地院全英硕士教学大纲（汇总）

2022.4.8

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# 第一学年

## 第1学期

### 中国概况

### 汉语言基础

### 数值分析625

### 高等石油地质学

 

**Course Syllabus**

 **Advanced Petroleum Geology (SZ01010)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 3 | Toal Course Hours | 48 |
| Lecture Hours | 48 | Experiment Hours |  |
| Programming Hours |  | Other Practical Hours |  |
| Course Instructors: Keyu Liu |
| Course Website:  |

**1. Objectives and Learning Outcomes**

This course is a compulsory course for graduate and overseas students majoring in geological resources, geological engineering and geological engineering. It is a core course with strong theory and practice. It mainly expounds the generation, migration and accumulation theory of modern oil and gas, as well as the research ideas and methods of hydrocarbon accumulation and distribution patterns. Through the study of this course, students are required to systematically grasp the mechanism and distribution theory of hydrocarbon accumulation in petroliferous basins, to have a comprehensive understanding of the leading theories and methods of petroleum geology, and to preliminarily grasp the research ideas and methods of hydrocarbon accumulation and distribution, so as to lay a theoretical foundation for future research on hydrocarbon accumulation and exploration. At the same time, students are required to read a large number of documents about hydrocarbon accumulation mechanism and enrichment law, compile a literature review report on relevant important theoretical issues, and combine with the actual geological scenario to make a comprehensive analysis, and preliminarily learn the comprehensive research methods of hydrocarbon geology.

**2. Course Content**

Chapter 1 Introduction（2 hours）

1.1 Overview of petroleum geology

1.2 Current research focus of petroleum geology

Chapter 2 Conventional petroleum system（8 hours）

2.1 Concept

2.2 Source rock and Petroleum generation and expulsion

2.3 Reservoir rocks and storage spaces

2.4 Seal Rocks and capping capacity

2.5 Petroleum migration and entrapment

Chapter 3 Basin and petroleum system modelling (BPSM) （6 hours）

3.1 Overview

3.2 Methodology and workflow

3.3 Geological model reconstruction

3.4 Thermal history modelling

3.5 Petroleum migration and entrapment modelling

3.6 Unconventional petroleum system modelling

Chapter 4 Rock physics and digital core（4 hours）

4.1 Overview

4.2 Methodology and workflow

4.3 Sandstone formation

4.4 Carbonate formation

4.5 Shale formations

Chapter 5 Continuous petroleum system（4 hours）

5.1 Overview of subtle petroleum reservoirs

5.2 Stratigraphic reservoirs

5.3 Lithological reservoirs

5.4 Formation mechanisms and case study

Chapter 6 Deep and ultra-deep petroleum resources（4 hours）

6.1 Overview

6.2 Origin of deep petroleum

6.3 Occurrence and phase states of deep petroleum

6.4 Petroleum accumulation models and key controlling factors

6.5 Case study

Chapter 7 Unconventional petroleum resources（4 hours）

7.1 Concept, definition and categories

7.2 Tight oil and gas

7.3 Shale oil and gas

7.4 Coalbed methane

7.5 Gas hydrate

**3. Course Material**

Required Text:

1. Knut Bjorlykke (Editor), 2015. Petroleum Geoscience: from Sedimentary Environments to Rock Physics, Springer；

2．L.B. and Dow, W.G., eds., 1994. The petroleum system – From source to trap: American Association of Petroleum Geologists Memoir, v. 60;

3. Zou, C. (Editor), 2013. Unconventional Petroleum Geology, Elsevier

Other reading materials：

AAPG Bulletin, Marine and Petroleum Geology, Organic Geochemistry, Journal of Petroleum Science and Engineering

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments, in-class activities and quizzes (15%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and quizzes. Any number of unannounced quizzes amy be given druing the semester at the beginning of class or at the end of class. A quiz may cover material from the assigned reading, any previous class period, or the current class period.

Case studies (10%):

Development projects (20%): This component of the final grade is based upon two development projects (breif description of the projects). Each project is worth 10%.

Middle-term exam (20%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

Final-term exam (20%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

Other Items: other factors, such as class and group participation and puncture, regular attdendance may be used, at the professor’s discretion, to make adjustments to final grades in borderline cases. The instructor will assume that you are well prepared for class each week.

Classroom lectures are mainly focused on the generation, migration and accumulation of modern oil and gas reservoir formation theory, as well as the research ideas and methods of hydrocarbon reservoir formation and distribution law, interspersed with scientific research case analysis and classroom discussion

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 储层地质学及油藏描述

 

**Course Syllabus**

**Reservoir Geology and Oil Reservoir Description (SZ01006)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 3 | Toal Course Hours | 48 |
| Lecture Hours | 48 | Experiment Hours | / |
| Programming Hours | / | Other Practical Hours | / |
| Course Instructors: ZHANG Xianguo |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Upon sucessful completion of the course, students will have gained and understanding of …… Specific learning objectives are:

1. Understand the concept and basic principles of reservoir description at different exploration and development stage;
2. Master basic method and principles of reservoir modeling, oil reservoie evaluation, reserve calculation and oil reservoir simulation;
3. Cultivating senior talents from reservoir description to reservoir scientific management.

**2. Course Content**

Chapter 1 Introduction

1.1 Basic concepts in reservoir geology and oil reservoir description

1.2 Research status and development trend

Chapter 2 Strata correlation and stratigraphic model

2.1 Objectives and concepts

2.2 Stratigraphic model

2.3 Methods and workflow

2.4 Study examples

Chapter 3 Structure description

3.1 Content and methods of structure description

3.2 Content and methods of fracture description

3.3 Study examples

Chapter 4 Sedimentary facies description and model

4.1 Sedimentary facies description of clastic rocks

4.2 Sedimentary facies model and its application of clastic sedimentary rocks

4.3 Sedimentary facies description of carbonate rocks

Chapter 5 Diagenesis of reservoirs

5.1 Diagenesis of clastic rocks

5.2 Diagenesis of carbonate rocks

Chapter 6 Reservoirs heterogeneity description

6.1 Reservoirs heterogeneity

6.2 Reservoirs architecture

6.3 Flow units

6.4 Reservoirs evaluation

Chapter 7 Reservoirs modeling and remaining oil distribution

7.1 Concept and methods of reservoir modeling

7.2 Forming mechanism of remaining oil

Discussion and students’ presentation

**3. Course Material**

Required Text:

1. 林承焰.剩余油形成与分布，石油大学出版社，2000
2. 贾爱林. 精细油藏描述与地质建模技术. 石油工业出版社,2017
3. Bryant I D, Flint S S. Quantitative Clastic Reservoir Geological Modelling: Problems and Perspectives[M]// The Geological Modelling of Hydrocarbon Reservoirs and Outcrop Analogues. 1993.
4. Farmer C L. Geological Modelling and Reservoir Simulation[M]// Mathematical Methods and Modelling in Hydrocarbon Exploration and Production. 2005.

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments, in-class activities and quizzes (20%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and quizzes. Any number of unannounced quizzes amy be given druing the semester at the beginning of class or at the end of class. A quiz may cover material from the assigned reading, any previous class period, or the current class period.

Development projects (20%): This component of the final grade is based upon two development projects (breif description of the projects). Each project is worth 10%.

Final-term exam (20%): This component is based upon performance on one individual examination. The exam will be closed book.

