Department of Mechanical and Energy Engineering

Program of Science and Engineering for Renewables for International Students (2023)

I. Introduction

Oriented to the future development of mechanical engineering, the Department of Mechanical and Energy Engineering (MEE) of Southern University of Science and Technology (SUSTech) aims at becoming a world-leading center for engineering education and research. The disciplines of the department include innovative design and advanced manufacturing, robotics, and automation, and new energy engineering with research focus on intelligent manufacturing, advanced forming and additive manufacturing, precision machining, robotics and automation, and energy engineering. There are three teaching and practice platforms in our department: advanced manufacturing, innovative design, and automation, robotics and artificial intelligence. We focus on educating two types of engineering talents: the academic talents who have solid science foundation in research, interdisciplinary perspective and experience, and good humanistic understanding, and insight into engineering problems, and the innovative talents with strong engineering leadership for solving important engineering problems.

The development and utilization of renewable energy is an important part of the national energy strategy and a key technology related to Chinese realization of the carbon peak in 2030 and carbon neutrality in 2060. In this context, the Ministry of Education has added a new major of science and engineering for renewable energy. This major involves the acquisition, storage, conversion, and utilization of renewable energy, such as solar energy, wind energy, geothermal energy and biomass energy. It is mainly oriented to the national energy development strategy and the new development trend of energy dynamics. It cultivates the basic knowledge of energy engineering, engineering thermodynamics, heat transfer and so on, and masters the principles of renewable energy conversion and utilization, photoelectric and photochemical conversion Professional knowledge in the field of new energy science in the direction of renewable energy heat utilization and thermal power generation principles and systems, energy storage science and

technology, and senior applied talents who can carry out teaching, scientific research, technology development, engineering application, operation and management in the field of national new energy science and engineering.

Academic subject areas: Energy and Power; Program code: 080503T

II. Objectives and Learning Outcomes

1. Objectives

The major cultivates interdisciplinary compound senior professionals with renewable energy scientific knowledge and engineering technology. The students need to master the basic theoretical knowledge of renewable energy science and engineering discipline, as well as various specialized technologies related to the major of this major, and be competent for the related technology development, engineering design, operation management, science and technology education and teaching in the field of renewable energy science and engineering. Graduates can engage in research, teaching, design, development, management, and other work in renewable energy utilization, energy conservation and emission reduction, carbon neutralization and other related directions in energy and power, chemical industry, metallurgy, electronics, automobile, machinery and other departments. Senior professionals with common sense of social responsibility, world-class vision, innovative spirit, practical ability and competitiveness.

The qualities that graduates of this major should have:

a) Professional capability: in the field of renewable energy science and engineering, the graduates have the technical ability to engage in research and development in academia and industry.

b) Engineering concept: the graduates have creative thinking and critical thinking. The graduates should be able to find and solve engineering and non-engineering problems in work based on engineering principles, and use the thinking mode of professional analysis to synthesize the obtained information, make reasonable judgments and propose innovative solutions.

c) Attitude: the graduates should be proactive, keep learning and keep pace with the times. The graduates should be honest, responsible, optimistic and calm in the face of difficulties, and have a world-class vision and make positive contributions to their posts.

d) Leadership: the graduates should be good at communication, gradually cultivate leadership ability in team cooperation, and lead the team to achieve goals.

2. Learning Outcomes

a) Engineering knowledge: systematically master the basic technical theories necessary for this major, mainly including the basic theories and knowledge of thermodynamics, heat transfer, new energy acquisition and storage, energy conversion and utilization, energy management and other directions; Master the basic principles and professional skills of the whole process of new energy acquisition, storage, utilization and management; Be able to use the basic theory and engineering knowledge learned to identify, formulate and solve complex engineering problems.

b) Experiment and data analysis: be able to design and complete new energy related experiments, analyze and interpret data, and draw reasonable and effective conclusions based on professional judgment of engineering knowledge.

c) Engineering solutions: be able to apply the engineering design concept to design solutions that meet specific needs, and consider several factors such as energy, environment, and economy in the design process.

d) Communication: have certain basic theoretical knowledge of humanities, social sciences, and natural sciences, and be able to effectively communicate with the audience.

e) Professional ethics and responsibility: be able to follow the engineering professional ethics and norms in engineering practice and perform professional duties; Have a good sense of social responsibility, be able to synthesize the information obtained and make reasonable and effective judgments.

f) Teamwork: be able to show leadership in team projects, create a collaborative and inclusive work environment, set goals, make plans, and achieve goals.

g) Independent learning: have a rigorous and realistic scientific attitude, the spirit of pursuing excellence, have good self-control and self-study ability, and the lifelong learning ability to constantly learn and adapt to new energy science and engineering.

