China University of Petroleum (East China) Graduate Program for Master of Science in Oil and Natural Gas Engineering (International Class)

Discipline name: Oil and Natural Gas Engineering

Discipline code: 0820

I. Program Description

Oil and Natural Gas Engineering (ONGE) is the predominant and characteristic discipline in China University of Petroleum (East China), and among the Key Constructive Disciplines in the "211 Project" and the "985 Project Innovation Platform". ONGE became the National Key Discipline in 2001, and always ranks No.1 over the nation in China Discipline Ranking (CDR). It was elected into the National "Double First-Rate" Disciplines in 2017, and two secondary disciplines, "Field Development Engineering" and "Offshore Oil and Gas Engineering", are under the grant from Overseas Expertise Introduction Project for Discipline Innovation ("111 Project").

This program provides five research fields, including oil & gas well engineering, reservoir engineering, production engineering, oilfield chemistry and enhanced oil recovery, and offshore oil & gas engineering. Specific directions such as complex well mechanics and control engineering, wellbore multiphase flow theory and pressure control technique, reservoir poromechanics and development, oilfield chemistry and enhanced oil recovery, offshore oil & gas engineering, etc., reach the international advanced and leading level, and contribute significantly to the national petroleum industry and the national economy.

II. Educational Objectives

In order to meet the current demands in oil and gas industry, this program aims at cultivating international talents in technology and stewardship. The graduates should be able to achieve high standards in ethic, intellectual and physical development, possess rigorous scientific

attitude and academic attainment, grasp solid basic theories and systematical knowledge in fields, exhibit international views and intercultural abilities in communication, competition and collaboration, and conduct related scientific research or engineering jobs.

III. Basic Requirements for Admission

All applicants must be qualified in the following selection criteria:

1. Ethic qualities: complying laws and regulations, possessing upright ethics, honesty and commitment, moral and physical health, sense of social responsibility and spirit of teamwork, actively practicing core values of socialism.
2. Academic attainments: exhibiting truth-seeking principle in science, rigorous attitude in study, and perseverant spirit in research; showing high standards in academia and consciousness in intellectual property. Following academic morals, advocating academic integrity, and passionate about scientific research.
3. Knowledge structure: adapting to the demands in energy industry, grasping the solid basic theories and knowledge in fields, acquaint with the disciplinary development and the international advances in academia, emphasizing on the applications with interdisciplinary knowledge, in order to provide a sound foundation for systematic and creative research.
4. Basic abilities: systematically mastering a foreign language, proficiently reading foreign literatures, possessing outstanding abilities in technical writing, information searching and acquiring, internationally academic communication, life-long studying, problem analysis and problem-solving, etc.; mastering advanced methods in scientific research, and exhibiting strong creative ability in academia.

IV. Training Directions

1. Oil and Gas Well Engineering

In order to establish a safe and efficient flow pathway from downhole to surface, oil and gas well engineering mainly studies on the physical, mechanical and chemical characteristics of rocks, fluids and strings, as well as their interaction trends and relevant control techniques during drilling,

completion and workover. This direction consists of oil and gas well mechanics, information and control, rock mechanics and engineering in oil and gas well, fluid mechanics and engineering in oil and gas well, chemistry and engineering in drilling fluid and completion fluid, etc.

2. Oil and Gas Field Development Engineering

In order to produce oil and gas resources economically, efficiently and to the maximum extent, oil and gas field development engineering mainly studies on a series of basic theories and technologies, including the vadose trends in reservoir, oil and gas field development plan, oil and gas production, enhanced oil recovery, etc. This direction consists of theories and applications in oil and gas seepage, theories and systematic engineering in oil and gas field development, theories and techniques in oil and gas production engineering, enhanced oil recovery and production chemistry, information techniques and applications in oil and gas production, etc.

3. Offshore Oil and Gas Engineering

With the special environmental conditions and the special working platform on ocean, in order to explore the offshore oil and gas resources safely and efficiently, offshore oil and gas engineering mainly studies on the physical, mechanical and chemical phenomena, laws, mechanics and techniques during offshore drilling, completion, production, gathering and transportation. This direction consists of offshore oil and gas drilling and production engineering, theories and techniques in hydrate production, safety and environmental protection in offshore oil and gas engineering, etc.