Final-report (40%): Literature research and summary on several given topics.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 地球物理勘探方法

 

**Course Syllabus**

**Methods of Geophysical prospecting (Course Code L6013051)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Total Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours |  |
| Programming Hours |  | Other Practical Hours |  |
| Course Instructors: |
| Course Website:  |

**1. Objectives and Learning Outcomes**

This course is the core course for graduated students majored in geological resources and geological engineering. The course systematically describes fundamental theory and various methods of modern geophysical prospecting. Students will learn the comprehensive research and analysis methods and data analysis techniques used by various geophysical exploration projects. Students should be able to solve various geological tasks of oil and gas field exploration and development. Students are required to read a lot of Chinese and foreign literature, understand the latest developments in the field of geophysical prospecting, and learn the comprehensive research methods of geophysical and geological data.

**2. Course Content**

|  |  |
| --- | --- |
| **Course content** | **Specific learning objectives** |
| Chapter 1 Introduction | Connotation and extension of geophysical exploration, Development status of geophysical exploration |
| Chapter 2 Seismic prospecting | Modern seismic acquisition methods, Broadband seismic technology, Special processing techniques, Modern imaging methods |
| Chapter 3 Gravity and magnetic prospecting | Gravity gradient method and technology, Borehole gravity method and technology, Borehole magnetic method and technology, Comprehensive exploration by gravity and magnetic methods |
| Chapter 4 Electrical prospecting | Marine electromagnetic methods and technologies, Comprehensive application of electrical exploration |

**3. Course Material**

Required Text:

This course teaches theory, method and technology of geophysical prospecting at graduate level. The basic theory, technical characteristics and development direction of modern geophysical exploration methods are discussed with the help of references. Lecturers will designate literatures for students, and students will study relevant literatures and prepare corresponding multimedia for classroom discussion under the guidance of teachers.

**4. Course Evaluation**

Students will be scored according to the activity of classroom discussion (70%) and final academic report of the course (30%).

**5. Course Policies**

Attendance and preparation for class: You are expected to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: shall be finished and submit before the deadline.

### 地球物理测井方法

 

**Course Syllabus**

Geophysical Well logging Method **(Course Code L6014051 )**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Total Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours |  |
| Programming Hours |  | Other Practical Hours |  |
| Course Instructors: |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Geophysical Well logging Method is an advanced compulsory course for graduates majoring in geophysics and in well logging. The course focuses on the topics of Electrical well logging, Nuclear logging, Sonic well logging, Application and Interpretation of logging data to help student grasp the modern well-logging technologies and methods applied in the oil and gas exploration and development.. Through the learning of this course, students will learned to apply all the knowledge in their future job and scientific studying.

**2. Course Content**

|  |  |
| --- | --- |
| **Course content** | **Specific learning objectives** |
| Chapter 1 Overview of well logging | Introduction of well logging (wireline, LWD, open or cased hole), the connection between well logging and reservoir properties  |
| Chapter 2 Electrical well logging | Physics and application of Spontaneous potential logging, Direct current loggingInduction logging, Micro electric logging |
| Chapter 3 Nuclear logging | Basic nuclear physics, Gamma ray logging, Formation density logging, Neutron porosity devices. |
| Chapter 4 Sonic well logging | Physics of sonic logging—acoustic waves in porous rocks, Acoustic velocity logging, Acoustic amplitude logging. |
| Chapter 5 Application and Interpretation of logging data | Reservoir identification, Lithology estimation, Porosity calculation, Permeability calculation, Saturation calculation, Clay quantification. |
| Chapter 6 Basic core sampling analysis for well log interpretation | Introduction to Core Drilling, Core Analysis Methods for Measuring Reservoir Rock Properties. |
| Chapter 7 LWD technologies and its application | Introduction to LWD technologies, Cases analysis on LWD application |
| Chapter 8 Modern technologies of well logging | Introduction to Modern technologies of well logging |

**3. Course Material**

Required Text:

1. Well Logging Guide book, electronic materials from KFU.
2. Reservoir properties from well logging, electronic materials from KFU.

**4. Course Evaluation**

Students will be scored according to the activity of classroom discussion (70%) and final academic report of the course (30%).

**5. Course Policies**

Attendance and preparation for class: You are expected to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: shall be finished and submit before the deadline.

### 应用地球物理前沿理论与技术

 

**Course Syllabus**

Applied geophysics new technologies **(Course Code L7013051 )**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 1 | Total Course Hours | 16 |
| Lecture Hours | 16 | Experiment Hours |  |
| Programming Hours |  | Other Practical Hours |  |
| Course Instructors: |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Applied geophysics new technologies is an advanced course for graduates majoring in geophysics to develop their knowledge on new technology and methods in the area of geophysics. The course focuses on the topics of seismic data interpretation, Seismic facies analysis, Surface Microseismic Hydraulic Fracture Monitoring, Application of satellite gravity data, Geomechanics for geophysicists, Monitoring technologies of bitumen deposits. Through the learning of this course, students will grasp the new technologies and methods applied in the present geophysics area, which will help them applied these new methods in their future job and scientific studying..

**2. Course Content**

|  |  |
| --- | --- |
| **Course content** | **Specific learning objectives** |
| Chapter 1 Revolution in seismic cableless recording systems | Cables in land and seismic crews, Key technologies for cableless seismic, radio telemetry cableless system, minimum cable recording systems, blind recording systems |
| Chapter 2 Applied technologies in seismic data interpretation: from mapping to the attribute analysis and AVO | Basic theory of seismic data, classification of seismic surveys, VSP-vertical seismic profile,Kinematic interpretation, tracing of horizons and faults, velocity models |
| Chapter 3 Seismic facies analysis | Seismic [facies](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/facies) and [lithofacies](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/lithofacies%22%20%5Co%20%22Learn%20more%20about%20lithofacies%20from%20ScienceDirect%27s%20AI-generated%20Topic%20Pages), nine independent parameters, new seismic parameters, seismic slice image analysis seismic geomorphology and seismic sedimentology |
| Chapter 4 Surface Microseismic Hydraulic Fracture Monitoring | Hydraulic Fracture, Microseismic emission,Data processing, Surface seismic records |
| Chapter 5 Application of satellite gravity data for Earth lithospheric modeling | Satellite gravimetry, global gravity field, lithospheric modeling, |
| Chapter 6 Basics of applied geomechanics for geophysisists | Stress, strains, plasticity, rock failure, wellbore stability, geomechanical effects in reservoirs modeling |
| Chapter 7 Monitoring technologies of bitumen deposits development process |  |

**3. Course Material**

Required Text:

1. Cableless revolution in land seismic, electronic materials from KFU.
2. Reservoir Geomechanics, electronic materials from KFU.
3. Satellite gravity for lithospheric modeling, electronic materials from KFU.
4. Seismic interpretation, electronic materials from KFU.

**4. Course Evaluation**

Students will be scored according to the activity of classroom discussion (70%) and final academic report of the course (30%).

**5. Course Policies**

Attendance and preparation for class: You are expected to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: shall be finished and submit before the deadline.

