

Mechanical Engineering

(Pathway from Secondary Vocational 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.

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

Four years.

IV. Length of Study

Flexible study period, generally four years, the minimum length of flexibility is not less than three years, the longest not more than six 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 166 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

Mechanical principles and Innovative Design of Mechanisms, Introduction to Engineering, Modern Engineering Drawing, Engineering Mechanics, Principles of Mechanics, Mechanical Design, Electrical and Electronic Engineering, Mechanical manufacturing processes, CNC Machine Tools and Programming, Production Management for Intelligent Manufacturing (MES/ERP), Practice for Interchangeability and Measurement Technology, Practice for Computer Aided Design and Manufacturing, Practice for CNC Programming and Machining, Practice for Mechanism Processes Design, Comprehensive Practice for Mechanical Engineering.

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

Category	Total Credit	%	Total Course	Theory Learning	Practical Training
Public Fundamental Course	60.5	37	1104	1018	84
General Education	10	6	160	160	0
Engineering Fundamental Course	18	11	288	246	42
Professional Fundamental Course	20	12	320	275	45
Professional Course	19	11	304	242	62
Professional Practice	37.5	23	1048	0	1048
Total	165	100	3224	1941	1283
Theory: Practical (%)	60:40				

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	School of Marxism	b1080006	Outline of Modern Chinese History	non-test	3	48	42	6	Autumn 1
	required	School of Marxism	b1080001	Basic Principles of Marxism	test	3	48	42	6	Spring 1
	required	School of Marxism	b1080009	Ethics and the Rule of Law	non-test	3	48	42	6	Spring 1
	required	School of Marxism	b1080010	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	test	3	48	42	6	Spring 2
	required	School of Marxism	b1080011	Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era	test	3	48	42	6	Autumn 2
	required	School of Marxism	----	Situation and Policy (Modules 1 to 4)	non-test	2	32	28	4	Autumn 1 to Spring 2
	required	School of Marxism	b1080008	Labour Education A	non-test	0.5	16	16		Autumn 2
	required	Others	b1110004	Mental Health Education for University Students	non-test	2	32	16	16	Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020080-	Advanced Mathematics A1	test	4	64	64		Autumn 1
	required	School of Mathematics, Physics and Statistics	b1020081-	Advanced Mathematics A2	test	4	64	64		Spring 1
	required	School of Mathematics, Physics and Statistics	b1020012-	Linear Algebra	test	2	32	32		Spring 1
	required	School of Mathematics, Physics and Statistics	b1020013-	Probability Theory and Mathematical Statistics	test	2	32	32		Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020023-	Functions of complex variables and integral transformations	non-test	2	32	32		Spring 2
	required	School of Mathematics, Physics and Statistics	b1020076	Calculation method	test	2	32	32		Spring 2
	required	School of Mathematics, Physics and Statistics	b1020062-	Academic Physics A (Module 1)	test	3	48	48		Spring 1
	required	School of Mathematics, Physics and Statistics	b1020065-	Academic Physics B	test	2	32	32		Autumn 2
	required	School of Mathematics, Physics and Statistics	b1020111-	Academic Physics C	non-test	2	32		32	Autumn 2
	required	College of Resources and Environment	b1013001-	Academic Chemistry	test	2	32	28	4	Autumn 1
	required	School of Foreign Language and Cultural Communication	b1020018	Academic Chinese	non-test	2	32	32		Spring 1
	required	Others	b1110003	Military skills	non-test	0.5	2W			Autumn 1
	required	Others	b1110002	Military theory	non-test	0.5	32	32		Autumn 2
required	College of Physical Education	----	Physical Education I to VI	non-test	3	160	160		Autumn 1 to Autumn 4	

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hours	Theory Learning	Practical Training	Recommended semester	
	required	School of Foreign Language and Cultural Communication	b1020003-	General English III	test	3	48	48		Autumn 1	
	required	School of Foreign Language and Cultural Communication	b1020004-	General English IV	test	3	48	48		Spring 1	
	required	School of Foreign Language and Cultural Communication	b1020005-	General Academic English A	test	2	32	32		Autumn 2	
	required	School of Foreign Language and Cultural Communication	---	English Knowledge Expansion	non-test	2	32	32		Spring 2	
Subtotal (Public Fundamental Course)							60.5	1104	1018	86	
General Education	selective	Art Education Center	b0 ---	Aesthetic Education	non-test	2	32	32		Autumn, Spring	
	selective	Each Colleges	b0 ---	Social Sciences and Humanistic Qualities	non-test	4	64	64		Autumn, Spring	
				Natural Sciences and Technology Innovation	non-test	4	64	64		Autumn, Spring	
Subtotal (General Education)							10	160	160		

