

能源化学工程

Energy Chemical Engineering

专业代码：081304T

学制：4年

Program Code:081304T

Duration: 4 years

培养目标：

培养适应新世纪社会、经济、科学技术发展需要的德、智、体、美全面发展，具有分析和解决问题能力，胜任能源化学工程和相关领域的分析与研究、设计与开发、策划与管理等各项工作，具备“基础厚、口径宽、能力强”的能源化学工程领域国际化复合型人才。

Educational Objectives:

The discipline of energy chemical engineering (ECE) aims to train the professional people meeting the needs of social, economic, science and technology development in the new era. The graduated students are able to well analyze and solve problems in ECE and relates. The capable graduates should have solid basic of knowledge and broadly international horizons together with exceptional ability.

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复杂能源化学工程问题；了解能源化工行业基本的发展态势，特别是实际工程问题的深刻数理本质；为解决能源化工实际问题奠定宽泛而扎实的知识基础。

№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较复杂的能源化工问题；能对能源化工领域的一般问题，通过理论联系实际的通用方法论分析问题的本质并作出合理、有效判定。

№3.设计/开发解决方案：能够针对较复杂的能源化工问题设计较可行的解决方案，能设计符合化工过程及系统设计规范并满足实现特定需求的系统、单元（部件）或工艺流程；能够在设计环节体现能源化工过程的创新意识，考虑社会、健康、安全、法律、文化以及环境等因素。

№4.研究：能够基于科学原理并采用科学方法对较复杂的能源化工问题进行研究，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.使用现代工具：能够针对较复杂的能源化工问题，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；能自觉地在知识积累、问题分析、研究和解决各环节应用现代工具，提高综合问题的解决能力；特别是能对较复杂的能源化工问题进行模化、计算和模拟预测，并能够理解其局限性。

№6.工程与社会：能够基于能源化学工程相关背景知识进行合理分析，评价能源化工实践和较复杂的能源化工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较复杂的能源化工问题的专业工程实践对环境、

社会可持续发展的影响。

№8.职业规范：具有人文社会科学素养、社会责任感，能够在能源化工实践中理解并遵守工程职业道德和规范，履行责任。

№9.个人和团队：充分理解能源化工系统的复杂性和团队协作的重要性，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：能够就较复杂的能源化工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；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：理解并掌握基本的工程管理原理与经济决策方法，并能在多学科环境中应用，能对能源化工项目进行较有效地管理。

№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。

Student Outcomes:

№1.Engineering Knowledge:An ability to apply knowledge of mathematics, science, engineering fundamentals and engineering specialization to the solution of complex engineering problems.

№2.Problem Analysis: An ability to identify, formulate and analyze complex engineering problems, reaching to substantiated conclusions using basic principles of mathematics, science, and engineering.

№3.Design / Development Solutions: An ability to design solutions for complex engineering problems and innovatively design systems, components or process that meet specific needs with societal, public health, safety, legal, cultural and environmental considerations.

№4.Research: An ability to conduct investigations of complex engineering problems based on scientific theories and adopting scientific methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

№5.Applying Modern Tools: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

№6.Engineering and Society: An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

№7.Environment and Sustainable Development: An ability to understand and evaluate the impact of professional engineering solutions in environmental and societal contexts and demonstrate knowledge of and need for sustainable development.

№8.Professional Standards: An understanding of humanity science and social responsibility, being able to understand and abide by professional ethics and standards responsibly in engineering practice.

№9.Individual and Teams: An ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

№10.Communication: An ability to communicate effectively on complex engineering problems with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive clear instructions, and communicate in cross-cultural contexts with international perspective.

№11.Project Management: Demonstrate knowledge and understanding of engineering management principles and methods of economic decision-making, to function in multidisciplinary environments.

№12.Lifelong Learning:A recognition of the need for, and an ability to engage in independent and life-long learning with the ability to learn continuously and adapt to new developments.