### 测井方法与技术前沿

 

**Course Syllabus**

**Frontiers of Method and Technology of Well-Logging (Course Code L7014051)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 1 | Total Course Hours | 16 |
| Lecture Hours | 16 | Experiment Hours |  |
| Programming Hours |  | Other Practical Hours |  |
| Course Instructors: |
| Course Website:  |

**1. Objectives and Learning Outcomes**

This course is designed for the postgraduate students majored in geophyis or geology. It introduces fundamental theory, basic application and tool design of each logging method with special emphysis on electric well logging. Latest techniques and frontier progress of well loging technology will also be introduced in this course in order to attract students by fostering their interests in borehole geophysics. This course aims to improve student's ability of thinking and spirits of innovation.

Upon sucessful completion of the course, students should:

(1). Master the physics, engineering causes, classical applications of each well logging method, e.g. later-type and induction/electromagnetic type logging;

(2). Have a fully understanding of the tool development and history, especially for the tool milestones from different oil service companies, and get the relationship of the tools with/without similar functions;

(3) Understand latest well logging techniques and their application in conventional and unconventional oil/gas reservoir;

(4) Analyze field data and apply well-logging datum to solve formation evaluation problems.

**2. Course Content**

|  |  |
| --- | --- |
| **Course content** | **Specific learning objectives** |
| Chapter 1 History of well logging | A preliminary understanding of well logging, development history and basic application. |
| Chapter 2 Latero-type logging | Master the principle of dual laterolog, array laterolog and azimuthal laterolog and learn the difference of electrode design and current focusing scheme |
| Chapter 3 Induction logging | Handle the physics of dual induction, array induction as well as triaxial induction logging, learn the software focusing method. |
| Chapter 4 Logging while drilling electromagnetic resistivity logging | Introduce operating theory of LWD electromagnetic resistivity, and analyze the difference between LWD tool and wireline tool/ |
| Chapter 5 Logging while drilling directional boundary detection tool | Able to get handle of the causes, theory and classical application of LWD boundary measurements. |
| Chapter 6 Cross-casing resistivity logging  | Able to depict the theory of cross-casing measurement and compare the tool design with wireline tools. |
| Chapter 7 Dielectric logging | Introduce the method of measuring the resistivity and dielectric constant, and learn the simple interpretation of dielectric logging data to improve the accuracy of formation saturation. |

**3. Course Material**

Required Text:

1. Gengji Zhang. Electric Well Logging [M]. Petroleum Industry Press, 1984.

Required Reading:

1. Darwin V.Ellis and Julian M. Singer. Well Logging for Earth Scientists [M]. Springer, 2008.
2. Richard Liu. Theory of Electromagnetic Well Logging [D]. Elseviser, 2017.

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments, in-class activities and quizzes (50%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and quizzes. Any number of unannounced quizzes may be given during the semester at the beginning of class or at the end of class. A quiz may cover material from the assigned reading, any previous class period, or the current class period.

Final project: Literature review and presentation (50%). Each student or group must conduct the literature review of one specific well logging technique and give the presentation at the class. The grade is give upon the performance of the final project. The part is mandatory.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 油区岩相古地理

 

**Course Syllabus**

**Oildom Lithofacies Paleogeography (SZ01042)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 22 | Experiment Hours | / |
| Programming Hours | 10 | Other Practical Hours | / |
| Course Instructors: Yang Jinxiu |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Upon sucessful completion of this course, students should be able to:

1. Understand the research procedures of lithofacies paleogeography;
2. Understand the concepts and basic charateristics of sedimentary facies types including facies marker, facies sequence and facies model;
3. Be able to draw lithofacies paleogeographic maps;
4. Understand the role of lithofacies paleogeography in oil/gas distribution;
5. Understand the lithofacies paleogeographic characteristics of typical petroliferous basins around the world.

**2. Course Description and Course Content**

**2.1 Course Descripion**

This course is designed for postgraduate students majoring in Geology, Marine geology, and Geological Resources and Geological Engineering. This course introduces the research methods of lithofacies paleogeography in oil areas and the paleogeographic characteristics of major oil-bearing basins around the world. Through the study of this course, students are required to master the research methods of sedimentary facies, the lithofacies paleogeographic characteristics of major oil-bearing basins around the world, and the compilation and analysis methods of lithofacies paleogeographic maps.

**2.2 Course Content**

Part I Research methods of Oildom lithofacies paleogeography

Chapter 1 Introduction

* 1. Oil and gas exploration and development in the world
	2. The basic geological structure unit of oil and gas formation and occurrence : Sedimentary basin
	3. Lithofacies paleogeography and its research contents
	4. The significance of lithofacies paleogeography

Chapter 2 Concepts of sedimentary facies and a brief history of lithofacies paleogeography

2.1 Concepts of sedimentary facies

2.2 Classification of sedimentary facies

2.3 Principles and methods for sedimentary facies analysis

2.4 A brief history of lithofacies paleogeography

Chapter 3 Research methods of sedimentary facies analysis

3.1 Sedimentary facies markers

3.2 Sedimentology in the field

3.3 Investigation of modern sedimentary processes

3.4 Core observation & description and sedimentary facies study+

3.5 Application of geochemistry in sedimentology

3.6 Application of ichnofossils and ichnofacies in sedimentological studies

3.7 Experimental study on sedimentation simulation

3.8 The contribution of logging data to sedimentology

3.9 Seismic sedimentology

Chapter 4 Sedimentary facies models and their relationship with hydrocarbon distribution

4.1 Alluvial fan facies

4.2 Fluvial facies

4.3 Delta facies and fan delta facies

4.4 Sand bar and beach facies of shallow-shore lacustrine

4.5 Lacustrine facies

4.6 Coastal facies

4.7 Submarine/Sublacustrine fan facies

4.8 Carbonate facies (platform and reef facies)

Chapter 5 Compilation of lithofacies paleogeographic map

5.1 Collection and analysis of basic data

5.2 Compilation of basic map

5.3 Compilation of lithofacies paleogeographic map

5.4 Analysis and application of the maps

Chapter 6 Analysis of paleogeographic conditions

6.1 Provenance analysis

6.2 Paleogeomorphological analysis

6.3 Analysis of paleoclimate conditions

6.4 Analysis of paleohydrodynamic conditions

Part II Case studies

Chapter 7 Petrofacies paleogeographic characteristics of typical petroliferous basins

7.1 Lithofacies paleogeography of the Sichuan basin

7.2 Lithofacies paleogeography of the North Sea

7.3 Lithofacies paleogeography of the central Saudi Arabia

**3. Course Material**

**Required Reading**

1. Facies Models (Geoscience Canada reprint series), Walker, Roger G., ISBN 13: 9780919216259, Geological Association of Canada Publications, Business and Economic Service,1984
2. Sedimentology and Stratigraphy (Second Edition), Gary J. Nichols, ISBN 13: 9780632035786, Wiley & Sons, Incorporated, John, 2009
3. Basin Analysis (Principles and Applications), Philip A. Allen & John R. Allen, ISBN 13:978-0-632-05207-3，Blackwell Publishing company, 2005
4. 油区岩相古地理，赵澄林等编著，ISBN：7-5636-1395-1，石油大学出版社，2001,

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments, in-class activities and quizzes (20%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and quizzes. Any number of unannounced quizzes amy be given druing the semester at the beginning of class or at the end of class. A quiz may cover material from the assigned reading, any previous class period, or the current class period.

Projects (30%): This component of the final grade is composed by two assignments. One is compilating the lithofacies paleogeographic map in specific study areas selected by students. The other one is oral presentations on case studies of oildom lithofacies paleogeography, and the students are encouraged to choose case studies from their own countries.

