مواصفات مقرر:جيولوجيا اليمن
Course Specification of: Geology of Yemen

General information about the course المعلومات العامة عن المقرر

1.	اسم المقرر Course Title	Geology of Yemen جيولوجية اليمن				
2.	رمز المقرر ورقمه Course Code and Number	PNR313				
3.	الساعات المعتمدة للمقرر Credit Hours	Credit Hours الساعات المعتمدة				الإجمالي Total
		محاضرات Lecture	عملي Practical	سمنار/تمارين Seminar/Tutorial	تدريب Training	
		2	1	-	-	3
4.	المستوى والفصل الدراسي Study Level and Semester	المستوى الثالث، الفصل الثاني 3rd Level, Second Semester				
5.	المتطلبات السابقة المقرر (إن وجدت) Pre-requisites (if any)	جيولوجية عامة(1) PNR111 General Geology (1)				
6.	المتطلبات المصاحبة (إن وجدت) Co-requisites (if any)	لايوجد Non				
7.	البرنامج الذي يدرس له المقرر Program (s) in which the course is offered	العلوم الجيولوجية Geosciences متطلب كلية				
8.	لغة تدريس المقرر Language of teaching the course	انجليزي English				
9.	نظام الدراسة Study System	فصلي Semester				
10.	مكان تدريس المقرر Location of teaching the course	كلية البترول والموارد الطبيعية Faculty of Petroleum and Natural Resources				
11.	اسم معد(و) مواصفاتالمقرر Prepared by	ا.د. عبد الكريم الصباري Prof. Dr. AbdulKarim Al-Subbary ا.م.د. خالد محمد خنبري Associate Prof. Khaled Khanbari				
12.	تاريخ اعتماد مجلس الجامعة Date of Approval	2020				

Course Description وصف المقرر

وصف المقرر ر بالإنجليزية	وصف المقرر ر بالعربية
This course gives an introduction to the geological history andthe stratigraphic column of Yemen from the Precambrian until now. Paleozoic-Mesozoic-Cenozoic tectonics, structural and Sedimentary Basinsas well as the Rifts of the Red Sea and Gulf of Aden are also covering. The course as well explain, the Basements, volcanic and sedimentary cover with an interest in describing the rock units, their composition, structure, minerals, fossils and their economic importance,to identify and determine the sequence of processesand history of the	يقدم هذا المساق مقدمة للتاريخ الجيولوجي والعمود الطبقي في اليمن من العصر ما قبل الكمبري حتى الآن.كما يغطي أيضاتكتونياتوبنيات والأحواضالرسوبية لليمن عبر العصور المختلفة (الباليوزوي القديم - والميزوزوي المتوسط - والسينوزوي الحديث)، بالإضافة إلى مناطقصدع البحر الأحمر وخليج عدن. كما يشرح هذا المقرر، صخور الأساس والغطاء البركاني والرسوبي مع الاهتمام على وصف الوحدات الصخرية والتكوين والهيكل والمعادن والأحافير والأهمية الاقتصادية لتحديد تسلسل العمليات وتاريخ القشرة الأرضية على امتداد

earth's crust along all Yemeni territories including Socotra island	الأراضي اليمنية بما في ذلك جزيرة سقطرى.