III. Study Length, Degree, and Graduation Requirements

1. Study length: 4 years.

2. Degree conferred: Students who complete and meet the degree requirements of the undergraduate program will be awarded a Bachelor's Degree in Engineering.

3. The minimum credit requirement for graduation: 152 credits. The specific requirements are as follows.

<table>
<tr><th colspan="2">Module</th><th>Category</th><th>Minimum Credit Requirement</th></tr>
<tr><td rowspan="14">General Education Courses</td><td rowspan="2">Chinese Language and Culture Module</td><td>Chinese Language and Culture</td><td>16</td></tr>
<tr><td rowspan="2">Arts and Physical Education Module</td><td>Physical Education</td><td>4</td></tr>
<tr><td>Arts</td><td>2</td></tr>
<tr><td rowspan="3">Competence Development Module</td><td>Computer Programming</td><td>3</td></tr>
<tr><td>Writing</td><td>2</td></tr>
<tr><td>Foreign Languages</td><td>14</td></tr>
<tr><td rowspan="3">Humanities and Social Sciences Module</td><td>Humanities</td><td rowspan="2">6</td></tr>
<tr><td>Social Sciences</td></tr>
<tr><td>Chinese Studies</td><td>2</td></tr>
<tr><td rowspan="4">Mathematics and Natural Sciences Module</td><td>Mathematics</td><td>12</td></tr>
<tr><td>Physics</td><td>10</td></tr>
<tr><td>Chemistry</td><td>3</td></tr>
<tr><td>Geoscience + Life science</td><td>3</td></tr>
<tr><td>GE to Majors Bridging Module</td><td>Introduction to Majors</td><td>2</td></tr>
<tr><td rowspan="4">Major Courses</td><td rowspan="3">Major Required Courses</td><td>Major Foundational Courses</td><td>28</td></tr>
<tr><td>Major Core Courses</td><td>18</td></tr>
<tr><td>Practice-based Learning (Undergraduate Thesis, Internships, Research projects, etc.)</td><td>12</td></tr>
<tr><td>Major Elective Courses</td><td>Major Elective Courses</td><td>15</td></tr>
<tr><td colspan="3">Total</td><td>152</td></tr>
<tr><td colspan="4">Note: please see the General Education Requirement for more details on Chinese Language and Culture Module, Arts and Physical Education Module, Competence Development Module (Foreign Languages & Writing) , Humanities and Social Sciences Module, and GE to Majors Bridging Module.</td></tr>
</table>

IV. Course Requirements for the Mathematics and Natural Sciences Module and Computer Programming

Course Category	Course Code	Course Name	Credits	Terms	Prerequisite	Dept.
Mathematics	MA101a/ MA117	Mathematical Analysis I /Calculus I	5/4	1 Fall	None	MATH
	MA102a/ MA127	Mathematical Analysis II /Calculus II	5/4	1 Spring	Mathematical Analysis I / Calculus I	MATH
	MA107/ MA113	Advanced Linear Algebra I / Linear Algebra	4	1 Spring & Fall	None	MATH
Physics	PHY101/ PHY105	General Physics I / College Physics I	5/4	1 Fall	None	PHY
	PHY102/ PHY106	General Physics II / College Physics II	5/4	1 Spring	General Physics I / College Physics I	PHY
	PHY104B	Experiments of Fundamental Physics	2	1-2 Spring & Fall	None	PHY
Chemistry	CH103/ CH105	General Chemistry / Chemistry: The Central Science	4/3	1-2 Spring & Fall	None	CHEM
Geoscience + Life science	BIO102B/ BIO103/E OE100	Principles of Biology / Introduction to Life Science/ Introduction to Earth Sciences	3	1-2 Spring & Fall	None	BIO, ESS, OCE, ESE
Computer Programming	CS109/ CS110/ CS111/ CS112/ CS113	Introduction to Computer Programming/ Introduction to Java Programming/ Introduction to C programming/ Introduction to Python Programming Python/ Introduction to Matlab Programming	3	1-2 Spring & Fall	None	CSE
Note: "/"means equivalent courses to be selected by students.						