Final-term exam (50%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview, sickness or visa issue) you must contact the instructor ahead of time.

Assignments: In both the professional and academic world, you must meet the deadlines.

### 油区构造解析

 

**Course Syllabus**

**Oil Region Structure Anlyzing (SSZ01041)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 22 | Experiment Hours | 10 |
| Programming Hours | 0 | Other Practical Hours | 0 |
| Course Instructors: Liu Yin |
| Course Website: / |

**1. Objectives and Learning Outcomes**

Upon sucessful completion of the course, students will have gained and understanding of the basic concepts of structural geology and their applications in the sedimentary basin. Specific learning objectives are:

(1) Understand the concepts and basic principles of structural geology and their applications in petroliferous basin;

(2) Identify, describe and have an understanding of the formation of different types of geological structures and their implication for the deformation history of a region.

(3) Recognise different types of faults and the different features found along fault planes, and understand their formation.

(4) Understand the basic concepts related to folds and the formation mechanism of different types of folds.

(5) Understand the formation of small scale structures and where the material comes from that fills these.

(6) Be able to use the stereonets to plot different types of structures and restore the evolution history of a area.

**2. Course Content**

Chapter 1 Deformation, stress and stereonents

1.1 Basic concepts of deformation

1.2 Basic concepts of stress

1.3 Introduction to stereonet

Chapter 2 Faults

2.1 Basic concepts of faults

2.2 Fault rocks

2.3 Thrust fault

2.4 Normal fault

2.5 Strike slip fault

Chapter 3 Strain

3.1 Distortional strain

3.2 Strain parameters

3.3 Simple shear and angular shear strain

3.4 Strain ellipse

Chapter 4 Folds

4.1 Fold terminology

4.2 Folds on stereonets

Chapter 5 Small-scale structures

5.1 Cleavage

5.2 Cleaveage on stereonets

Chapter 6 Folding mechanisms

6.1 Flexural slip

6.2 Flexural Flow

6.3 Tangential Longitudinal Strain

6.4 Buckle folds and its forming mechanism

6.5 Kink folds

6.6 Forced folds

Chapter 7 Applications and Case Studies

7.1 Fault plane solutions

7.2 Structural case studies

**3. Course Material**

Required Text:

Handouts of this course.

Required Reading

1. Structural Geology, Fossen Haakon, ISBN 978-0-521-51664-8, Cambridge University Press, 2010
2. Structural Geology (2nd edition), Robert Twiss and Eldridge Moores, ISBN 0-7167-4951-3, W. H. Freeman and Coompany, 2007.
3. 3-D Structural Geology, Richard Groshong, Jr., ISBN 3-540-31054-1, Springe, 2006.

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, in-class activities and practicles (30%): This component of the final grade is based upon your contribution to the class in the form of attendance (5%) and class activities (5%). At lease five practicles will be given throughout the whole course (with 10 hours, 20%), these practicles will help the students understand the conents of classes.

Literature review (30%): This component is based on the latest academic hot spots, which need the students review the related published articles.

Final-term exam (40%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 地球物理反演基础

 

**Course Syllabus**

**Fundamentals of geophysical inversion (S6013007)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours | / |
| Programming Hours | / | Other Practical Hours | / |
| Course Instructors: Zhang Zhiying |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Upon sucessful completion of the course, students should be able to:

1. Understand the concept and basic principles of inversion theory;
2. Understand the general methodology of inversion problem;
3. Understand the appraisal of inversion method;
4. Understand the basic theory behind model construction;
5. Be able to create new inversion tehnique according to specific geophysical problem.

**2. Course Description and Course Content**

**2.1 Course Descripion**

This course is an introduction to some of the balkanized family of techniques and philosophies that reside under the umbrella of inverse theory.As a “capstone” course for geoscience related students, this course mainly discusses fundamental theory and principle behind geophysical research work, which is always under continuous developing and updating process. Students will be assigned technical papers and try to make a presentation. This course is designed for postgraduate students majoring in Geophysics, Geo-resources&Geo-engineering.

**2.2 Course Content**

Chapter 1 Overview of inverse theory

* 1. Introduction
	2. Data Space
	3. Model Space
	4. Forward Modelling
	5. Inverse Modelling
	6. Over-, even-,under-and mixed-determined problems
	7. Outline and Scope of this Course

Chapter 2 A brief review of essential mathematics

2.1 Introduction

2.2 Matrices and Linear Transformations

2.3 Probability and Statistics

Chapter 3 L2-norm construction

3.1 The linear forward problem

3.2 The linear inverse problem

3.3 Consideration of data errors

3.4 Regularization: adding a priori constraints

3.5 Matrix inversion techniques

3.6 Singular value decomposition (SVD) analysis of the inverse problem

Chapter 4 Non-linear problems

4.1. Linearization of a non-linear problem

4.2 Non-linear conjugate gradient method

4.3 Full Newton method

4.4 Gauss-Newton method

4.5 Quasi-Newton methods

Chapter 5 Resolution and covariance of the model and data parameters

5.1 Model resolution matrix

5.2 Data resolution matrix

5.3 Model covariance matrix

Chapter 6 *l*2 –norm cnstruction

6.1 *l*2 –norm Construction

6.2 Smallest dviation mdel

6.3 Flattest mdel cnstruction

6.4 Weight Norm Models

6.5 Inversion of RMS vlocities

6.6 Incorporation of dta erors

Chapter 7 *l*1-norm cnstruction :lnear pogramming mthods

Chapter8 Appraisal

8.1 Appraisal With Accurate Data

8.2 Deltaness Criterion

8.3 Least Squares(First Dirichlet) Criterion

8.4 Spread Criterion of Backus and Gilbert

8.5 Appraisal With Inaccurate Data

8.6 Time-Domain Signature Deconvolution

**3. Course Material**

**Required Text:**

 FUNDAMENTALS OF GEOPHYSICAL INVERSION, School of Geosciences, China University of Petroleum,2017

**Required Reading**

(i) Geophysical data analysis:discrete inverse theory, William Menke,ISBN：0-12-490921-3，Academic press,INC.,1989

(ii)nverse problem theory and methods for model parameter estimation,Albert Tarantola,ISBN:0-89871-572-5, the Society for Industrial and Applied Mathematics,2005

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance(10%), homework assignments(10% ),in-class presentation (80%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, final presentation.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview, sickness or visa issue) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 成岩作用及储层评价

 

**Course Syllabus**

**Diagenesis and Reservoir Evaluation (SZ01025)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours | / |
| Programming Hours | / | Other Practical Hours | / |
| Course Instructors: Yuan Guanghui |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Upon sucessful completion of the course, students will have gained and understanding of …… Specific learning objectives are:

(1) Understand the concept, the main contents and the sigficance of diagenesis;

(2) Be able to identify compaction, cementation and dissolution in the rocks and the controlling factors of these diagenetic events.

(3) Understand the types of geofluids and mass transfer processes in sedimentary basins.

(4) be able to do quantative diagenetic analysis and reconstruct diagenetic sequences.

(5) Be able to identify pores and pore structures in the rocks

(6) Understand the impact of diagenesis on reservir quality and be able to predict reservoir quality with simple geological background.