Course Intended Learning Outcomes (CILOs) مخرجات تعلم المقرر

After completing the course, the student will be able to:		بعد الانتهاء من دراسة المقرر سوف يكون الطالب قادرا على أن:	
a1.	Describe the geological history and the stratigraphic column of Yemen	يوصف التاريخ الجيولوجي والعمود الطبقي اليمني	- a1
a2.	identify geological field relationships and interpret them in the context of stratigraphic settings	يحدد العلاقات الميدانية الجيولوجية وتفسيرها في سياق الإعدادات الطباقية	–a2
b1.	Distinguish between the Lithostratigraphic units and the sequence processeswithin the different geological periods.	يميز بين وحدات التتابع الصخريوعمليات التسلسل في الفترات الجيولوجية المختلفة.	–b1
b2.	create, and assess hypotheses of the earth evolution using field based data sets to solve problems	ينشئ ويقيم فرضيات تطور الصخور باستخدام مجموعة البيانات الميدانية لحل المشاكل	- b2
c1.	Interpret geological evolution and processes from field relations	يفسر التطور الجيولوجي والعمليات من العلاقات الميدانية	- c1
c2.	explain the development of key concepts in geological thinking	يشرح تطور المفاهيم الرئيسية في التفكير الجيولوجي	- c2
d1.	Present geological data on a map and summarize geological interpretations in a written report.	تقديم بيانات جيولوجية على خريطة وتلخيص التفسيرات الجيولوجية في تقرير مكتوب	- d1
d2.	Work in a team efficiently to produce a geological map of a region, using appropriate software and report information clearly to the specialist audiences.	يعمل في فريق بكفاءة لإنتاج خريطة جيولوجية للمنطقة، باستخدام البرامج المناسبة ويوصل المعلومات بوضوح إلى الجمهور متخصص.	- d2

مواءمة مخرجات تعلم المقرر مع مخرجات التعلم للبرنامج:

Alignment of CILOs (Course Intended Learning Outcomes) to PILOs (Program Intended Learning Outcomes)

مخرجات التعلم المقصودة من المقرر (Course Intended Learning Outcomes)		مخرجات التعلم المقصودة من البرنامج (Program Intended Learning Outcomes) (تكتب جميع مخرجات البرنامج كما هي رمزا ونصا)	
a1	Describe the geological history and the stratigraphic column of Yemen	A1	Express knowledge and understanding of geological-specific theories, paradigms, concepts and principles, in addition to general literature and basic science.
a2	identify geological field relationships and interpret them in the context of stratigraphic settings	A2	Explain fundamental geological principles and concepts in theoretical, practical and vocational situations and the possibility of applying them.
b1	Distinguish between the Lithostratigraphic units and the sequence processeswithin the different geological periods.	B1	Integrate synthesized geological data on a range of spatial and temporal scales to allow for scientific interpretations.
b2	create, and assess hypotheses of the earth evolution using field based data sets to solve problems	B2	Explore knowledge and skills in solving geological and environmentalproblems logically and professionally.
c1	Interpret geological evolution and processes from	C1	Demonstrate the ability to identify rocks, minerals, and

	field relations		different structure in the field and in the lab.
c2	explain the development of key concepts in geological thinking	**C2**	Apply new and established technologies with efficiency to collect and interpret geological data, recognizing their strengths and limitations.
d1	Present geological data on a map and summarize geological interpretations in a written report.	**D2**	Elucidate the necessary skills of practicing responsible and personal characteristics with discipline, and ability in making decision.
d2	Work in a team efficiently to produce a geological map of a region, using appropriate software and report information clearly to the specialist audiences.	**D2**	-

مواءمةمخرجات التعلم باستراتيجيات التعليم والتعلم والتقويم

Alignment of CILOs to Teaching and Assessment Strategies

أولا: مواءمة مخرجات تعلم المقرر (المعارف والفهم)بإستراتيجيةالتعليم والتعلموالتقويم:

First: Alignment of Knowledge and Understanding CILOs

مخرجات المقرر/ المعرفة والفهم KnowledgeandUnderstandingCILOs		إستراتيجيةالتعليم والتعلم TeachingStrategies	إستراتيجية التقويم AssessmentStrategies
a1-	Describe the geological history and the stratigraphic column of Yemen	Lectures Dialogue and discussion Self-education Collaborative learning	Examinations, Assignments, Oral presentations
a2 -	identify geological field relationships and interpret them in the context of stratigraphic settings		

ثانيا:مواءمة مخرجات تعلم المقرر(المهارات الذهنية)بإستراتيجيةالتدريس والتقويم:

