

《石油工程概论》教学大纲

一、基本信息

课程名称：石油工程概论

课程代码：240901G013

总学时：15

实验学时：0

开课学院：石油学院

课程性质：选修

英文课程名称：Introduction to petroleum engineering

总学分：1

课内学时：15

上机学时：0

适用专业：全校专业

先修课程：无

二、课程简介

石油，工业的血液，国家能源安全的保障，与国民经济建设、人民生活紧密相关，习近平同志强调“端好能源的饭碗，走好绿色发展之路”。石油开发是资金密集、技术密集型的产业，工艺流程复杂，需要研究开发原理与方法，优化钻采工艺与技术，需要各专业的高层次人才的共同努力。

课程以油气开发、生产的工艺过程为主线，较全面、系统地介绍油气开采各工艺过程与环节的基本知识、原理、方法以及相关的工艺技术；具备国家规划教材、授课视频、名师课堂、工程体验等线上线下资源；可为今后从事与油气开发有关的工作打下良好的基础。

三、课程教学目标

- (1) 知识目标：掌握油气开采过程涉及的油藏物性、开发设计、动态分析、建井、开采的基础知识；
- (2) 能力目标：掌握油气开采各工艺过程与环节的原理、方法以及相关的工艺技术，培养分析解决油气开发中油藏工程、钻井工程、采油工程问题的能力；
- (3) 素质目标：理解石油工程与所学专业的关系，培养学科交叉创新能力，锻炼高阶思维能力，提升团队协作、解决复杂问题等方面的能力。

四、课程教学内容与学习要求

(可按章节顺序或教学单元顺序编写，要详细说明具体教学内容、教学重点和难点，应清楚地表达知识、技能的范围和深度，充分反映课程的知识 and 技能要求，体现课程特点。)

章节/教学单元		教学内容、重点、难点	学时	学习要求
绪论	第一节 油气重要性	1. 油气钻井开发视频资料学习	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解
第一章 油藏流体的物性	第一节 油藏流体的物性	1. 油气的化学组成 2. 油气的相态 3. 原油的高压物性 4. 天然气及地层水的高压物性	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解
第二章 油藏岩石的物理性质	第一节 油藏岩石的物理性质	1. 储层岩石骨架的性质 2. 岩石的孔隙度和流体饱和度 3. 岩石的比面和压缩系数 4. 油藏岩石的渗透率	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解

章节/教学单元		教学内容、重点、难点	学时	学习要求
		5. 岩石的润湿性和油水微观分布		
第三章	油田开发设计基础	1. 油田勘探开发程序 2. 储量计算 3. 油藏驱动方式及其开采特征 4. 油田开发层系的划分与组合 5. 砂岩油田的注水开发 6. 油田开发方案的编制 7. 复杂断块油田开发	2	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第四章	油藏动态分析和开发调整	1. 试井分析方法 2. 经验方法 3. 物质平衡方法 4. 油藏数值模拟方法 5. 油田开发调整	2	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第五章	油气钻井方法及工艺	1. 钻井发展史 2. 钻井类型 3. 钻井设备 4. 钻头 5. 钻柱及井口工具	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第六章	钻井工艺技术	1. 影响钻进速度的主要因素 2. 钻进参数选择 3. 井斜及其控制 4. 钻井液	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第七章	固井、完井与试油	1. 井身结构 2. 固井 3. 完井方式 4. 试油	2	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解
第八章	采油方式	1. 自喷与气举采油 2. 常规有杆泵采油 3. 其他常用采油方法	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第九章	注水工程	1. 注水系统与水质处理方法 2. 注水井吸水能力与注水管柱	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第十章	油水井增产增注技术	1. 水力压裂技术 2. 酸处理技术 3. 其他地层处理技术	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用
第十一章	提高采收率原理	1. 采收率及其影响因素 2. 提高采收率的基本方法-化学驱油法 3. 提高采收率的基本方法-其他驱油法	1	<input checked="" type="checkbox"/> 记忆 <input checked="" type="checkbox"/> 理解 <input checked="" type="checkbox"/> 应用