专业简介：

本专业源于 2004 年教育部批准设立的“能源工程及自动化专业”，并于 2011 年获批为广东省特色专业。因应 2013 年教育部专业调整，通过专家评议和教育部审议，更名为“能源化学工程专业”。能源化学工程专业涉及天然气利用、石油加工和可再生能源等知识领域，研究以天然气、石油、可再生能源等自然资源为原料的能源开发、转化、输配及应用的共性问题。本专业通过现代能源化学工程的系统训练，培养具有一定专长的“宽厚、复合、开放、创新”型高级人才。作为教育部直属研究型大学的化学工程国家重点学科下属专业，能源化工专业不仅具有深厚的化工底蕴还肩负科技振兴的社会使命，为此在注重人才工程教育的同时也强调科研素养的培养，充分利用天然气资源利用、燃料电池研发和生物质能源开发等新能源过程的丰硕科研成果，采用教学与科研相互促进的良性人才培养模式。本专业 95% 专业课由高级职称教师担任；拥有 200 多平方米的专业实验室及价值超过 300 万元的专业实验仪器。

Program Profile:

Energy structure and utilization have been greatly changed with the rapid development in global society, economics, science and technology. To meet the needs of human resource for this development, the discipline of energy chemical engineering (ECE) has been born after the peer review and the approval of Ministry of Education (MOE). This discipline originates from the energy engineering and automation, which was approved to establish in 2004, and has been honored as the featured discipline in Guangdong Province.

ECE has an important intercross with many other disciplines, like natural gas utilization, petrol processing and renewable energy, as ECE studies the common basic of energy conversation, transmission and utilization for both new and traditional energy resources. After the systematic trainings in the field of modern ECE, the well educated professionals have been cultivated to gain the solid basic of knowledge and broadly international horizons together with exceptional ability.

As supported with the state key discipline of chemical engineering in South China University of Technology, directly administrated by MOE, ECE, strongly characterized as a branch of chemical engineering, bears the mission to realize the lofty ideal of national rejuvenation. In the professional

education of ECE, the mutual promotion of undergraduate education and scientific research in the fields of natural gas utilization, fuel cells, biomass and so on will greatly help our students to become qualified engineers with the necessary scientific research qualities.

The faculty of ECE, including 14 Ph.D supervisors, has strong background of engineering and scientific research. The 95% of specialty-related courses will be directly taught by the professors or associate professors. The ECE also has the specialty-related laboratories of over 200 square meters and instruments cost over 3 million RMB.

专业特色：

依托“国家级重点学科”化学工程，通过“教、学、研”贯通培养高素质、高层次、多样化的“三创型”人才；就业率高，能较好地满足天然气、石油、可再生能源的发展战略需要；通过前沿性科研和国际化教育促进学科发展。

Program Features:

Based on the nationally reputed discipline of Chemical Engineering in South China University of Technology, we continually engages to cultivate the talent graduates with broadly international horizon, solid knowledge and strong ability by the pedagogical approach with the integration of learning, research and development. The high employment rate indicates that our graduates have been well trained to meet to the needs of natural gas, petrol and renewable energy industry in China. The active frontier exploration and international education can facilitate the development of Energy Chemical Engineering.

授予学位：工学学士学位

Degree Conferred: Bachelor of Engineering

主干课程：

流体力学、传热学、传质与分离工程、工程热力学、化学反应工程、燃气燃烧与应用、天然气输配。

Core Courses:

Fluid Mechanics, Heat Transfer, Mass Transfer and Separation, Engineering Thermodynamics, Process Control and Instrument Automation in Chemical Engineering, Chemical Reaction Engineering, Gas Combustion and Utilization, Gas Transmission and Distribution,

特色课程：

双语教学课程：能源化学工程概论、传热学、燃气燃烧与应用

专题研讨课：学科前沿讲座

MOOC: 计算机辅助设计

校企合作课: 工程设计、产业模式与创业, 世界名企讲座

专题设计课: 化工原料课程设计、燃气输配课程设计、机械设计基础课程设计、能源化工设计

创新实践课程: 能源化工设计实训

创业教育课程: 工程设计、产业模式与创业, 世界名企讲座

Featured Courses:

Bilingual Courses: Introduction to Energy Chemical Engineering, Heat Transfer, Gas Combustion and Utilization

Special Topics: Seminar on Chemical and Energy Engineering

MOOCs: Computer Aided Design

Cooperative Courses with Enterprises: Introduction to Engineering Design, Paradigm and Entrepreneurship

Special Designs: Course Project of Chemical Engineering Principle, Course Project on Gas Transmission and Distribution, Course Project on Mechanical Design, Design in Energy Chemical Engineering

Innovation Practice: Practice of Energy Chemical Engineering

Entrepreneurship Courses: Introduction to Engineering Design, Paradigm and Entrepreneurship