**2. Course Content**

Chapter 1 Introduction to Diagenesis

1.1 What is diagenesis

1.2 Tool and Techiniques to study Diagenesis

1.3 Significance of diagenesis

Chapter 2 Compaction and Controlling factors

2.1 Compaction

2.2 Controlling Factors of Compaction

2.3 Porosity compaction curve

Chapter 4 Cementation and various cements

3.1 Cementation

3.2 Various cements and features

Chapter 4 Mineral Dissolution and Secondary pores

4.1 Mineral Dissolution

4.2 Secondary pores

4.3 Genetic mechamism of secondary pores

4.4 Existing problems

Chapter 5 Geofluids and mass transfer in sedimentary basins

5.1 Geofluids in sedimentary basins

5.2 Mass transfer and source vs. sink in subsurface rocks.

5.3 Open vs closed geochemical systems

Chapter 6 Quantative Evolution of Diagenetisis, Porosity and Oil Charging

6.1 Diagenetic stages

6.2 Diagenetic sequences and Quantative diagenesis

6.3 Coupled evolution of porosity and oil charging

Chapter 7 Diagenetic evolution models in different rocks in sedimentary basins

7.1 Diagenesis in different mudstones

7.2 Diagenesis in different sandsones

7.3 Coupled diagenetic evolution models….

Chapter 8 Pores and Pore Structures

8.1 Pores and thorats

8.2 Methods to study pores and pore structures

8.3 Pores in sandstones

8.4 Pores in mudstones

Chapter 9 Genesis of Deeply Buriled High Quality Reservoris

9.1 Identification of High Quality Reservoris

9.2 Types and fetures of High Quality Reservoris

9.3 Genetic mechanism of High Quality Reservoris

Chapter 10 Reservoir Quality Prediction PriDrilling

10.1 Empirical Methods of Reservoir Quality prediction

10.2 Geochemical Models

**3. Course Material**

Required Text:

1. Reservoir Diagenesis and Quality Prediction, Chen Honghan, 978-7-5625-2903-3, China University of Geosciences of Press CO. LTD., 2012.
2. Reservoir Quality Assessment and Prediction in Clastic Rocks>，Michael Wilson，SEPM (Society for Sedimentary Geology), 1994.

Required Reading

1. Petroleum Geosciences— From Sedimentary Environments to Rock Physics，Knut Bjørlykke, 978-3-642-34131-1, Springer, 2015，
2. 碎屑岩储层中长石和碳酸盐矿物的溶蚀机理及其物性响应, 远光辉，操应长，王艳忠，978-7-5183-1362-4,石油工业出版社，2016

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance and in-class activities (10%): This component of the final grade is based upon your contribution to the class in the form of attendance and class activities.

Homework assignment and presentation (25%): This component of the final grade is based upon performance on one homework assignment and one PPT presentation.

Middle-term quiz (25%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be open book.

Final-term exam (40%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be open book.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

## 第2学期

### 应用地球化学

 

**Course Syllabus**

**Applied Geochemistry (****SSZ01038)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours |  |
| Programming Hours |  | Other Practical Hours |  |
| Course Instructors: Keyu Liu |
| Course Website:  |

**1. Objectives and Learning Outcomes**

This course is a compulsory course for graduate and overseas students majoring in geological resources and engineering and geology. It is a core course with strong application. The course aims to teach students to grasp the basic concept of applied geochemistry and familiarize with various techniques that can be used in petroleum exploration and development. Students are required to read a large number of documents about the application of organic, inorganic and isotope geochemistry in studying hydrocarbon generation, migration and accumulation, compile a literature review report on relevant important theoretical issues, and combine with the actual geological scenarios to make a comprehensive analysis, and preliminarily grasp the analytical methods.

**2. Course Content**

Chapter 1 Introduction of Geochemistry（4 hours）

1.1 Elements, atoms and chemical bonds

1.2 Earth system and geochemistry

1.3 Petroleum geochemistry

Chapter 2 Elemental Geochemistry and Chemostratigraphy（6 hours）

2.1 Concept and principle

2.2 Chemostratigraphy

2.3 Chemo-sedimentary facies analysis

2.4 Elemental mapping at micro scales

2.5 Application

Chapter 3 Isotope geochronology （6 hours）

3.1 Overview

3.2 Concept and principles

3.3 Workflow and methodology

3.4 K-Ar and Ar-Ar dating of authigenic illite

3.5 Rb-Sr, U-Pb and Re-Os geochronology

Chapter 4 Molecular Geochemistry（4 hours）

4.1 Overview

4.2 Depositional environmental and age diagnostic biomarkers

4.3 Thermal and biogenic alteration indicative biomarkers

4.4 Application

Chapter 5 Isotope Geochemistry（4 hours）

5.1 Overview

5.2 Stable isotopes (H, C, O)

5.3 Radiogenic isotopes (K, Ar, U, Th)

5.4 Applications

Chapter 6 New Development in Petroleum Geochemistry（4 hours）

6.1 Compound specific isotope analysis (CSIA)

6.2 Precision and clumped isotopes

6.3 Noble gas geochemistry

6.4 Multi-isotope geochronology

6.5 Case study

Chapter 7 Geochemical Techniques and Instrumentation（4 hours）

7.1 Overview

7.2 Elemental geochemistry

7.3 Isotope geochemistry

7.4 Molecular geochemistry

7.5 Geochronology

**3. Course Material**

Required Text:

1. J.M. Hunt, 1995. Petroleum Geochemistry and Geology. W. H. Freeman and Company, New York, 743 pp., ISBN 0-7167-2441-3.；

2. K. E. Peters，C. C. Walters，J. M. Moldowan, 2004. The Biomarker Guide. Cambridge University Press, 700 pp. ISBN: 0-5218-3762-6;

3. Kliti Grice, 2014. Principles and Practice of Analytical Techniques in Geosciences, Royal Society of Chemistry, 412 pp., ISBN: 978-1-84973-649-7, DOI:10.1039/9781782625025-00094

Other reading materials：

AAPG Bulletin, Marine and Petroleum Geology, Organic Geochemistry, Applied Geochemistry

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments, in-class activities and quizzes (15%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and quizzes. Any number of unannounced quizzes amy be given druing the semester at the beginning of class or at the end of class. A quiz may cover material from the assigned reading, any previous class period, or the current class period.

Case studies (10%):

Development projects (20%): This component of the final grade is based upon two development projects (breif description of the projects). Each project is worth 10%.

Middle-term exam (20%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

Final-term exam (20%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

Other Items: other factors, such as class and group participation and puncture, regular attdendance may be used, at the professor’s discretion, to make adjustments to final grades in borderline cases. The instructor will assume that you are well prepared for class each week.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 层序地层学

 

**Course Syllabus**

**Sequence Stratigraphy (SZ01024)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 28 | Experiment Hours | 0 |
| Programming Hours | 0 | Other Practical Hours | 4 |
| Course Instructors: Zhang Shiqi |
| Course Website:  |

**1. Objectives and Learning Outcomes**

Upon sucessful completion of the course, students should be able to:

(1) Understanding the sources and categories of basic data of Sequence Stratigraphic study, especially the functions of outcrop data, Logging data and seismic data in the studying of sequence.

(2) To grasp the research process, main contents, research methods, and the identifying standards of different kinds of sequence and map making.

(3) Through the practice of basic skills training, students have ability to use various types of data to understand, analyze and solve sequence problems comprehensively.

(4) Understanding how to restore the paleo-environment in the framework of sequence and explore the stable oil and gas pools.