V. Prerequisites for Major Declaration

<table>
<tr><th>Major Declaration Time</th><th>Course Code</th><th>Course Name</th><th>Prerequisite</th></tr>
<tr><td rowspan="6">Declare major at the end of the first academic year</td><td>MA101a/ MA117</td><td>Mathematical Analysis I /Calculus I</td><td>None</td></tr>
<tr><td>MA102a/ MA127</td><td>Mathematical Analysis II /Calculus II</td><td>Mathematical Analysis I / Calculus I</td></tr>
<tr><td>PHY101/ PHY105</td><td>General Physics I /College Physics I</td><td>None</td></tr>
<tr><td>PHY102/ PHY106</td><td>General Physics II /College Physics II</td><td>General Physics I / College Physics I</td></tr>
<tr><td colspan="3">Note:
The above courses are required to be completed. In addition, at least one of the following Course Category should be passed:
1. Mathematics: MA107/MA113 Advanced Linear Algebra I / Linear Algebra.
2. Physics: PHY104B Experiments of Fundamental Physics.
3. Chemistry: CH103/CH105 General Chemistry / Chemistry: The Central Science.
4. Geoscience + Life science: BIO102B/BIO103/EOE100 Principles of Biology / Introduction to Life Science/ Introduction to Earth Sciences .
5. Computer Programming: CS109/CS110/CS111/CS112/CS113 Introduction to Computer Programming/ Introduction to Java Programming/ Introduction to C programming/ Introduction to Python Programming Python/ Introduction to Matlab Programming.
（ “/”means equivalent courses to be selected by students. ）</td></tr>
<tr><td rowspan="6">Declare major at the end of the second academic year</td><td>MA101a/ MA117</td><td>Mathematical Analysis I /Calculus I</td><td>None</td></tr>
<tr><td>MA102a/ MA127</td><td>Mathematical Analysis II /Calculus II</td><td>Mathematical Analysis I / Calculus I</td></tr>
<tr><td>PHY101/ PHY105</td><td>General Physics I /College Physics I</td><td>None</td></tr>
<tr><td>PHY102/ PHY106</td><td>General Physics II /College Physics II</td><td>General Physics I / College Physics I</td></tr>
<tr><td>MA107/ MA113</td><td>Advanced Linear Algebra I / Linear Algebra</td><td>None</td></tr>
<tr><td colspan="3">Note:
The above courses are required to be completed. In addition, at least one of the following Course Category should be passed:
1. Physics: PHY104B Experiments of Fundamental Physics.
2. Chemistry: CH103/CH105 General Chemistry / Chemistry: The Central Science.
3. Geoscience + Life science: BIO102B/BIO103/EOE100 Principles of Biology / Introduction to Life Science/ Introduction to Earth Sciences .
4. Computer Programming: CS109/CS110/CS111/CS112/CS113 Introduction to Computer Programming/ Introduction to Java Programming/ Introduction to C programming/ Introduction to Python Programming Python/ Introduction to Matlab Programming.
（ “/”means equivalent courses to be selected by students. ）</td></tr>
<tr><td colspan="4">Note:
1. If the number of students entering a major at the end of the first academic year in the department is greater than or equal to the total number of the teaching-research faculty (PI)*2*60%, all majors in the department may implement the prerequisites for major declaration at the end of the second academic year.
2. If the number of students entering a major at the end of the first academic year in the department is less than the total number of the teaching-research faculty (PI)*2*60%, all majors in the department do not implement the prerequisites for major declaration at the end of the second academic year.
3. Suppose the number of students applying for a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), then the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students’ suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).
4. For departments that do not implement prerequisites for major declaration at end of the second academic year, if the cumulative number of students applying for a major at the end of the second academic year and the</td></tr>
</table>

number of students who have entered a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).