学时数 Total	必修学时 Compulsory	选修学时 Elective	理论教学学时 Theory Course	实验教学学时 Lab	学分数 Total	必修学分 Compulsory	选修学分 Elective	集中实践教学环节 学分 Practice-concentrated Training	理论教学学分 Theory Course Credits	实验教学学分 Lab	创新创业教育学分 Innovation and Entrepreneurship Education
2300	1860	440	1904	396	177	149.5	27.5	37	128	12	6

三、专业教学计划表 (Teaching Schedule)

类别 Course Category	课程 代码 Course No.	课程名称 Course Title	是否 必修 C/E	学时数 Total Curriculum Hours				学分 数 Credits	开课 学期 Semester	毕业 要求 Student Outcomes	
				总学 时 Class Hours	上机 Computer-ai ded Class Hours	实验 Lab Hours	实践 Practice Hours				
公共基础课 General Basic Courses	143093	思想道德修养与法律基础 Cultivation of Thought and Morals & Fundamental of Law	必修 课 C	(40) (36)				2.5	1	№8	
	143091	中国近现代史纲要 Skeleton of Chinese Modern History		(32) 24				2.0	2	№8	
	143106	毛泽东思想和中国特色社会主义理论体系概论 Thought of Mao ZeDong and Theory of Socialism with Chinese Characteristics		(80) 48				5.0	3	№8	
	143090	马克思主义基本原理 Fundamentals of Marxism Principle		(40) 36				2.5	4	№8	
	143094	形势与政策 Analysis of the Situation & Policy		(128)				2.0	1-8	№8	
	144001	大学英语 (一) College English(1)		64				4.0	1	№10	
	144002	大学英语 (二) College English(2)		64				4.0	2	№10	
	145223	大学计算机基础 Foundations of Computer		32				2.0	1	№5	
	145268	C++程序设计基础 C++ Programming Foundations		48				3.0	2	№5	
	152001	体育 (一) Physical Education (1)		32			32	1.0	1	№12	
	152002	体育 (二) Physical Education (2)		32			32	1.0	2	№12	
	152003	体育 (三) Physical Education (3)		32			32	1.0	3	№12	
	152004	体育 (四) Physical Education (4)		32			32	1.0	4	№12	
	106001	军事理论 Military Principle		(16)				1.0	2	№9	
	140189	微积分 I (一) Calculus (1)		80				5.0	1	№1	
	140190	微积分 I (二) Calculus (2)		64				4.0	2	№1	
	140197	线性代数与解析几何 Linear Algebra & Analytic Geometry		48				3.0	1	№1	
	140019	概率论与数理统计 Probability & Mathematical Statistics		48				3.0	2	№1	
	141001	大学物理 I (一) General Physics (1)		48				3.0	2	№1	
	141002	大学物理 I (二) General Physics (2)		48				3.0	3	№1	
	141007	大学物理实验 (一) Physics Experiment (1)		32		32		1.0	2	№1	
	141008	大学物理实验 (二) Physics Experiment (2)		32		32		1.0	3	№1	
	130139	工程制图 (一) Engineering Drawing (1)		48				3.0	1	№3	
	130140	工程制图 (二) Engineering Drawing (2)		32				2.0	2	№3	
		人文科学领域 Humanities		96	通识 课 E				6.0		№8
		社会科学领域 Social Science		64					4.0		№8

合 计 Total		1036	0	64	128	67.0		
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三、专业教学计划表（续）（Teaching Schedule）