Second: Alignment of Intellectual Skills CILOs

مخرجات المقرر/ المهارات الذهنية IntellectualSkillsCILOs		إستراتيجيةالتعليم والتعلم TeachingStrategies	إستراتيجية التقويم Assessment Strategies
b1 -	Distinguish between the Lithostratigraphic units and the sequence processes within the different geological periods.	Lectures Dialogue and discussion Practical exercises Self-education Field training	Mid-term test Monthly duties Oral presentations - Homework
b2 -	create, and assess hypotheses of the earth evolution using field based data sets to solve problems		

ثالثا:مواءمة مخرجات تعلم المقرر(المهارات المهنية والعملية)بإستراتيجيةالتدريس والتقويم:

Third: Alignment of Professional and Practical Skills CILOs

مخرجات المقرر/ المهارات المهنية والعملية Professional and Practical Skills CILOs		إستراتيجيةالتعليم والتعلم TeachingStrategies	إستراتيجية التقويم AssessmentStrategies
c1-	Interpret geological evolution and processes from field relations	Lectures Dialogue and discussion Practical exercises Self-education Collaborative learning	Achievement tests Presentations Short essays Oral question Reports
c2-	explain the development of key concepts in geological thinking		

Prepared by	Quality Assurance Unit	Dean of the Faculty	Dean of the Development & Quality Assurance Center
Assoc.Prof. Adel Al-Matary	Assoc.Prof. Adel Al-Matary	Assoc.Prof. Bassim AlKhirbash	Assoc.Prof. Huda Al-Emad

Rector of Sana'a University
Prof. Dr. Al Qaseem Mohammed Abas

			Final Exam

رابعا: مواءمة مخرجات تعلم المقرر(المهارات العامة) بإستراتيجيةالتدريس والتقويم:

Fourth: Alignment of Transferable (General) Skills CILOs

مخرجات المقرر Transferable (General) Skills CILOs		إستراتيجيةالتعليم والتعلم TeachingStrategies	إستراتيجية التقويم AssessmentStrategies
d1-	Present geological data on a map and summarize geological interpretations in a written report.	Lectures Brainstorming Lab Experiments Presentation Project	Achievement tests Case Studies Presentations Reports
d2-	Work in a team efficiently to produce a geological map of a region, using appropriate software and report information clearly to the specialist audiences.		

محتوى المقررCourse Content

موضوعات الجانب النظريTheoretical Aspect

الرقم Order	الموضوعات الرئيسة/ الوحدات Topic List / Units	الموضوعات الفرعية Sub Topics List	عدد الأسابيع Number of Weeks	الساعات الفعلية Contact Hours	رموز مخرجات التعلم للمقرر (CILOs)
1	**Introduction**	- Geological map of Yemen - Stratigraphy of the geological column	**1**	**2**	a1,a2, b1,c1,c2
2	**Basement (Arabian Shield)**	- Rock units - Basement terranes in Arabian Shield - Tectonic evolution	**1**	**2**	a1,a2, b1,c1,c2
3	**Basement rocks of Yemen**	- Geological setting of the basement in the northern and western part of Yemen - Tectonic events of the basement in the northern and western part of Yemen - Lithostratigraphic units of the basement in the northern and western part of Yemen	**1**	**2**	a1,a2, b1,c1,c2
4	**Basementrocks of Yemen**	- Lithostratigraphic units of the basement in the southern and eastern part of Yemen - Lithostratigraphic units of the basement of Socotra Island - Precambrian Terranes in Yemen - Deformation history and tectonic evolution of the basement rocks	**1**	**2**	a1,a2, b1,c1,c2

