Mechanical Engineering

(Pathway from Higher Vocational Education to Undergraduate Education-Undergraduate Education Level)

(Grade of 2023)

Course code: 080201

I. Cultivation Objectives

This program strives to strengthen the fundamental task of establishing moral values and educating people, promote the spirit of craftsmanship and the value orientation of the spirit of model workers, cultivate high quality applied technical talents with solid basic theories of natural science and engineering, good humanistic qualities and professional ethics, good communication and collaboration and lifelong learning ability, and comprehensive development of morality, intellect, physique, aesthetics and labour, who master the professional knowledge of mechanical design, mechanical manufacturing and its automation, have strong engineering practice ability, and can engage in design and manufacturing, technology development, engineering application, production management and technical services in mechanical engineering and its related fields.

Five years after graduation, students in this program should achieve the following objectives:

(1)Be able to meet the technological developments in mechanical engineering and propose solutions to complex engineering problems in mechanical engineering and related fields in practical work using professional theories and engineering knowledge.

(2)Have spirit of technological innovation, the ability to perform engineering innovation, the ability to comprehensively use expertise and modern tools, and the ability to engage in the design, development and production of products related to complex engineering problems in mechanical engineering and related fields to meet the needs of companies, institutions and users.

(3)Have the sense of social responsibility, an understanding of and adherence to professional standards, and the ability to integrate legal, safety, environmental and sustainability considerations into engineering practice

(4)Have good scientific and humanistic qualities, dedication to work, selflessness, teamwork, effective communication skills and the ability to manage engineering projects

(5)Have the ability to follow the latest developments and trends at both domestic and international levels in the field of mechanical engineering in practical work, have an international perspective, and the ability for independent and lifelong learning.

II. Requirement for Graduation

According to the motto of Shanghai Polytechnic University and the 12 graduation requirements of the General Standard of China Engineering Education Accreditation Association (CEEAA), the mechanical engineering program has expanded the core competencies and quality expressions of the 12 graduation requirements in accordance with the orientation of talent cultivation in our university, and the indicators of each graduation requirement are listed as follows:

1. Engineering Knowledge: The ability to apply mathematical, natural science and engineering fundamentals and expertise to the solution of complex engineering problems in mechanical engineering and related fields.

1-1: Master the concepts and principles of mathematics, physics and other natural sciences and engineering

fundamentals, be able to understand their role in solving complex problems in the field of mechanical engineering and have the ability to apply them to mechanical engineering expertise.

1-2: Be able to develop and solve a mathematical model for a complex mechanical system or mechanical engineering process.

1-3: Be able to apply relevant knowledge and mathematical models to the derivation, analysis and discrimination of solutions to complex engineering problems in mechanical engineering and related fields.

1-4: Be able to apply mathematical models and relevant engineering knowledge to analyse, compare and attempt to improve solutions to complex engineering problems in mechanical engineering and related fields.

2. Analysis of the Problem: Be able to apply the fundamental principles of mathematics, natural and engineering sciences to identify, represent, and through literature research to analyse complex engineering problems in mechanical engineering and related fields in order to reach valid conclusions.

2-1: Be able to apply the fundamental principles of mathematics, natural and engineering sciences to identify and determine the key techniques and parameters of complex engineering problems in mechanical engineering and related fields.

2-2: Be able to correctly represent and analyse complex engineering problems in mechanical engineering and related fields based on relevant scientific principles and mathematical models.

2-3: Be able to recognize that there are multiple options for solving complex engineering problems in mechanical engineering and related fields and seek alternative and stand-by solutions through literature research.

2-4: Be able to apply basic principles of mechanical engineering and related fields to analyse how solutions may be affected during implementation and obtain valid conclusions.

3. Design/Develop of Solutions: Be able to design solutions to complex engineering problems in mechanical engineering and related fields, to design mechanical systems, mechanical components or machining processes that meet specific needs, and demonstrate the spirit of innovation in the design process, taking into account social, health, safety, legal, cultural and environmental factors.

3-1: Master the basic design/development methods and techniques for the full life cycle and full process of mechanical engineering design and mechanical product development. Be able to describe design objectives and understand the factors that influence design objectives and technical solutions.