类别 Course Category	课程 代码 Course No.	课 程 名 称 Course Title	是 否 必 修 C/E	学 时 数 Total Curriculum Hours				学 分 数 Credits	开 课 学 期 Semester	毕 业 要 求 Student Outcomes
				总学时 Class Hours	上机 Computer-ai ded Class Hours	实验 Lab Hours	实践 Practice			
学科基础课 Disciplinary Basic Courses	147001	无机化学 I Inorganic Chemistry	必 C	32				2.0	1	№1
	147003	无机化学实验 I Experiment of Inorganic Chemistry	必 C	16		16		0.5	1	№1
	147020	有机化学 I Organic Chemistry	必 C	48				3.0	2\3	№1
	147007	有机化学实验 I Organic Chemistry Experiments	必 C	32		32		1.0	3	№1
	147009	分析化学 II Analytical Chemistry	必 C	40				2.5	3	№1
	147013	分析化学实验 II Analytical Chemistry Experiment	必 C	32		32		1.0	3	№1
	147058	物理化学 I Physical Chemistry	必 C	48				3.0	3	№1
	147055	物理化学实验 II Physical Chemistry Experiment	必 C	32		32		1.0	3	№1
	135026	电工与电子技术 I Electrical Engineering and Electrotechnics	必 C	72		24		4.0	4	№1
	130083	机械设计基础 Basis of Mechanical Design	必 C	48				3.0	5	№3
	130311	机械基础综合实验 II Poly-experiment of Mechanical Fundamentals	必 C	16		16		0.5	5	№3
	137103	流体力学 Fluid Mechanics	必 C	48				3.0	4	№1
	137104	传热学 Heat transfer	必 C	48				3.0	5	№1
	170013	传质与分离工程 III Mass Transfer and Separation Processes	必 C	48				3.0	6	№1
	137063	化工原理实验（一） Experiment of Chemical Engineering Principles (1)	必 C	16		16		0.5	5	№1
	137064	化工原理实验（二） Experiment of Chemical Engineering Principles (2)	必 C	16		16		0.5	6	№1
	137060	工程热力学 Engineering Thermodynamics	必 C	48				3.0	4	№1
			合 计 Total	必 C	640		184		34.5	
专业领域课	137058	化学反应工程 Chemical Reaction Engineering	必 C	48				3.0	6	№1
	137145	化学反应工程与热力学实验 Experiment of Chemical Reaction Engineering and Thermodynamics	必 C	16		16		0.5	6	№1
	137067	自动控制理论 Process control and automation in Chemical Engineering	必 C	56		4		3.5	5	№1,5
	137146	能源化工设计 Design in Energy Chemical Engineering	必 C	32				2.0	7	№3,6

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				总学时 Class Hours	上机 Computer-ai ded Class Hours	实验 Lab Hours	实践 Practice			
				137091	燃气燃烧与应用 Gas Combustion and Utilization	必 C	48			
137096	天然气输配 Gas Transmission and Distribution	必 C	48				3.0	5	№1,3,6	
137101	石油加工 Petroleum Processing	必 C	48				3.0	6	№1,2,4	
137093	天然气开采与综合利用 Natural Gas Utilization	选 E	48				3.0	5	№1,2,4	
137133	生物质资源与能源 Biomass resources and bio-energy	选 E	32				2.0	6	№1,2,4	
137134	太阳能利用 Solar energy utilization	选 E	32				2.0	6	№1,2,4	
137130	风能利用技术 Wind Energy Utilization Technology	选 E	32				2.0	6	№1,2,4	
137076	计算机辅助设计 Computer Aided Design	选 E	40	16			2.5	4	№3,5	
137148	能源化学工程概论 Introduction to Energy Chemical Engineering	选 E	32				2.0	4	№1,2,4	
137095	高效换热器原理与设计 High-efficiency Heat Exchanger: Principle and Design	选 E	32				2.0	5	№1,2,4	
137105	热能与动力工程基础 Basic of Thermal and Power Engineering	选 E	40				2.5	5	№1,2,4	
137128	工程设计、产业模式与创业 Introduction to Engineering Design, Paradigm and Entrepreneurship	选 E	16				1.0	5	№3,9,10	
137022	工业催化 Industrial Catalysis	选 E	32				2.0	6	№1,2,4	
137025	化工环境工程 Environmental Engineering of Chemical Engineering	选 E	32				2.0	6	№6,7	
137045	学科前沿讲座 Seminar on Chemical and Energy Engineering	选 E	16				1.0	6	№10	
137056	文献检索与实践 Literature Retrieval and Survey	选 E	16				1.0	6	№2,5	
137098	化工过程模拟软件的使用 Process Simulation in Chemical Engineering	选 E	32	10			2.0	6	№2,3,5	
137100	制冷与空调 Refrigeration & AirConditioning	选 E	32				2.0	6	№1,2,4	
137129	化工过程安全 Chemical Process Safety	选 E	32				2.0	6	№3,6,8	
137131	压力容器与管道技术 Pressure vessel and Pipeline	选 E	32				2.0	6	№6,8	
137120	世界名企讲座 Seminar on Worldwide Celebrated Enterprises	选 E	16				1.0	6	№10	
137026	化工技术经济学 Technological Economy of Chemical Engineering	选 E	32				2.0	7	№6	
137034	化学工艺学 Chemical Technique	选 E	48				3.0	7	№2	
137099	能源材料 Energy Materials	选 E	32				2.0	7	№1,2,4	