V. Time Limitations

Normal time limit for graduation is three years, and the maximum time limit for graduation is five years from the date of admission into the degree program.

VI. Training Mode

The program adopts the full-time study mode. The training activities mainly involve course study, research training, international and Hong Kong, Macao and Taiwan academic exchange and study, and degree thesis,

under the supervision of an individual advisor or team advisors. Courses are taught in English by international experts.

VII. Credit Requirements

The minimum number of total credits is 28, and that of required courses is 13 for graduation.

VIII. Curriculum Settings

1. Core Curricula

Core Curriculum 1: Physics of Fluid Flow in Porous Media

Introduction: Through the study of this course, students will understand the phenomena and mechanisms of fluid flow in porous media, and master the methods to acquire reservoir rock and fluid parameters. In addition, students will get to know the current structure and development of oil and gas flow in porous media. The main contents include: the new theories and methods of reservoir physics, multiphase flow in multi-scale porous media with multi-field coupling effect, the seepage theory in tertiary oil production, non-isothermal seepage, etc., which provides a theoretical foundation for oil and gas exploration work.

Core Curriculum 2: Advanced Rock Mechanics

Introduction: Through the study of this course, students will systematically learn the mechanical properties of the formation. The main contents include: the strength and deformation of rock, elastic-plastic analysis principles, analytical and numerical simulation of rock mechanics problems, determining methods of *in-situ* stress, rock failure criteria, measurement and monitoring technology of rock mechanics, etc. In addition, the students will master the mechanical response characteristics of related operations in petroleum engineering, including wellbore stability, hydraulic fracturing and fracture stability, sand production and other typical engineering problems, which provides a foundation to solve real engineering problems.

Core Curriculum 3: Modern Drilling and Completion Engineering

Introduction: Through the study of this course, the students will systematically learn the latest achievements, technical principles and methods in drilling and completion engineering. The main contents include: optimization of drilling parameters, drilling design of complex wells,

MWD and trajectory control, mechanic analysis of downhole drill string and tools, drill string stability and torque, new methods to increase ROP, automated drilling engineering, intelligent drilling engineering, cementing operation design of complex wells, design and optimization of casing and tubing, completion techniques and equipment, etc.

Core Curriculum 4: Advanced Oil & Gas Production Engineering

Introduction: Through the study of this course, students will grasp the main theories, calculation methods and new developments involved in the design of oil and natural gas production system, and build a solid base for the research of highly efficient artificial lift methods. The main contents include: inflow performance of oil and gas reservoir, multiphase flow behavior in pipes, pressure and temperature gradient prediction in wellbore, well deliverability prediction, production system analysis and optimization, working process of artificial lift methods in oil and gas wells, and artificial lift methods optimization and diagnosis in oil and gas wells.

Core Curriculum 5: Advanced Oil & Gas Reservoir Engineering

Introduction: Through the study of this course, the students will thoroughly master the basic principles and methods of oil and gas geology, reservoir evaluation, engineering design, dynamic analysis and development adjustment for different types of hydrocarbon reservoirs. The main contents include: oil and gas reservoir evaluation methods, principles and methods in well test analysis, development dynamic analysis methods, residual hydrocarbon distribution and development adjusting methods, basic theories and methods of complex hydrocarbon reservoir development, etc. Meanwhile, the students will learn the disciplinary advances, and master the abilities to solve complex problems encountered in projects of oil and gas field development, through case analysis and comprehensive training.

Core Curriculum 6: Principles and Methods for Improved Oil Recovery (IOR)

Introduction: Through the study of this course, the students will master the latest achievements, techniques, mechanisms and methods in IOR, and learn the evaluation methods in IOR. The main contents include: polymer flooding, profile control and water shutoff, surfactant flooding,

alkaline flooding, combination flooding, thermal oil recovery, gas flooding. The students should be able to choose the optimized IOR method based on given reservoir conditions.