3-2: Be able to develop solutions and complete component and part designs for complex engineering problems in mechanical engineering and related fields.

3-3: Be able to design complex mechanical systems or manufacturing processes that meet specific requirements and to demonstrate the spirit of innovation in the design.

Indicators 3-4: Be able to comprehensively consider social, health, safety, legal, ethical, cultural and environmental factors in design.

4. Research: Be able to use scientific principles and methods to investigate complex engineering problems in mechanical engineering and related fields, including designing experiments, analyzing and interpreting data, and synthesizing information to reach reasonable and valid conclusions.

4-1: Be able to investigate and analyse complex engineering problems in mechanical engineering and related fields based on scientific principles, combined with literature research or related methods.

4-2: Be able to select routes of research and design experimental protocols based on the characteristics of complex engineering problems in mechanical engineering and related fields, such as mechanical systems and control systems.

4-3: Be able to construct experimental systems based on experimental protocols, conduct experiments in a safe and standardized manner, and collect experimental data correctly.

4-4: Be able to correctly analyse and interpret experimental results and synthesize information to reach reasonable and valid conclusions.

5. Use of modern tools: Be able to develop, select and use appropriate techniques, resources, modern engineering tools and information technology tools for complex engineering problems in mechanical engineering and related fields, including prediction and simulation of complex engineering problems in mechanical engineering and related fields, and be able to understand their limitations.

5-1: Understand the principles and methods of using modern instruments, information technology tools, engineering tools and simulation software commonly used in mechanical engineering, and understand the limitations of their use.

5-2: Be able to select and use appropriate instruments, information resources, engineering tools and specialist simulation software to analyse, calculate and design complex engineering problems in mechanical engineering and related fields.

5-3: Be able to develop or select modern tools to meet specific needs, simulate and predict specialist problems for specific objects of complex engineering problems in mechanical engineering and related fields and be able to analyse their limitations.

6. Engineering and Society: Be able to perform reasonable analysis based on engineering-related contextual knowledge and evaluate how engineering practices and solutions to complex engineering problems in mechanical engineering and related fields may impact society, health, safety, law, and culture, and understand the responsibilities involved.

6-1: Understand the system of technical standards, intellectual property rights, industrial policies and laws and regulations in fields related to mechanical engineering and understand the impact of different social cultures on engineering activities.

6-2: Be able to analyze and evaluate the impacts of mechanical engineering practices and complex engineering problems on society, health, safety, law, culture and the impacts of these constraints on project implementation, and understand the responsibilities involved.

7. Environment and Sustainable Development: Be able to understand and evaluate the impacts of engineering practices for complex engineering problems in mechanical engineering and related fields on environment and sustainable development of society.

7-1: Understand the meaning and significance of environmental protection and sustainable development of society and be able to practise environmental protection and sustainable development of society when solving complex engineering problems in mechanical engineering and related fields.

7-2: Be able to evaluate the potential damage and hazards to humans and the environment in relation to actual mechanical engineering projects, and understand the social, safety and legal responsibilities involved.

8. Professional Codes: Have humanistic, social and scientific qualities, social responsibility, and the ability to understand and comply with engineering ethics and codes in the practice of mechanical engineering and fulfill the responsibilities.

8-1: Have humanistic, social and scientific qualities, correct values, understanding of the relationship between the individual and society, and knowledge of the Chinese context.

8-2: Understand the engineering ethics and codes of honesty, fairness and integrity, and be able to consciously observe them in the practice of mechanical engineering.

8-3: Understand the social responsibility of mechanical engineers for the safety, health and well-being of the public, and for environmental protection, and be able to consciously exercise this responsibility in the practice of mechanical engineering.

9. Individual and team: Be able to assume the role of individual, team member and leader of multidisciplinary team.

9-1: Be able to communicate effectively and collaborate proactively with members of other disciplines.

9-2: Be able to work independently or cooperatively in a team and have good teamwork spirit.

9-3: Be able to assume the role of team leader, manage the work schedule of the project, and organize and coordinate the work of team members.

10. Communication: Be able to communicate and interact effectively with industry peers and the public on complex engineering issues in mechanical engineering and related fields, including writing reports and design submissions, presenting statements, clearly expressing or responding to instructions, and having an international perspective and the ability to communicate and interact in a cross-cultural context.