注：在“学习要求”一栏补充选项，可以多选，无要求可不填，也可自定要求。**记忆**，指能从记忆库中找到相关的知识、概念、术语或材料与当前的信息进行比较、确认，能记住并能不加理解的列出、描述这些知识、概念、术语或材料；**理解**，指能对所学的内容作归纳、分类、解释、总结、推断和一定程度的发挥；**应用**，指能选择正确的程序应用、实施所学到的内容，并能进行必要的计算或决断；**综合分析**，指能将所学的内容分解并找出它们的相互关系和构成，或能计划、创造、建造、有改变的重构，或能作评论、总结、估计、预测、评估、论证和答辩。

六、教学方法

本课程提倡学生广泛阅读参考书和参考文献，实行课堂讲授、自学与课堂讨论相结合的教学方法，实现教师理论精讲和案例分析，学生达到知识丰富、实验熟练的学习效果。

七、考核方式

智慧树在线考试

课内开卷：40%

平时成绩：50%

章节测试成绩：10%

最终成绩评定方式为两等级制，综合成绩 ≥ 60 为合格，否则为不合格。

八、教材与参考书

（一）教材

1. 《现代石油工程导论与前沿技术》，李军，薛永超，张辉 著，中国石油大学出版社。

（二）参考书目或文献

1. 《钻井工程手册》，JJ.阿扎，G.罗艾罗.萨莫埃尔 著，石油工业出版社。
2. 《钻井工程》，王建学，万建仓等，石油工业出版社。
3. 《欠平衡钻井基础理论与实践》，杨虎，王利国 著，石油工业出版社。

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审核人：刘红现

制（修）订时间：2024 年 9 月

《Introduction to petroleum engineering》 Syllabus

I. Basic Information

Course Name: Introduction to petroleum engineering	Name in Chinese: 石油工程概论
Course No.: 240901G013	Total Credits:1
Total Hours:15	Lecture Hours:15
Lab Hours: 0	Computer Lab Hours: 0
Offering College: Petroleum Institute	Corresponding Majors: all majors
Course Type: elective course	Prerequisite: none

II. Course Introduction

Petroleum development is a capital intensive and technology intensive industry, with complex technological processes. It requires research and development principles and methods, optimization of drilling and production processes and technologies, and the joint efforts of high-level talents from various professions.

The course focuses on the process of oil and gas development and production, and comprehensively and systematically introduces the basic knowledge, principles, methods, and related process technologies of various processes and links in oil and gas extraction; Having online and offline resources such as national planning textbooks, teaching videos, renowned teacher classrooms, and engineering experiences; It can lay a solid foundation for future work related to oil and gas development.

III. Course Objective

(1) Knowledge objective: Master the basic knowledge of reservoir properties, development design, dynamic analysis, well construction, and production involved in the oil and gas extraction process;

(2) Ability objective: Master the principles, methods, and related process technologies of various processes and links in oil and gas exploitation, and cultivate the ability to analyze and solve problems in oil and gas reservoir engineering, drilling engineering, and oil production engineering in oil and gas development;

(3) Quality objectives: Understand the relationship between petroleum engineering and the major studied, cultivate interdisciplinary innovation ability, exercise higher-order thinking ability, enhance team collaboration, solve complex problems, and other abilities.