VI: Major Course Arrangement

Table 1: Major Required Courses

Program of Science and Engineering for Renewables

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Major Foundational Courses	ME271	Fundamentals of Thermodynamics and Heat Transfer	4	0	2/Fall	MA127	MEE
	ME102	CAD and Engineering Drawing	3	1.5	2/Fall		MEE
	EE104	Fundamentals of Electric Circuits	2	0	2/Fall	MA101B, MA113	EE
	MAE207	Engineering Fluid Mechanics	3	0	2/Fall	MA127	MAE
	MSE202	Physical Chemistry	3	0	2/Spring	CH105/ CH103, MA127	MSE
	MSE204	Physical Chemistry Experiments	1	1	2/Spring	MSE202	MSE
	ME272	Semiconductor Physics for Energy Devices	3	0	2/Spring	PHY106	MEE
	ME261	Engineering Materials - Science, Processing and Design	3	0	2/Spring	PHY106, CH105/ CH103	MEE
	ME273	Introduction to Energy Science	3	0	2/Spring	PHY106, CH105/ CH103，ME271	MEE
	ME103	Awareness Practice of Manufacturing Engineering	3	2	2-3 Spring &Fall		MEE
	Total		**28**	**4.5**			
Major Core Courses	ME371	Principle of Solar to Electricity and Solar Photochemistry Conversion	3	0	3/Fall	ME272	MEE
	ME372	Principles of Electrochemistry	3	0	3/Fall	MSE202, MSE204	MEE
	ME373	Energy Materials Chemistry	3	0	3/Fall	ME273	MEE
	ME376	Fundamentals of Energy Catalysis	3	0	3/Spring	ME273	MEE
	ME377	Principle and Technology of Energy Storage	3	0	3/Spring	ME273	MEE
	ME378	Characterization Technique of Energy Materials	3	0.5	3/Spring	ME273	MEE
	Total		**18**	**0.5**			
Practice-based Courses	ME498	Senior Project*	12	12	4/Spring		MEE
	Total		**12**	**12**			
Total			**58**	**17**			

Note：*Students who have completed Comprehensive Design Ⅰ& Ⅱ are not required to take the Senior Project (ME498) .

Table 2: Major Elective Courses

Program of Science and Engineering for Renewables

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Elective Courses of Professional Capability	ME381	Photovoltaic Power Generation Technology	3	0	3/Fall	ME273	MEE
	ME382	Artificial Light Synthesis Fuel Technology	3	0	3/Fall	ME273	MEE
	ME383	Grid Connection Technology of New Energy Power Generation	3	0	3/Fall	ME273	MEE
	MEE5402	New energy technology: hydrogen and fuel cell technology	3	0	3/Fall	ME273	MEE
	MEE5405	Solar Thermal Energy Utilization Technologies	3	0	3/Spring	MA127	MEE
	ME385	Photoelectric Conversion Films and Devices	2	0	3/Spring	ME273	MEE
	ME384	Electrochemical Measurement	3	2	3/Spring	ME372	MEE
	MEE5410	Lithium Ion Battery Technology	3	0	3/Spring	ME273	MEE
	ME387	Solid State Electrochemistry and All Solid State Battery	3	0	3/Spring	ME372	MEE
	ME386	Advanced Batteries for Electrical Vehicles	3	0	3/Spring	PHY106	MEE
Elective Courses of Engineering Basic	ME212	Mechanics of Materials M	3	0	2/Fall	MA127	MEE
	ME374	Science and Ethics	2	0	3/Fall		MEE
	SDM274	Artificial Intelligence and Machine Learning	3	0	3/Fall	MA127, MA113	SDIM
	MEE5215	Flexible and Wearable Electronics: Design and Fabrication Techniques	3	0	3/Spring	ME261	MEE
	ME388	Energy System for Electric Vehicle	2	0	3/Spring	ME372	MEE
	MEE5411	Renewable Energy Systems	3	0	3/Spring	ME273	MEE
	ME485	Energy Policy	1	0	3/Spring	ME273	MEE
	ME486	Comprehensive Experiment for Energy Engineering	2	2	3/Spring		MEE
	ME491	Practice	3	3	1-3 Spring &Fall&Summer, 4 Spring &Fall		MEE
Total			**51**	**7**			

Note:

1. The minimum requirement for graduation in this module is 15 credits.
2. Major elective courses selected by a student during any specific semester may be changed according to the

loading situation.