类别 Course Category	课程 代码 Course No.	课程名称 Course Title	是否 必修 C/E	学时数 Total Curriculum Hours				学分 数 Credits	开课 学期 Semester	毕业 要求 Student Outcomes
				总学时 Class Hours	上机 Computer-ai ded Class Hours	实验 Lab Hours	实践 Practice			
	137132	能源审计与管理 Energy Audit and Management	选 E	32				2.0	7	No11
	120003	创新研究训练 Train on creativity	选 E	32				2.0		No2,3,4
	120004	创新研究实践 I Practice on creative research	选 E	32				2.0		No2,3,4
	120005	创新研究实践 II Practice on creative research	选 E	32				2.0		No2,3,4
	120006	创业实践 Practice on Entrepreneurship	选 E	32				2.0		No2,3,6
	合计 Total		必 C	296	0	20	0	18.0		
			选 E	选修课修读最低要求 17.5 学分 minimum elective course credits required:17.5						

备注：1.课程代码为 137093、137133、137134、137130 的课程至少修读 7 个学分，除这 4 门课剩余专业领域选修课至少修读 10.5 个学分。2.学生根据自己开展科研训练项目、学科竞赛、发表论文、获得专利和自主创业等情况申请折算为一定的专业选修课学分（创新研究训练、创新研究实践 I、创新研究实践 II、创业实践等创新创业课程）。每个学生累计申请为专业选修课总学分不超过 4 个学分。经学校批准认定为选修课学分的项目、竞赛等不再获得对应第二课堂的创新学分。3.建议第 4、5、6 学期分别选修 2、6、9.5 学分。

四、集中实践教学环节（Practice-concentrated Training）

课程 代码 Course No	课程名称 Course Title	是否 必修 C/E	学时数 Total Curriculum Hours		学分数 Credits	开课 学期 Semester	毕业要求 Student Outcomes
			实践 Practice weeks	授课 Lecture Hours			
106002	军训 Military Training	必 C	3 周		3.0	1	No9
143197	马克思主义理论与实践 Principle and Practice of Marxism	必 C	2 周		2.0	假期	No8
130356	工程训练 I Engineering Training	必 C	2 周		2.0	4	No6
130195	机械设计基础课程设计 Course Project on Mechanical Design	必 C	2 周		2.0	5	No3
141075	电子工艺实习 I Practice of Electronic Technology	必 C	1 周		1.0	5	No3
137108	燃气输配课程设计 Course Project on Gas Transmission and Distribution	必 C	2 周		2.0	6	No3
137076	化工原理课程设计 Course Project on Chemical Engineering Principle	必 C	2 周		2.0	6	No3
137147	能源化工设计实训 Practice of Energy Chemical Engineering	必 C	2 周		2.0	7	No3,6
137020	专业实验 Integrated Experiment of Chemical and Engineering	必 C	2 周		2.0	7	No8
137090	生产实习 Field Practice	必 C	2 周		2.0	7	No8
137075	毕业实习 Internship	必 C	2 周		2.0	8	No8
137149	毕业设计（论文） Graduation Project (Thesis)	必 C	15 周		15.0	8	No2,3,4
	合计 Total		必 C	37 周		37.0	

五、第二课堂

第二课堂由人文素质教育和创新能力培养两部分组成。

1.人文素质教育基本要求

学生在取得专业教学计划规定学分的同时，还应结合自己的兴趣适当参加课外人文素质教育活动，参加活动的学分累计不少于 2 个学分。

2.创新能力培养基本要求

学生在取得本专业教学计划规定学分的同时，还必须参加国家创新创业训练计划、广东省创新创业训练计划、SRP（学生研究计划）、百步梯攀登计划或一定时间的各类课外创新能力培养活动（如学科竞赛、学术讲座等），参加活动的学分累计不少于 4 个学分。

5.“Second Classroom” Activities

“Second Classroom” Activities are comprised of two parts, Humanities Quality Education and Innovative Ability Cultivation.

1)Basic Requirements of Humanities Quality Education

Besides gaining course credits listed in one’s subject teaching curriculum, a student is required to participate in extracurricular activities of Humanities Quality Education based on one’s interest, acquiring no less than two credits.

2)Basic Requirements of Innovative Ability Cultivation

Besides gaining course credits listed in one’s subject teaching curriculum, a student is required to participate in any one of the following activities: National Undergraduate Training Programs for Innovation and Entrepreneurship, Guangdong Undergraduate Training Programs for Innovation and Entrepreneurship, Student Research Program (SRP), One-hundred-steps Innovative Program, or any other extracurricular activities of Innovative Ability Cultivation that last a certain period of time (e.g. subject contests, academic lectures), acquiring no less than four credits.