5	**Volcanic activities**	- Plate tectonics and volcanism - Characteristic magma series associated with specific tectonic settings	**1**	**2**	a1,a2, b1,c1,c2
6	**Yemen Trap Series (Tertiary volcanic)**	- Location and thickness - Rock units - Age of Yemen Trap Series - Extension and Magmatsim	**1**	**2**	a1,a2, b1,c1,c2
7	**Yemen Volcanic Series(Quaternary volcanic)**	- Location and thickness - Lithology and age - Quaternary volcanic fields - Geothermal activities	**1**	**2**	a1,a2, b1,c1,c2
8	**Introduction to the Sedimentary cover of Yemen**	- Stratigraphic Settings of the Sedimentary rocks units and its Economic importance in Yemen - The Sedimentary Basins of Yemen • **Ghabar Group**(Infra–Cambrian-Earliest Paleozoic):Stratigraphy of the geological column • **Qinab Group**(Infra-Cambrian - Lowest Cambrian): Volcano–sedimentary succession	**1**	**2**	a1,a2, b1
9	**Sedimentary cover of the Paleozoic Sediments**	• **Wajid Formation** (Cambrian - Carboniferous): Quartz sandstone. • **Akbarah Formation** (Late Carboniferous-Permian): Geological history, Sedimentary Succession and Rock Units	**1**	**2**	a1,a2, b1,c1,c2
10	**Sedimentary cover of the Mesozoic Sediments**	• **Kuhlan Formation** (Lower– Middle Jurassic): Geological history, Sedimentary Succession and Rock Units • **Amran Group** (Middle Jurassic-Lower Cretaceous): Carbonate marl/shale with evaporitic succession.	**1**	**2**	a1,a2, b1,c1,c2
		• **Tawilah Group** (Cretaceous): Geological history, Sedimentary Succession and Rock Units • **Mahra Group** (Cretaceous): Geological history, Sedimentary Succession and Rock Units	**1**	**2**	a1,a2, b1,b2, c1,c2
11	**Sedimentary cover of the Cenozoic**	• **Hadramawt Group** (Paleocene-Middle Eocene Geological history, Sedimentary Succession and Rock Units	**1**	**2**	a1,a2, b1,b2, c1,c2
		• **Majzir Formation** (Paleocene-Lower	**1**	**2**	a1,a2,

	Sediments	Eocene): A shallow marine-littoral sandstone succession. • **Shihr Group** (Oligocene-Pliocene): Geological history, Sedimentary Succession and Rock Units • **Tihamah Group** (Middle-Upper Miocene): Geological history, Sedimentary Succession and Rock Units			b1,b2, c1,c2
12	**The Geology of Socotra Archipelago**	• Geological setting of Socotra island • Stratigraphy and Sedimentary cover of Socotra island • Caves and Paleoclimate of Socotra island	**1**	**2**	a1,a2, b1,b2, c1,c2
عدد الأسابيع والساعات الفعلية **Number of Weeks /and Contact Hours Per Semester**			**14**	28	

Practical Aspect (if any) الموضوعات العملية (إن وجدت)

الرقم Order	التجارب العملية/ التمارين / تدريبات Practical / Exercises/Tutorials topics	عدد الأسابيع Number of Weeks	الساعات الفعلية Contact Hours	رموز مخرجات التعلم Course ILOs
1	Interpretation of geological maps of Yemen	**1**	**2**	a1,a2, b1
2	Description of Basement rocks (Gneiss unit)	**1**	**2**	a1,a2, b1
3	Description of Basement rocks (Meta-volcanic and Meta-sediment belts)	**1**	**2**	a1,a2, b1
4	Description of Basement rocks (Granitic Intrusions)	**1**	**2**	a1,a2, b1, d1,d2
5	Description of Tertiary volcanic rocks	**1**	**2**	a1,a2, b1, c1,d2
6	Description of Quaternary volcanic rocks	**1**	**2**	a1,a2, b1
7	• Geological & Stratigraphic Settings of Yemen, Description of Sedimentary Succession and Rock Units	**1**	**2**	a1,a2, b1,b2, c1,c2
8	• Origin and Description of Sedimentary Succession and Rock Units of the Paleozoic Sediments : Wajid and Akbarah Formations	**1**	**2**	a1,a2, b1,b2, c1,c2
9	• One day field practice observation of outcrops	**1**	**2**	All
10	• Origin and Description of Sedimentary Succession and Rock Units of the Mesozoic Sediments: Kuhlan Formation Amran Group, and Tawilah Group	**1**	**2**	a1,a2, b1,b2, c1,c2
11	• Origin and Description of Sedimentary Succession and Rock Units of the Mesozoic Sediments: Medjzir Formation, Shihr Group and Tihama	**1**	**2**	a1,a2, b1,b2, c1,c2