IV. Contents and Requirements

Chapter/Teaching Unit		Teaching content, key points, and difficulties	class hour	learning requirements
introduction	Importance of oil and gas	1. Learning video materials for oil and gas drilling development	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter One	Physical properties of reservoir fluids	1. Chemical composition of oil and gas 2. Phase state of oil and gas 3. High pressure physical properties of crude oil 4. High pressure physical properties of natural gas and formation water	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter 2	Physical properties of reservoir rocks	1. Properties of reservoir rock skeleton 2. Porosity and fluid saturation of rocks 3. Specific surface area and compression coefficient	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application

Chapter/Teaching Unit		Teaching content, key points, and difficulties	class hour	learning requirements
		of rocks 4. Permeability of reservoir rocks 5. The wettability of rocks and the microscopic distribution of oil and water		
Chapter III	Fundamentals of Oilfield Development Design	1. Oilfield Exploration and Development Procedures 2. Reserve calculation 3. Reservoir driving methods and their extraction characteristics 4. Division and combination of oil field development layers 5. Water injection development of sandstone oil fields 6. Preparation of oilfield development plan 7. Development of complex fault block oil fields	2	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter 4	Reservoir dynamic analysis and development adjustment	1. Well testing analysis method 2. Empirical methods 3. Material balance method 4. Numerical simulation methods for oil reservoirs 5. Oilfield development adjustment	2	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter V	Oil and gas drilling methods and processes	1. History of Drilling Development 2. Drilling type 3. Drilling equipment 4. Drill bit 5. Drill string and wellhead tools	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter VI	drilling technology	1. Main factors affecting drilling speed 2. Selection of drilling parameters 3. Well deviation and its control 4. Drilling fluid	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter VII	Cementing, completion, and oil testing	1. Well structure 2. Cementing 3. Completion method 4. Oil testing	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding
Chapter VIII	Oil extraction method	1. Self injection and gas lift oil recovery 2. Conventional rod pump oil extraction 3. Other commonly used oil recovery methods	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter 9	Water injection engineering	1. Water injection system and water quality treatment methods 2. Water absorption capacity of water injection wells and water injection string	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
chapter x	Techniques for increasing production and injection of oil and water wells	1. Hydraulic fracturing technology 2. Acid treatment technology 3. Other Formation Processing Technologies	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application
Chapter XI	Principles of improving oil recovery	1. Recovery rate and its influencing factors 2. Basic method for improving oil recovery - chemical flooding method 3. Basic methods for improving oil recovery - other oil displacement methods	1	<input checked="" type="checkbox"/> Memory <input checked="" type="checkbox"/> Understanding <input checked="" type="checkbox"/> Application

Note: in the column of "learning requirements", you can select more than one option. If there is no requirement, you can leave it blank or set your own requirements. Memory refers to the ability to find relevant knowledge, concepts, terms or materials from the memory bank, compare and confirm with the current information, and be able to remember and list and describe these knowledge, concepts, terms or materials without understanding; Understanding refers to the ability to summarize, classify, explain, summarize, infer and give play to the learned content to a certain extent; Application refers to the ability to select the correct program, apply and implement the learned content, and make necessary calculations or decisions; Comprehensive analysis refers to the ability to decompose the learned content and find out their mutual relationship and composition, or plan, create, build and restructure with changes, or make comments, summaries, estimates, forecasts, evaluations, demonstrations and defense.

VI .Teaching methods

This course advocates students to widely read reference books and literatures, and implement the teaching method of combining classroom teaching, self-study and classroom discussion, so as to realize teachers' fine theoretical lectures and case analysis, and students can achieve the learning effect of rich knowledge and skilled experiment.

VII、 Evaluation

Online examination

In class opening: 40%

Usual score: 50%

Chapter Test Score: 10%

The final score is assessed in a two-level system. The overall score ≥ 60 is qualified, otherwise it is failed.

VIII、 Teaching materials and reference books

(1) Textbook

1. Introduction and foreword technology of modern petroleum engineering, Li Jun, Xue Yongchao, Zhang Hui, China University of Petroleum Press.

(2) Reference

1. Drilling engineering manual, written by JJ aza, G. roero samoel, petroleum industry press.
2. Drilling engineering, Wang Jianxue, Wan Jiancang, etc., petroleum industry press.
3. Basic theory and practice of underbalanced drilling, written by Yang Hu and Wang Ligu, petroleum industry press.