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	b2011246	Modern Engineering Drawing	test	4	64	40	24	Autumn 1		
	required	School of Intelligent Manufacturing and Control Engineering	b2011397	Fundamentals of Engineering Materials	test	2	32	28	4	Spring 1		
	required	School of Intelligent Manufacturing and Control Engineering	b2011049	Engineering Mechanics I	test	3	48	48		Autumn 2		
	required	School of Intelligent Manufacturing and Control Engineering	b2011050	Engineering Mechanics II	test	3	48	44	4	Spring 2		
	required	Engineering Training and Innovation Education Center	b2090001	Electrical and Electronic Engineering	test	3	48	42	6	Spring 2		
	required	School of Intelligent Manufacturing and Control Engineering	b2011521	Fundamentals of Thermal Engineering and Fluid Mechanics	test	3	48	44	4	Autumn 3		
Sub-total (Engineering Fundamental Course)							18	288	246	42		
Professional Fundamental Course	required	School of Intelligent Manufacturing and Control Engineering	b2011188	Introduction to Engineering	non-test	1	16	16	0	Autumn 1		
	required	School of Intelligent Manufacturing and Control Engineering	b2011020	Fundamentals of Programming C++	test	2	32	26	6	Spring 1		
	required	School of Intelligent Manufacturing and Control Engineering	b2011310	Mechanical principles and Innovative Design of Mechanisms	test	4	64	50	14	Autumn 2		
	required	School of Intelligent Manufacturing and Control Engineering	b2011077	Mechanical design	test	3	48	45	3	Spring 2		
	required	School of Intelligent Manufacturing and Control Engineering	b2011312	Mechanical manufacturing processes	test	4	64	56	8	Autumn 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011047	Principles of engineering control	test	2	32	30	2	Autumn 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011016	Testing techniques	non-test	2	32	26	6	Spring 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011143	Project Management	non-test	2	32	26	6	Spring 3		
Subtotal (Professional Fundamental Course)							20	320	275	45		
Professional Course	required	School of Intelligent Manufacturing and Control Engineering	b2011520	Scientific and Technical Paper Writing and Literature Search	non-test	1	16	16		Autumn 2		
	required	School of Intelligent Manufacturing and Control Engineering	b2011182	Programmable Controllers (PLC)	non-test	2	32	24	8	Autumn 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011119	CNC machines and programming	test	2	32	26	6	Autumn 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011152	Hydraulic and Pneumatic Transmission	test	2	32	28	4	Autumn 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011311	Numerical control systems and Its principles	test	2	32	28	4	Spring 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011055	Industrial robots and applications	non-test	2	32	24	8	Spring 3		
	required	School of Intelligent Manufacturing and Control Engineering	b2011433	Production Management of Intelligent Manufacturing (MES/ERP)	test	2	32	24	8	Spring 3		
	Subtotal (Required Professional Course)							13	208	170	38	
	Selective 6 credits		School of Intelligent Manufacturing and Control Engineering	b2011257	Fundamentals of microcontroller technology	test	2	32	24	8	Autumn 3	
			School of Intelligent Manufacturing and Control Engineering	b2011181	Electromechanical Transmission control	non-test	2	32	24	8	Autumn 3	
			School of Intelligent Manufacturing and Control Engineering	b2011494	Intelligent control systems	test	2	32	26	6	Autumn 3	
			School of Intelligent Manufacturing and Control Engineering	b2011141	Modern design theory and methods	non-test	2	32	26	6	Spring 3	
			School of Intelligent Manufacturing and Control Engineering	b2011156	Finite Element Analysis and Its Practice	non-test	2	32	24	8	Spring 3	
			School of Intelligent Manufacturing and Control Engineering	b2011469	Precision and ultra-precision machining technology	non-test	2	32	26	6	Spring 3	
			School of Intelligent Manufacturing and Control Engineering	b2011135	Advanced Manufacturing Technology	non-test	2	32	26	6	Autumn 4	
		School of Intelligent Manufacturing and Control Engineering	b2011476	Additive manufacturing technology	non-test	2	32	24	8	Autumn 4		
	School of Intelligent Manufacturing and Control Engineering	b2011522	Artificial intelligence technologies and applications	non-test	2	32	26	6	Autumn 4			
Subtotal (Selective Professional Course)							6	96	72	24		
Subtotal (Professional Course)							19	304	242	62		

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	b4011088	Modern Engineering Mapping and Surveying	non-test	2	48		48	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011282	Practice B for Interchangeability and Measurement Technology	non-test	3	72		72	Summer 1
	required	School of Intelligent Manufacturing and Control Engineering	b4011059	Practice for Computer Aided Design and Manufacturing	non-test	3	72		72	Spring 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011106	Corporate Understanding Internship	non-test	1	24		24	Summer 2
	required	Engineering Training and Innovation Education Center	b4090005	Technical internship for Electrical Engineering	non-test	1	24		24	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011302	Course Design for Mechanical Design (E)	non-test	2	48		48	Summer 2
	required	School of Intelligent Manufacturing and Control Engineering	b4011285	Practice for Designing Mechanism Process Protocols	non-test	2	48		48	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4000012	Innovation and Entrepreneurship of Mechanical Engineering	non-test	2	48		48	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011339	Labour Education B	non-test	0.5	16		16	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011329	Comprehensive practice for CNC machining	non-test	3	72		72	Spring 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011342	Intelligent equipment fault diagnosis and maintenance	non-test	3	72		72	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011256	Practice for Multi-axis machining and simulation	non-test	2	48		48	Summer 3
	required	School of Intelligent Manufacturing and Control Engineering	b4011352	Mechanical systems design and precision manufacturing project	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011353	Mechanical Engineering Internship	non-test	2	48		48	Autumn 4
	required	School of Intelligent Manufacturing and Control Engineering	b4011264	Comprehensive Practice for Mechanical Engineering	non-test	3	72		72	Autumn 4
required	School of Intelligent Manufacturing and Control Engineering	b4011247	Mechanical Engineering Graduation Internship and Graduation	non-test	6	288		288	Spring 4	
Subtotal (Professional Practice)							37.5	1048	1048	
Extracurricular Class	required	Others	b5110001	Extracurricular Class	non-test	1	-	-	-	Autumn, Spring, Summer
Total							166	3224	1941	1283

Explanation of the relevance of professional certificates to the course:

Through the courses of "Modern Engineering Drawing", "Modern Engineering Drawing and Surveying" and "Practice of Computer Aided Design and Manufacturing", mechanical engineering students can take the examinations for UG/Solidworks Advanced Certificate and other professional certificates related to this program; through the courses of "Mechanical manufacturing processes", "CNC Machine Tools and Programming", "Practice of CNC Programming and Machining", "Mechanical System 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.