**2. Course Content**

Chapter 1 Introduction

 1.1 Concepts and terms of sequence stratigraphy

 1.2 The evolution of sequence stratigraphy

 1.3 The method of the study of sequence stratigraphy

 1.4 The relationship between the cycle of Eustasy and the formation of sequence boundary

 Chapter 2 Parasequence

 2.1 The scope of observations and characteristics of parasequence

 2.2 Formation mechanism of parasequence

 2.3 Lithofacies combination of parasequence

 Chapter 3 Parasequence sets

 3.1 The definition of parasequence sets

 3.2 The characteristics of parasequence sets

 3.3 The boundaries of parasequence sets

 3.4 The types of parasequence sets

 3.5 Lithofacies combination of parasequence sets

 3.6 The significance of parasequence sets correlation

 Chapter 4 Sequence

 4.1 Basin types

 4.2 System tracts

 4.3 The inner composition of the sequences

 4.4 The characteristics of sequence boundaries

 Exercise one: The making and using of chronostratigraphic chart of sequence

 Chapter 5 Genetic stratigraphic sequence

 5.1 Genetic sequence and sedimentary sequence

 5.2 Sedimentary cycles and Genetic sequence

 Chapter 6 T-R Sequence model put forward by F. Embry

 6.1 T-R Cycle

 6.2 The composition of T-R Cycle

 Chapter 7 Carbonate sequence stratigraphy

 7.1 Depositional profile and facies belts

 7.2 Controls on the carbonate productivity and deposition

 7.3 Sequence boundary and systems tracts

 Chapter 8 Sequence stratigraphic models of Rift-Lacustrine basin

 8.1 The examples of fault-depression sequence stratigraphic models in overseas

 8.2 The mechanisms of formation of sequence boundary

 8.3 Sequence stratigraphic models of Rift Lacustrine basin

 Chapter 9 Sequence stratigraphy characteristics of other continental basins

 9. 1 Sequence stratigraphic models in double-fault-depression lacustrian basin

 9.2 Sequence stratigraphic models in coal-accumalating basin

 9.3 Sequence stratigraphic models in alluvial environment

 9.4 Parasequence recognition in Deep-water environment

 Exercise two: The relative sea level changes chart and accommodation space chart

Project：Measurement and analysis of sea level changes in Qingdao shoreline

**3. Course Material**

Required Text:

(1) Sequence Stratigraphy, Zhang Shiqi, Teaching material printed by China University of Petroleum, 2001.

(2) Exercise book of Sequence Stratigraphy, Zhang Shiqi, Teaching material printed by China University of Petroleum, 2003.

Required Reading

(1). Principle of Sequence Stratigraphy - Approach of Sea level changes, C.K. Wilgus, ISBN: 0-918985-74-9, SEPM special Publication No.42, 1988.

(2). Principle of Sequence Stratigraphy, Octavian Catuneanu, ISBN: 0-444-51568-2, Elsevier Scientific Publication Company, 2005.

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments, in-class activities and quizzes (10%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and quizzes. Any number of unannounced quizzes amy be given druing the semester at the beginning of class or at the end of class. A quiz may cover material from the assigned reading, any previous class period, or the current class period.

Exercises (30%): This component is based upon performance on the making and using of chronostratigraphic chart of sequence (15%) and the relative sea level changes chart and accommodation space chart (15%).

Project of Sea level changges (30%): This component of the final grade is based upon the project of measurement and analysis of sea level changes in Qingdao shoreline.

Final-term exam (30%): This component is based upon performance on one individual examination. The exam is mandatory. The exam will be closed book.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.

### 地震资料数字处理

 

**Course Syllabus**

**Seismic Data Processing (SZ01029)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours | / |
| Programming Hours | / | Other Practical Hours | / |
| Course Instructors: Sun Xiaodong |
| Course Website:  |

**1. Objectives and Learning Outcomes**

This introductory course “Seismic Data Processing” is designed for graduates in the major of Geological Engineering. This course illustrates the ramifications of processing decisions on subsequent interpretations, showing data’s potential and the possible pitfalls for the unwary. The course is also of value for seismic acquisition specialists who desire to understand the constraints that seismic processing places on acquisition design.

**2. Course Description and Course Content**

**2.1 Course Descripion**

This course presents material in a sequence used in processing. Each processing step has its own input requirements; thus, understanding those input requirements provides the motivation for understanding the each preceding processing step.

Seismic processing is inherently mathematical. However, this course uses cartoons and real data examples to provide an intuitive understanding of the seismic processing procedures, resorting to an algebra-based argument on rare occasions.

**2.2 Course Content**

Chapter 1 Fundamental

1.1 Introduction

1.2 The 1-D Fourier transform

1.3 Worldwide assortment of common-shot gathers

1.4 Basic data processing sequence

1.5 Gain applications

1.6 The 2-D Fourier transform

Chapter 2 Deconvolution

2.1 Introduction

2.2 The convolutional model

2.3 Inverse filtering

2.4 Least-squares inverse filtering

2.5 Minimum phase

2.6 Optimum Wiener filters

2.7 Predictive deconvolution in practice

2.8 The problem of nonstationarity

Chapter 3 Velocity Analysis, Static Corrections and Stacking

3.1 Introduction

3.2 Normal moveout

3.3 Velocity analysis

3.4 Residual statics corrections

3.5 Residual statics corrections in practice

3.6 Refracton statics

Chapter 4 Migration

4.1 Introduction

4.2 Migration principles

4.3 Migration in practice

4.4 Migration before stack

4.5 Migration velocity analysis

**3. Course Material**

**Required Text:**

 SEISMIC DATA PROCESSING, Ozdogan Yilmaz, ISBN: 0-931830-41-9 (Series 1), ISBN: 0-931830-40-0 (Volume 2), Society of Exploration Geophysicists, 1987.

**Supplemental Reading material:**

(i) Exploration Seismology (Second Edition), R. E. Sheriff and L. P. Geldart, ISBN:0-521-46282-7, Cambridge University Press, 1995.

(ii) Seismic Data Analysis, Ozdogan Yilmaz, ISBN:1-56080-098-4 (Volume I), ISBN:1-56080-099-2 (Volume II), Society of Exploration Geophysicists, 2001.

(iii) 地震数据处理方法，李振春，张军华，ISBN：7-5636-1823-6，中国石油大学出版社，2004

**4. Course Evaluation**

Grades will be calculated as follows:

Final grade: Final Exam 70%, Exercises 30%

The letter grade is determined from a scale such as this:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Letter Grade | % of 100% possible | Letter Grade | % of 100% possible | Letter Grade | % of 100% possible |
| A | 90-100 | B- | 77-79 | D+ | 63-66 |
| A- | 87-89 | C+ | 73-76 | D | 60-62 |
| B+ | 83-86 | C | 70-72 | D- | 57-59 |
| B | 80-82 | C- | 67-69 | F | 0-56 |

**5. Course Policies**

Attendance at all scheduled class sessions is required. If you will be missing a session for a good reason, please inform instructor in advance with your explanation.