Core Curriculum 7: Deepwater Drilling and Production Engineering

Introduction: Through the study of this course, the students will learn the latest achievements in offshore drilling and production, and master the basic concepts, mechanisms, methods and calculating skills regarding all the related steps and technologies. The students should be able to use these theories and methods to analyze and solve the technical problems encountered in the construction of offshore drilling and production, and grasp the basic designing methods in major processing steps and technical measures. The main contents include: procedure and main equipment in deepwater drilling operation, design of deepwater wellbore structure, deepwater drilling control techniques, deepwater drilling and completion fluids, deepwater drilling test techniques, modes and features of deepwater oil & gas field development, subsea production system, submarine pipelines and standpipes, flow insurance in deepwater production, etc.

2. Detailed Settings

Table 1 Curriculum System for Master of Science (M.S.) students in Oil and Natural Gas Engineering (International Class)

Course Type		Course Name	Credits	Credit Requirement
Required Courses	Public Required Courses	1. <Research on the Theory and Practice of Socialism with Chinese Characteristics>; replaced by <Overview of China> for international master students	2.0	4.0
		2. <Primary Foreign Language> (exemptible upon application); replaced by <Chinese Linguistic Basics> for international master students	2.0	
	Public Basic Course	<Numerical Analysis>	3.0	9.0
	Specialized Basic Courses	<Physics of Fluid Flow in Porous Media>	2.0	
		<Deepwater Drilling and Production Engineering>	2.0	
		<Advanced Rock Mechanics>	2.0	
Optional	Specialized Optional	<Modern Drilling and Completion Engineering>	2.0	≥8.0

Courses	**Courses**	<Advanced Oil & Gas Reservoir Engineering>	2.0	
		<Advanced Oil & Gas Production Engineering>	2.0	
		<Principles and Methods for Improved Oil Recovery (IOR)>	2.0	
		<Numerical Reservoir Simulation>	2.0	
		<Reservoir Stimulation Technology>	1.0	
		<Reservoir Description and Modeling>	2.0	
		<Environmental Pollution and Protection in Oil and Gas Exploitation>	1.0	
		<Advanced Colloid Chemistry of Oil and Gas Engineering>	1.0	
		<Academic English Reading and Writing of Petroleum & Oil Engineering>	1.0	
		<Courses from the graduate program of secondary discipline>	≤3.0	
	Public Optional Courses	1. <Introduction to Dialectics of Nature> (18 semester hours, 1.0 credit, REQUIRED); replaced by <History of Chinese Science and Technology> or <Chinese Contemporary Economy> (1.0 credit for each, 1.0 total credit REQUIRED)	1.0	≥4.0
		2. University Managed Courses – Foreign Language: (1) Practical linguistic skills: <Graduate Visual-Audio-Oral English>, <Comparison and Translation between English and Chinese>; (2) Humanities: <Intercultural Communication, English Classic Literatures>; (3) ESP Courses: <Energy English>, <English for Oversea Studying> (18 semester hours for each course, 1.0 credit each, 2.0 total credits REQUIRED）	1.0	
		3. <Public Physical Education> (1.0 credit, REQUIRED)	1.0	
		4. <Other University Managed Courses>		
	UPCIC courses	UPCIC stands for UPC Intensive Curricula, normally 0.5 or 1.0 credit		≤1.0
	Deficiency Courses	<Production Engineering>	3.5	Arbitrarily 2 courses
		<Petrophysics>	3.0	
		<Engineering Fluid Mechanics>	4.0	
		<Oilfield Chemistry>	3.0	
		<Drilling Engineering>	3.5	
		<Rock Mechanics>	2.0	

		<Fluid Flow in Porous Media>	3.5	
		<Reservoir engineering>	3.5	
		<Offshore Petroleum Engineering>	2.0	
Required Activities		1. Attending 10+ seminars, making a public academic presentation	1.0	3.0
		2. International and Hong Kong, Macao and Taiwan academic exchange and study	1.0	
		3. Literature review and research proposal for degree	1.0	

Notes for curriculum settings:

(1) The program brings in UPCIC courses, in order to make the program flexible and fulfill the need for the diverse development of the graduate students. UPCIC stands for UPC Intensive Curricula, and normally accounts for 0.5 or 1.0 credit. It includes various intensive academic activities or creative and practical activities, such as summer schools, summer intensive courses, academic seminars, graduate student symposium, intensive training for essential disciplinary contests, graduate projects for innovation and entrepreneurship, etc.