10-1: Be able to express views accurately, respond to challenges and understand the differences in communication with industry peers and the public on complex engineering issues in mechanical engineering and related fields, either orally, in manuscripts, diagrams or drawings.

10-2: Understand international trends and research hotspots in the field of mechanical engineering, as well as understand and respect the differences and diversity of different cultures around the world.

10-3: Be able to communicate verbally and in writing across cultures and to communicate and interact in a basic way in the cross-cultural context on complex engineering issues in mechanical engineering.

11. Project management: Understand and master the principles of engineering management and economic decision-making methods and be able to apply them in a multidisciplinary environment.

11-1: Master the principles of engineering management and economic decision-making methods involved in mechanical engineering activities.

11-2: Understand the cost components of engineering and mechanical products throughout their life cycle and processes, and understand the engineering management and economic decision-making issues involved.

Target point 11-3: Be able to apply engineering management and economic decision-making methods in the design and development of mechanical engineering project solutions in a multidisciplinary environment (including simulated environment).

12. Lifelong learning: Have the spirit of independent and lifelong learning and the ability to learn and adapt to development constantly.

12-1: Be able to properly understand the necessity of self-exploration and lifelong learning and have the spirit of independent and lifelong learning.

12-2: Master the methods of independent learning, understand the ways to expand knowledge and abilities, pay attention to the dynamics of development of the profession and have the ability to adapt to development and update knowledge.

III. Schooling System

Two years for Undergraduate Education.

IV. Length of Study

Flexible study period, generally two years, the minimum length of flexibility is not less than one and a half years, the longest not more than three years.

V. Requirements for Graduation and Degree Conferring

Students of this program must complete the minimum credits required for each category of courses and complete all the content specified in extracurricular class according to the requirements of the instructional training plan, and the total credits must reach 67.5 credits for graduation; those who meet the requirements for bachelor's degree can be conferred bachelor degree in engineering.

VI. Discipline

Mechanical Engineering, Mechanics

VII. Core Courses (2 years of undergraduate study)

Introduction to Engineering, Mechanical Manufacturing Technology, Hydraulic and Pneumatic Transmission, Projects Integration of Mechanical Systems Design and Precision Manufacturing, CNC Machine Tools and Programming, Practice for Multi-axis Machining and Simulation

VIII. Course Structure and Course Hours (excluding Extracurricular Class)

Category	**Total Credit**	**%**	**Total Course Hours**	**Theory Learning**	**Practical Training**
Public Fundamental Course	9	13	160	140	20
General Education	4	6	64	64	0
Engineering Fundamental Course	5	8	80	72	8
Professional Fundamental Course	9	14	144	124	20
Professional Course	16	24	256	208	48
Professional Practice	23.5	35	712	0	712
Total	66.5	100	1416	608	808
Theory: **Practical** (%)	43:57				

IX. Teaching schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester
Public Fundamental Course	required	Others	b1110004	Mental Health Education for University Students	non-test	2	32	16	16	Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020076	Calculation method	test	2	32	32		Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020023	Functions of complex variables and integral transformations	non-test	2	32	32		Autumn 1
	required	School of Resources an Environment	b1013001	Academic Chemistry	test	2	32	28	4	Autumn 1
	required	College of Physical Education	-----	Physical Education V	non-test	0.5	16	16		Autumn 1
	required	College of Physical Education	-----	Physical Education VI	non-test	0.5	16	16		Spring 1
Subtotal				**(Public Fundamental Course)**		**9**	**160**	**140**	**20**	
General Education	selective	Each Colleges	b0 ---	Social Sciences and Humanistic Qualities Natural Sciences and Technology Innovation	non-test	4	64	64		Autumn, Spring
Subtotal				**(General Education)**		4	64	64		Autumn, Spring