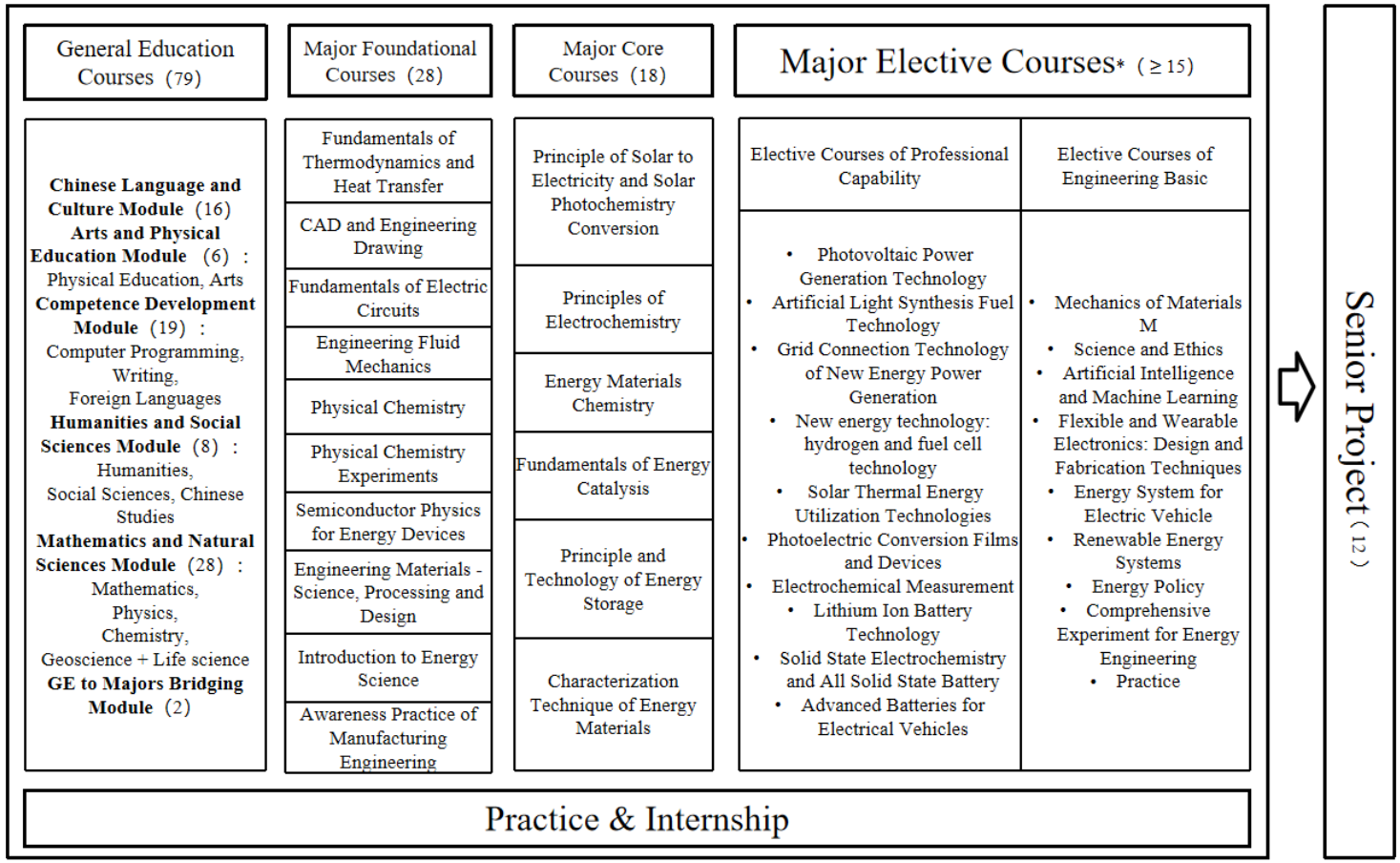
3. The number and contents of major elective courses offered by the department may be adjusted according to the development of curriculum construction.

Table 3: Overview of Practice-based Learning

Program of Science and Engineering for Renewables

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
ME102	CAD and Engineering Drawing	3	1.5	2/Fall		MEE
MSE204	Physical Chemistry Experiments	1	1	2/Spring	MSE202	MSE
ME103	Awareness Practice of Manufacturing Engineering	3	2	2-3 Spring &Fall		MEE
ME378	Characterization Technique of Energy Materials	3	0.5	3/Spring	ME273	MEE
ME384	Electrochemical Measurement	3	2	3/Spring	ME372	MEE
ME486	Comprehensive Experiment for Energy Engineering	2	2	3/Spring	ME273	MEE
ME491	Practice	3	3	1-3 Spring &Fall&Summer, 4 Spring &Fall		MEE
ME498	Senior Project	12	12	4/Spring		MEE
Total		30	24			

Curriculum Structure of Science and Engineering for Renewables



Note*: Here only list some of the major elective courses. The full list is detailed in the program of Science and Engineering for Renewables for International Students.