(2) Primary Foreign Language (graduate-level) is a public required course, and the degree candidates can apply for exemption if their English level meets relevant standards. Other language-speaking students (other than Chinese) take corresponding linguistic courses.

(3) The students must choose the core curriculum/curricula listed in the specialized required courses from their own training direction.

(4) Deficiency courses: the students from another discipline or enrolled with equivalent scholarship must take two undergraduate main courses in corresponding major appointed by the advisor. The credits earned from these deficiency courses do not count in the total credits.

(5) International and Hong Kong, Macao and Taiwan academic exchange and study: international academic exchange and study is a required activity. The students need to attend international and Hong Kong, Macao and Taiwan academic conferences, summer schools, research collaboration, academic exchange, training, collaborative programs etc., and submit conclusive report.

IX. Mid-Term Evaluation

A comprehensive mid-term evaluation is scheduled in the fourth semester for all master students in this program. The students need to summarize the progress of their degree thesis. Based on the contents in the research proposal, students are required to complete 30-40% of the thesis work; otherwise, the students are subject to extended evaluation or discretionary dismissal. Evaluation committee must consist of at least 5 faculty members with middle-rank titles or above, and the student's advisor must be in the committee; if the advisor is not in the committee, the student cannot attend the mid-term evaluation. For detailed procedure of the evaluation, please refer to <Temporary Regulations on the Mid-Term Evaluation for Graduate Students in Master of Science at China University of Petroleum (East China)> (UPC-EC-[2015]35) and relevant requirements in the School of Petroleum.

X. Research Training and Degree Thesis

This work must comply with the requirements of corresponding secondary disciplinary program. The M.S. students must search and read current literatures, select reasonable research topics, conduct academic research, and write degree thesis under the guidance of the advisor or team advisors. The topic of the degree thesis is expected to contribute significantly to the theoretical and technical development in oil and natural gas engineering. The M.S. degree thesis should be the fundamental or applicable research in oil and natural gas engineering, or the innovative research and development that considerably influences oil and natural gas engineering. The students choose topics for degree thesis in the third semester (at the end of the second semester) normally.

Degree thesis is an important index, which comprehensively measures the training quality and academic level of an M.S. student, and students should complete their theses individually. Degree thesis should strictly comply with the requirements for academic standards, the requirements for thesis format from the university and other relevant regulations. Degree thesis must report concisely on true, original and creative research, with plausible hypothesis, rigorous logics, reliable data, reasonable structure, clear hierarchy, coherent literary, and standard charts.

XI. Creative Achievements

The M.S. candidates must publish one research article in the field on a journal, which is listed in the statistical source/CSCD core journal catalog (graduate student and advisor must be the first two in the author list; invalid for other situations); or publish one research article in foreign language, which is closely related to the research in thesis, on a foreign official journal (graduate student and advisor must be the first two in the author list; invalid for other situations); or apply one national/oversea invention patent/software copyright as the first two applicants; or publish one article on an international/nationally-famous conference recognized in the field (closely related to the research in thesis); or win the second award in a national competition in petroleum engineering (as the main group member for a group award, and the first two for an individual award).

China University of Petroleum (East China) should be the first affiliation for all the achievements listed above; the articles, patents, software copyrights and other relevant achievements must include the advisor's name.

XII. Review and Defense of Degree Thesis

If the M.S. candidate successfully completed all the courses and activities in the program, passed all the exams, met the credit requirements, and complied with relevant regulations in the university, the student is able to apply the review and defense of his/her degree thesis. The review and defense of degree thesis normally carries out in the sixth semester after the enrollment. For detailed information about the review and defense, please refer to <Detailed Rules for Awarding Degrees of China University of Petroleum (East China)> (UPC-EC-[2015]33) and other relevant regulations.

If the student successfully passed the defense of degree thesis and met all the criteria for graduation, he/she is awarded with the diploma in the corresponding discipline. If the student met all the standards for the degree (awarding) in this discipline and other relevant requirements, he/she is awarded with the Master of Science degree in Engineering, based on <Detailed Rules for Awarding Degrees of China University of Petroleum (East China)> (UPC-EC-[2015]33).

Signature of Associate Dean for Research and Graduate Studies (School Stamp):

Date: