第 1 学期 1St Semester	生命科学与工程学院 School of Life Science and Engineering	1.1, 2.1	
	无机与分析化学实验 Experiments of Inorganic & Analytic Chemistry	必修 Compulsory	1	1	第 1 学期 1St Semester	生命科学与工程学院 School of Life Science and Engineering	4.1, 4.4 5.1	
	有机化学 BI Organic Chemistry BI	必修 Compulsory	2	0	第 2 学期 2Nd Semester	生命科学与工程学院 School of Life Science and Engineering	1.1, 1.2	
	有机化学 BII Organic Chemistry BII	必修 Compulsory	2	0	第 3 学期 3Rd Semester	生命科学与工程学院 School of Life Science and Engineering	1.2, 1.2	
	有机化学实验 Organic Chemistry Experiment	必修 Compulsory	1	1	第 3 学期 3Rd Semester	生命科学与工程学院 School of Life Science and Engineering	4.1, 4.2 4.3, 4.4	
	物理化学 B Physical Chemistry B	必修 Compulsory	2	0	第 3 学期 3Rd Semester	生命科学与工程学院 School of Life Science and Engineering	1.2, 2.1	
	物理化学实验 Experiments of Physical Chemistry	必修 Compulsory	1	1	第 3 学期 3Rd Semester	生命科学与工程学院 School of Life Science and Engineering	4.1, 4.2 4.3, 4.4	
	普通生物学 General Biology	必修 Compulsory	3	0	第 1 学期 1St Semester	生命科学与工程学院 School of Life Science and Engineering	5.1, 7.1 9.2	

专业基础课 Professional Foundational Courses	普通生物学实验 B Experiments of General Biology B	必修 Compulsory	1	1	第 1 学期 1St Semester	生命科学与 工程学院 School of Life Science and Engineering	4.3, 4.4 9.3	
	生物化学 A Biochemistry A	必修 Compulsory	4	0	第 3 学期 3Rd Semester	生命科学与 工程学院 School of Life Science and Engineering	2.3, 4.1 9.2	
	生物化学实验 A Experiments of Biochemistry A	必修 Compulsory	1	1	第 3 学期 3Rd Semester	生命科学与 工程学院 School of Life Science and Engineering	4.3, 4.4	
	细胞生物学 Cell Biology	必修 Compulsory	3	0	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	5.1, 9.2 12.2	
	细胞生物学实验 Experiments of Cell Biology	必修 Compulsory	1	1	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	2.3, 4.2	
	微生物学 A Microbiology A	必修 Compulsory	3	0	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	5.1, 9.2 12.2	
	微生物学实验 Experiments of Microbiology	必修 Compulsory	1	1	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	2.3, 4.2	
	英语科技论文写作 Scientific English Writing	必修 Compulsory	1	0	第 3 学期 3Rd Semester	生命科学与 工程学院 School of Life Science and Engineering	5.1, 10.3 12.1	
	遗传学 B Genetics B	限修 Distributional Elective	3	0.5	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	8.1, 9.3 12.1, 12.2	限修 5 学分 Distributional Elective 5 credits
	免疫学 Immunology	限修 Distributional Elective	2	0	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	4.1, 6.2	
	生物信息学 Bioinformatics	限修 Distributional Elective	3	0.5	第 4 学期 4Th Semester	生命科学与 工程学院 School of Life Science and Engineering	2.3, 4.4	