IX. Teaching schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester
Engineering Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011397	Fundamentals of Engineering Materials	test	2	32	28	4	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011521	Fundamentals of Thermal Engineering and Fluid Mechanics	test	3	48	44	4	Spring 1
Sub-total (Engineering Fundamental Course)						**5**	**80**	**72**	**8**	
Professional Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011188	Introduction to Engineering	non-test	1	16	16	0	Autumn 1
	required	Engineering Training and Innovation Education Center	b2090012	Fundamentals of Programming C++	test	2	32	26	6	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011047	Principles of Engineering Control	test	2	32	30	2	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011016	Testing Techniques	non-test	2	32	26	6	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011143	Project Management	non-test	2	32	26	6	Autumn 2
Subtotal (Professional Fundamental Course)						**9**	**144**	**124**	**20**	
Professional Course	required	School of Intelligent Manufacturing and Control Engineering	b2011081	Mechanical Manufacturing Technology	test	3	48	42	6	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011119	CNC Machines and Programming	test	2	32	26	6	Autumn 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011152	Hydraulic and Pneumatic Transmission	test	2	32	28	4	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011520	Scientific and Technical Paper Writing and Literature Search	non-test	1	16	16		Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b2011055	Industrial Robots and Applications	non-test	2	32	24	8	Autumn 2
	Subtotal (Required Professional Course)					**10**	**160**	**136**	**24**	
	Selective 6 credits	School of Intelligent Manufacturing and Control Engineering	b2011182	Programmable Controllers (PLC)	non-test	2	32	24	8	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011181	Electromechanical Transmission Control	non-test	2	32	24	8	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011395	Mechanical Design Practice	non-test	2	32	16	16	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011156	Finite Element Analysis and Practice	non-test	2	32	16	16	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011141	Modern Design Theory and Methods	non-test	2	32	26	6	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011135	Advanced Manufacturing Technology	non-test	2	32	26	6	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011396	Execution Systems of Intelligent Manufacturing (MES)	non-test	2	32	26	6	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011510	Injection Moulding Process and Mould Design	non-test	2	32	26	6	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011511	Material Forming CAE	non-test	2	32	26	6	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011476	Additive Manufacturing Technology	non-test	2	32	26	6	Spring 1
		School of Intelligent Manufacturing and Control Engineering	b2011512	Green Manufacturing and Environmental Protection	non-test	2	32	26	6	Spring 1
	Subtotal (Selective Professional Course)					**6**	**96**	**72**	**24**	
Subtotal (Professional Course)						**16**	**256**	**208**	**48**	

IX. Teaching schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester
Professional Practice	required	School of Intelligent Manufacturing and Control Engineering	b4011339	Labour Education B	non-test	0.5	16		16	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011255	Practice A for Interchangeability and Measurement Technology	non-test	3	72		72	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011166	Practice for Designing Mechanism Process Protocols	non-test	2	48		48	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011352	Mechanical Systems Design and Precision Manufacturing Project Integration	non-test	2	48		48	Spring 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011111	Practice for CNC Programming and Machining	non-test	3	72		72	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b4000012	Innovation and Entrepreneurship of Mechanical Engineering	non-test	2	48		48	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011256	Practice for Multi-axis Machining and Simulation	non-test	2	48		48	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011264	Comprehensive Practice for Mechanical Engineering	non-test	3	72		72	Autumn 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011247	Mechanical Engineering Graduation Internship and Graduation Design (Thesis)	non-test	6	288		288	Spring 2
Subtotal (Professional Practice)						**23.5**	**712**	**0**	**712**	
Extracurricular Class	required	Others	b5110001	Extracurricular Class	non-test	**1**	-	-	-	Autumn, Spring, Summer
Total						**67.5**	**1416**	**608**	**808**	

Explanation of the relevance of professional certificates to the course:

Through the courses of "Machine Manufacturing Technology", "CNC Machine Tools and Programming", "Practice for CNC Programming and Machining" and "Mechanical systems design and precision manufacturing project integration", mechanical engineering students can take the examinations for professional certificates related to this program such as CNC Milling, CNC assembly, commissioning and maintenance as well as can apply for the trainee professional engineer qualification certificate (China Construction Machinery Society).

X. Credit of Extracurricular Class

Through taking extracurricular classes, students are encouraged to take part in academic lectures, social practice activities, campus cultural and sports activities, innovative and entrepreneurial activities, voluntary activities, etc. to improve their social adaptability and enhance the competitiveness in the job market. Details are specified in Students' Manual.