### 油气勘探综合技术实训

 

**Course Syllabus**

**Oil and Gas Exploration Technology of Comprehensive Training Course Code:** SZ01014

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 32 | Experiment Hours | / |
| Programming Hours | 0 | Other Practical Hours | / |
| Course Instructors: Li Yong |
| Course Website:  |

**1. Objectives and Learning Outcomes**

1. Fully understand the petroleum system, petroleum as a resource, and the value chain.
2. Be familiar with all tools and techniques used in the search for and production of hydrocarbon reserves.
3. Understand how geologists conduct the search for petroleum resources through the value chain or the life cycle of a petroleum resource.  This will include the processes involved and actual examples.
4. Learn details on how to begin evaluating a hydrocarbon play and developing a prospect.
5. Learn the principles of mapping a subsurface reservoir and estimating their volumes.
6. Obtain skills in correlating potential reservoir rocks and recognizing structures with log data.

**2. Course Description and Course Content**

**2.1 Course Descripion**

The course ofOil and Gas Exploration Technologies is a comprehensive course on how to find the oil and gas resource, procedures and risks during the exploration of oil and gas field. To do so, following things must be understood: Firstly, where oil and gas are from, how they are formed and where they will be accumulated. Secondly, what kind of methods and techniques can be used for oil and gas exploration, such as geological methods, geophysical techniques, geochemistry method, drilling and completion methods. Finally, how to get the oil and gas from the subsurface and what kind of impacts on environments and human beings during oil and gas exploration. Besides these, some unconventional oil and gas resources have become predominant in the oil and gas industry, in the last part, the exploration methods on unconventional oil and gas will be discussed.

**2.2 Course Content**

Chapter 1 Introduction on oil and gas exploration technologies

1.1 Course arrangement

1.2 What is petroleum and natural gas.

1.3 The subsurface environment (temperature, pressure, fluid)

1.4 Historical Review of Hydrocarbon Exploration.

1.5 Examples on oilfield exploration in China

Chapter 2 Introduction on petroleum system

2.1 Review on petroleum system

2.2 Source rock Evaluation

2.3 Hydrocarbon traps and seals

2.4 Migration and reservoir rock property

Chapter 3 Exploration procedures and risk analysis

3.1 Exploration Procedures

3.2 Risk analysis

**Home work: write a report on the exploration history of an oilfield or gas field and the lessons.**

Chapter 4 Exploration techniques and methods on Oil and gas exporation

4.1 Geology surveying

4.2 Geochemical Sampling

4.3 Remote Sensing

4.4 Gravity surveying

4.5 Magnetic surveying

4.6 Seismic surveying and interpretation

**Exercise: seismic profile interpretation**

4.7 well logging and formation evaluation

**Exercise: Applications of Logs (formation correlations and structural map construction)**

4.8 Well Drilling and Completion.

**Reading material: What could possibly go wrong? The Deep Water Horizon Spill.ppt Reading: Ch. 3, pp. 37-55**

Chapter 5 Field Development.

5.1 Well planning and drilling issues

5.2 Reservoir Modeling

5.3 Life of a Field

**Reading: "**[**Development and Production**](http://www.geo.wvu.edu/~jtoro/petroleum/Development%20and%20Production-Gluyas%20and%20Swarbrick.pdf)**", p. 271-301, in: Petroleum Geoscience by J. Gluyas and R. Swarbrick**

**Project exercises: 15 minutes presentation on oilfield evaluation**

**(choose an oilfield you are familiar and give the evaluation on their source rock, reservoir and trap types).**

Chapter 6 Sedimentary Rocks and sedimentary environment

6.1 Clastic rocks and its feature

6.2 Carbonate rocks and its feature

6.3 Examples of sedimentary environments and facies

6.4 Continental Sedimentary Environments

6.5 Marine Sedimentary Environments

**Reading: Read the chapter on "**[**Sedimentary Environments**](http://www.geo.wvu.edu/~jtoro/petroleum/sedimentary_enviroments.pdf)**" from Earth Systems History textbook.**

6.6 Paleogeography reconstruction and Facies analysis

**Exercise: Paleogeography reconstruction**

Chapter 7 Basin analysis

7.1 Basin type and basin mechanism

7.2 Geohistory (subsidence) analysis

Exercise: subsidence analysis

7.3 Geothermal history analysis

**Exercise: Geothermal history analysis**

Chapter 8 Prospect Evaluation

8.1 Geological Aspects.

8.2 Economic Aspects.

8.3 Reserves and Resources.

8.4 Assessment of Basin Reserves.

**Exercise: oil reserve calculation of an oilfield.**

Chapter 9 Explorations on special and unconventional reservoirs

9.1 Carbonate reservoir and fractured reservoir

9.2 Tar sand and heavy oil exploration

**Reading: Canada tar sand**

9.3 Exploration on shale oil and gas

Field trip: field visit to Lingshan Island

9.4 Exploration on gas hydrate and coalbed methane

**Project on oil and gas exploration technologies (PPT presentation)**

**15 minutes presentation on unconventional oil and gas field exploration (take one oilfield you know as an example).**

**3. Course Material**

**Required Text:**

1. Elements of petroleum geology. Richard C. Selley. 2nd edition
2. Basin analysis: principles and application. Allen P A, Allen J R. 2005

**Required Reading**

1. 3-D Structural Geology. A Practical Guide to Quantitative Surface and Subsurface Map Interpretation, 2nd ed. Woodcock N. GROSHONG R. H. JR. 2006.
2. Carbonate Reservoir Characterization[M]. Jerry Lucia B, Springer Berlin Heidelberg, 2007.
3. Field Methods for Petroleum Geologists. Assaad F A. .2009.
4. Principles of Structural Geology[M]. Suppe J. Prentice-Hall, 1985.
5. Sedimentary Environments: Processes, Facies and Stratigraphy. H.G. Reading (Ed.)

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, in-class activities (10%): This component of the final grade is based upon your contribution to the class in the form of attendance, class activities and tests or on class PPT presentation. Any number of unannounced tests or PPT presentation may be given during the semester. A test or PPT presentation may cover material from the assigned reading, any previous class period, or the current class period.

Homework and exercises (20%): homework and exercises are based on the knowledege and contents of the class, and may be given at or after the class.

Final Projects (70%): Final project may be based upon the reading of textbook, report or published papers. Several topics will be given at the end of class, and you will be finishedn the report in one week. PPT presentation is also required. Both PPt and report shall include the abstract, introduction, main body, analysis, and conclusion.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview, sickness or visa issue) you must contact the instructor ahead of time.

Assignments: In both the professional and academic world, you must meet the deadlines.

### 油藏地质基本技能实训

 

**Course Syllabus**

**Basic Skills Training of Reservoir Geology (SZ01013)**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Credits | 2 | Toal Course Hours | 32 |
| Lecture Hours | 12 | Experiment Hours | / |
| Programming Hours | 20 | Other Practical Hours | / |
| Course Instructors:Liu Taixun |
| Course Website:  |

**1. Objectives and Learning Outcomes**

This course is a professional optional course for master of geological engineering. Through this course, students can integrate the knowledge of geology, seismology, logging, computer and other disciplines. They can preliminarily grasp the basic theory, professional knowledge and technical means to analyze and study the basic geological problems of reservoirs, such as core observation, stratigraphic correlation, structural interpretation, sedimentary facies analysis, reservoirs modeling, reserve calculation and other common skills. Upon sucessful completion of the course, students should be able to:

1. Understand the concept and basic principles of stratigraphic correlation, seismic interpretation, Facies analysis, reservoir evaluation, reservoir modeling and its applications in petroleum exploration and development;
2. Be able to correlate the reservoir according to core data, seismic data, logging data, and be able to draw the strata column chart, stratigraphic correlation section, and isochore map.
3. Be able to interpret the reservoir structure and analyze the structural feature according to seismic data, and be able to draw the structure map of reservior.
4. Be able to analyze the sedimentary facies acorrding to geology, seismology and logging data, and be able to draw the facie analysis column chart, sedimentary facies section, and sedimentary facies map.
5. Be able to evaluate reservoir property comprehensively.
6. Be able to use geomodeling software as a tool to build stratigraphic model, structural model, facies model, porosity model, permeabilty model and water saturation model.
7. Be able to use reserve parameters to caculate reserve of reservoir.