	天然药物化学 Natural Pharmaceutical Chemistry	限修 Distributional Elective	2	0.5	第 4 学期 4Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.3, 2.1	
专业课程 (含实验) Specialized Courses (Including Experiment) 共 36 学分, 其中必修 34 学分, 限修 2 学分, 选修 0 学分 A total credits of 36, including 34 for compulsory courses, 2 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
专业核心课程 Specialized Core Course	发酵工程 A Fermentation Engineering A	必修 Compulsory	3	0	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.1, 2.1 3.1, 7.2	
	发酵工程实验 Experiments of Fermentation Engineering	必修 Compulsory	1	1	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	4.1, 4.2 4.4, 9.3	
	基因工程 A Genetic Engineering A	必修 Compulsory	3	0	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	5.1, 6.2 12.1	
	基因工程实验 Experiments of genetic Engineering	必修 Compulsory	1	1	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	4.3, 4.4	
	蛋白质及酶工程 Protein and enzyme engineering	必修 Compulsory	2	0	第 6 学期 6Th Semester	生命科学与工程学院 School of Life Science and Engineering	4.1, 5.1	
	分子模拟与计算机辅助药物设计 Molecular simulation and computer-aided drug design	必修 Compulsory	2	0.5	第 6 学期 6Th Semester	生命科学与工程学院 School of Life Science and Engineering	2.2, 5.1 9.2	
	化工原理 A Principle of Chemical Engineering A	必修 Compulsory	4	0	第 4 学期 4Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.2, 2.2 3.1	
	化工原理实验 A Experiments of Principle of Chemical Engineering A	必修 Compulsory	2	2	第 4 学期 4Th Semester	生命科学与工程学院 School of Life Science and Engineering	2.3, 4.2 9.1	

专业核心课程 Specialized Core Course	生物分离工程 Biochemical Isolation Engineering	必修 Compulsory	2	0	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.3, 3.1	
	生物分离工程实验 Biochemical Isolation Engineering Experiments	必修 Compulsory	1	1	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	3.2, 4.2	
	生物反应工程 Bioreaction Engineering	必修 Compulsory	2	0	第 7 学期 7Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.2, 2.2 3.1	
	工程制图 A Engineering Drawing A	必修 Compulsory	3	0	第 4 学期 4Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.1, 5.1	
	生物工程设备及工厂设计 Equipment & Plant Design of Bioengineering	必修 Compulsory	3	0	第 6 学期 6Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.3, 2.2 3.2	
	化工仪表及自动化 Chemical Instruments and Automation	必修 Compulsory	2	0	第 5 学期 5Th semester	电气工程学院 School of Electrical Engineering	1.2, 1.3 2.3	
	生产过程安全与环保 Safety and environmental protection of production process	必修 Compulsory	1	0	第 7 学期 7Th Semester	生命科学与工程学院 School of Life Science and Engineering	7.1, 7.2 7.3, 8.3	
	工程经济与项目管理 Engineering economics and project management	必修 Compulsory	2	0	第 6 学期 6Th Semester	经济管理学院 School of Economics and Management	3.2, 9.2 11.1, 11.2	
专业限修课程 Specialized Restricted Courses	仪器分析 Instrumental Analysis	限修 Distributional Elective	2	0.5	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	4.3, 5.1 5.3, 9.1	限修 2 学分 Distributional Elective 2 credits
	生物技术制药 Biotechnological Pharmaceutics	限修 Distributional Elective	2	0	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	1.3, 2.1 2.2, 3.1	
	药物化学 B Pharmaceutical Chemistry B	限修 Distributional Elective	2	0.5	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	2.2, 2.3	

	药品生产质量管理工程 Pharmaceutical Production Quality Management Engineering	限修 Distributional Elective	2	0	第 5 学期 5Th Semester	生命科学与工程学院 School of Life Science and Engineering	6.1, 6.2 11.1, 11.2	
实习实践教学 Practice Course 共 21 学分，其中必修 21 学分，限修 0 学分，选修 0 学分 A total credits of 21, including 21 for compulsory courses, 0 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
基本技能训练、 实习实训、综合 课程设计、社会 与文化素质实践、 毕业实习与 毕业设计 Basic Skills Training, Practical Training, Integrated Curriculum Design, Social and Cultural Quality Practice, Graduation Internship and Graduation Design	专业认识实习 Identification Practice of Pharmaceutical Plants	必修 Compulsory	1	1	短 1 学期 Short Semester 1	生命科学与工程学院 School of Life Science and Engineering	5.2, 6.1 7.1, 9.2	
	工程训练 C Engineering Training C	必修 Compulsory	1	1	第 3 学期 3Rd Semester	工程训练中心 Engineering Training Center	9.1, 9.2 9.3	
	化工原理课程设计 Design of Principles of Chemical Engineering	必修 Compulsory	2	2	短 2 学期 Short-Semester 2	生命科学与工程学院 School of Life Science and Engineering	3.1, 9.2 11.2	
	生物工程课程设计 A Design of Bioengineering A	必修 Compulsory	3	3	短 3 学期 Short-Semester 3	生命科学与工程学院 School of Life Science and Engineering	3.2, 5.2 7.3, 9.2 11.2	
	生物工艺学综合实验 Comprehensive experiment of Biotechnology	必修 Compulsory	2	2	短 3 学期 Short-Semester 3	生命科学与工程学院 School of Life Science and Engineering	3.1, 4.4 7.3, 9.2	
	生产实习 field practice	必修 Compulsory	2	2	短 3 学期 Short-Semester 3	生命科学与工程学院 School of Life Science and Engineering	6.1, 6.2 8.3, 10.1	
	毕业设计（论文） Graduation Project	必修 Compulsory	10	10	第 8 学期 8Th Semester	生命科学与工程学院 School of Life Science and Engineering	2.3, 3.3 4.4, 7.2 10.1, 10.2	
多元化课程 Diversified course 共 4 学分，其中必修 0 学分，限修 0 学分，选修 4 学分 A total credits of 4, including 0 for compulsory courses, 0 for distributional electives and 4 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes

跨学科课程 Interdisciplinary Course	全校跨学科课程 Interdisciplinary Course of University	选修 Free Electives	4	0	6-7 学期 6-7 Semester	全校 The whole school	9.1, 9.2 9.3, 12.2	选修 4 学分, 按照《西南交通大学多元化课程修读指导手册》执行。 Free Electives 4 Credits ,Follow the《Instruction manual of diversified courses of southwest Jiaotong University》
美育专业类课程 Aesthetic Education Specialty Courses	全校美育专业类课程 Aesthetic Education Specialty Courses of University							
学科竞赛类课程 Subject Competition Courses	全校学科竞赛课程 Subject Competition Courses of University							
个性化选修课程 Personalized Elective Courses	全校个性化选修课程 Personalized Elective Courses of University							
创新创业实践 Innovation and Entrepreneurship Practice 共 2 学分, 其中必修 2 学分, 限修 0 学分, 选修 0 学分 A total credits of 2, including 2 for compulsory courses, 0 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
创新创业训练计划项目、个性化实验、学科竞赛、创新讲座等 Innovation and Entrepreneurship Training Program, Personalized Experiments, Subject Competition, Innovation Lectures, etc	课外创新实践 Extracurricular Innovation Practice	必修 Compulsory	2	2	3-7 学期 3-7 Semester	生命科学与工程学院 School of Life Science and Engineering	9.1, 9.2 9.3, 10.1 12.1 (按选择课程细化) (specified by different courses)	按照《西南交通大学创新实践学分认定与管理办法》规定执行 By Credit Recognition and Management of Innovative Practice in Southwest Jiaotong University
必修环节 A compulsory part 共 0 学分, 其中必修 0 学分, 限修 0 学分, 选修 0 学分 A total credits of 0, including 0 for compulsory courses, 0 for distributional electives and 0 for free electives								
课程类型 Course Type	课程名称 Course Name	课程性质 Nature of Course	总学分 Credits	课内实践学分 In-class practice credits	开课学期 Semester	开课学院 School	支撑毕业要求指标点 Indicators which Support Graduation Requirements	备注 Notes
大学生综合素质提升、学生体质达标测评 Comprehensive Quality Improvement Courses for College Students, Assessment of Students' Physical Fitness	大学生综合素质提升（第二、第三课堂） Comprehensive Quality Improvement Courses for College Students（The Second and Third Classroom）	必修 Compulsory	0	0	1-8 学期 1-8 Semester	校团委 Communist Youth League Committee	8.1, 8.2	
	学生体质达标测评 Assessment of Students' Physical Fitness	必修 Compulsory	0	0	秋季学期 fall Semester	体育部 Dept. of Physical Education	8.2, 9.3	
学分总计 Total Credits			166					