**2. Course Content**

**Chapter 1 introduction (1** **Course hour)**

This chapter introduces the research content and development history, course nature, course objectives, course framework and assessment requirements of Basic Skills Training of Reservoir Geology.

**Chapter 2** **Core Observation and Comprehensive Analysis of** **Key Wells** **(Core Wells) (3 Course Hours)**

A comprehensive analysis column of core wells will be compiled on the basis of core observation and description, thin slice identification, combined with particle size analysis, reservoir physical analysis, paleontology analysis and other data.

3.1 Observation and description of core

3.2 Making comprehensive analysis column of core wells

**Chapter 3 Division and correlation of strata and oil layers (10 Course hours)**

Based on logging data, the division and correlation of stratum and oil layers are carried out, and the basis, method and process of division and correlation should be mastered. The key profile of oil layer correlation will be compiled by geological software.

3.1 Division of reservior units of key wells (core wells)

3.2 Selection and building of well sections

3.3 Reservoir correlation and making correlation section figures

**Chapter 4** **Structure analysis of Oil and Gas Fields (10 Course hours)**

Based on the results of oil layer division and correlation, combined with 3D seismic data, well-seismic analysis will be carried out, oil field structure map and oil and gas field geological profile map will be compiled, and fine structure map of oil and gas field will be compiled.

4.1 Seismic data input

4.2 Synthetic generation and Integrated seismic well tie

4.3 Fault interpretation

4.4 Horizon interpretation

4.5 Making Structrual map and depth conversion

**Chapter 5 Sedimentary (Microfacies) Studies (10 Course hours)**

Based on the analysis of sedimentary facies in key wells, the plane distribution map of sedimentary microfacies will be compiled by geological mapping software through compiling the isograms of sand layer thickness, net/gross ratio and combining with the comprehensive analysis of logging curve shape.

5.1 Analysis of sedimentary facies in key wells (core wells)

5.2 Analysis of sedimentary facies section

5.3 Making sedimentary facies maps

**Chapter 6** **Comprehensive** **evaluation of reservoirs and reservoir geological modeling (10 Course hours)**

The comprehensive evaluation of oil, gas and water layers will be made by using logging data, and the permeability contour map and shale content contour map will be compiled according to the comprehensive interpretation results of logging data. The relationship between reservoir heterogeneity and oil and gas recovery, the geological factors affecting reservoir characteristics and heterogeneity will be analyzed. On the basis of above work to carry on the comprehensive evaluation of reservoir,and using modeling software to build 3D reservoir model.

6.1 Comprehensive evaluation of reservoirs

6.2 3D resservior modeling

**Chapter 7 calculation of oil and gas reserves (4 Course hours)**

Grasp the methods of oil and gas reserves calculation, especially the volumetric method to calculate oil and gas reserves, and master the acquisition methods of key parameters such as oil-bearing area (compilation of small layer plan), effective thickness of oil layer, effective porosity, oil saturation and other parameters.

 On the basis of the above work, prepare a report and presentation and communicate.

**3. Course Material**

**Required Text:**

1. Modern Reservoir Geology, Xiong Qihua, Wang Zhizhang, Wu Shenghe et al., ISBN: 7-50214-2830-1,Science Press, 2010

熊琦华，王志章，吴胜和等.现代油藏地质学.科学出版社，2010

1. Reservoir Geology (Second Edition), Wu Youjia, ISBN:7-502-1-322-1, Petroleum Industry Press, 2004

伍友佳. 油藏地质学（第二版）. 石油工业出版社, 2004

1. Reservoir Geology, Cai Zhengqi. ISBN:9787502185107, Petroleum Industry Press, 2011

蔡正旗. 油藏地质学. 石油工业出版社, 2011.

1. Computer Geology Mapping and Application, Lu Guoxiang, Zhang Ying, ISBN: 978-7-5647-1409-3,University of Electronic Science and Technology Press, 2013

吕国祥，张瀛.计算机地质制图及应用.电子科技大学出版社，2013.

1. Analysis of reservoir modeling algorithm, ISBN:9787502190712, Li Shaohua, Zhang Changmin, Yin Yanshu. Petroleum Industry Press, 2012

李少华，张昌民，尹艳树.储层建模算法剖析.石油工业出版社，2012.

**Required Reading**

1. Elements of Petroleum Geology, Richard C. Selley,Stephen A. Sonnenberg, ISBN: 978-0-12-386031-6, Academic Press,2015
2. Fundamentals of Structural Geology(4th printing), David D. Pollard, Raymond C. Fletcher, ISBN:978-0-521-83927-3 ,Cambridge University Press, 2010
3. Stratigraphy\_A Modern Synthesi, Andrew D. Miall, ISBN:978-3-319-24302-3, Springer International Publishing AG Switzerland, 2016
4. Petroleum Geoscience From Sedimentary Environments to Rock Physics (Second Edition), Knut Bjørlykke, ISBN:978-3-642-34131-1, Springer, 2015
5. Sedimentary Geology\_An Introduction to sedimentary Rocks and Stratigraphy (Third Edition), Donald R. Prothero, Fred Schwab, ISBN-13: 978-1-4292-3155-8, W. H. Freeman and Company/New York, 2013
6. Principles of Sequence Stratigraphy, O. Catuneanu, ISBN-13: 978-0-444-51568-1, Elsevier,2006
7. Basic Steps in Geostatistics: The Variogram and Kriging, Margaret A. Oliver,Richard Webster, ISBN 978-3-319-15864-8, Springer International Publishing AG Switzerland, 2015

**4. Course Evaluation**

In order to successfully pass the course, students will be expected to complete the activities listed below. Weights indicate the contribution to the final course grade.

Attendance, homework assignments and in-class activities and presentation (20%): This component of the final grade is based upon your contribution to the class in the form of attendance, homework assignments, class activities and presentation..

Projects (40%): This component of the final grade is based upon one trainning project, using data and method to correlate the reservoir,interpret the structure, analyze the sedimentary facies, evaluate the quality of reservoir and build the 3D reservoir model of the research area. Presentation of the project is required, which should include the brief introduction of the reservoir, the correlation, structure interpretation, sedimentary facies, comprehensive evaluation of reservoirs and geological modeling, the results and analysis, and conclution.

Final-term report (40%): the final-term practical training report should include the brief introduction of the reservoir, the correlation, structure interpretation, sedimentary facies, comprehensive evaluation of reservoirs and geological modeling, the results and analysis, and conclution.

**5. Course Policies**

Attendance and preparation for class: You are expectecd to attend all scheduled class sessions with your reading and supplementary materials.

Absences: Absence from class is inexcusable and will result in a reduction in your performance evaluation. In the event you have an excused absence from the class (e.g. a job interview) you must contact the instructor ahead of time.

Assignments: In both the profesional and academic world, you must meet the deadlines.