	Group.			
12	Review to the Geological & Stratigraphic Settings of Yemen: Rock units and its Economic importance.	1	2	All
إجمالي الأسابيع والساعات الفعلية Number of Weeks /and Contact Hours Per Semester		12	26	

استراتيجيات التعليم والتعلم Teaching Strategies

- المحاضرات التفاعلية Interactive lectures
- تمارين عملية Practical exercises
- التعلم الذاتي Self-learning
- التعلم التعاوني Collaborative learning
- العصف الذهني Brain storm

الأنشطة والتكليفات Tasks and Assignments

م No	التكليف/ الواجب Assignments/ Tasks	نوع التكليف (فردي/ تعاوني)	الدرجة المستحقة Mark	أسبوع التنفيذ Week Due	مخرجات التعلم CILOs (symbols)
1	NA	-	-	-	-
	Total Score إجمالي الدرجة		NA		

تقييم التعلم Learning Assessment

الرقم No.	أنشطة التقييم Assessment Tasks	أسبوع التقييم Week due	الدرجة Mark	نسبة الدرجة إلى الدرجة النهائية Proportion of Final Assessment	مخرجات التعلم CILOs (symbols)
1	الحضور والنشاط في المعمل Lab attendance and activities	Weekly	5	3.3%	All
2	تطبيقات، تقارير وكويز (عملي) Exercises, reports and Quiz (practical)	Bi-weekly basis	5	3.3%	a1,a2,b1
3	اختبار نصف الفصل (عملي) Mid-Term Exam(practical)	Week 6	10	6.6%	a1,a2,b1
4	اختبار نهاية الفصل (عملي) Final Exam (practical)	Week 14	30	20%	a1,a2,b1,c1,c2
5	حضور و نقاشات المحاضرات (نظري) Lecture attendance and class discussion (theoretical)	Weekly	5	3.3%	All
6	Quizzes (theoretical)(كويز (نظري	Bi-weekly basis	5	3.3%	a1,a2,b1
7	اختبار نصف الفصل (نظري) Mid-Term written exam (theoretical)	Week 7	15	10%	a1,a2,b1

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8	تقارير ومشروع (نظري) Project and Report (theoretical)	Week 10	5	3.3%	a1,a2,b1, c2, d2
9	اختبار نهاية الفصل (نظري) Final Exam (theoretical)	Week 16	70	46.7%	All
Total الإجمالي			150	%100	

Learning Resources مصادر التعلم

توثق المراجع حسب نظام APA (اسم المؤلف، سنة النشر، اسم الكتاب، دار النشر، بلد النشر).

Required Textbook(s) المراجع الرئيسة(لا تزيد عن مرجعين)

1- Beydoun, Z.R., Mustafa A.L. As-Saruri, Hamed El-Nakhal, Ismail N. Al-Ganad, Rasheed S. Baraba, Abdul Sattar O. Nani and Mohammed H. Al-Aawah, (1998). International Lexicon of Stratigraphy, Asia, IUGS Publication No. 34, Volume III, pp 6-46.

Essential References المراجع المساندة

1. Menzies, M., Al-Kadasi, M., Al-Khirbash, S., **Al-Subbary**, A., Baker, J., Blakey., S., Bosence, D., Davison, I., Dart, C., Owen, L., McClay, K., Nichols, G., Yelland, A. and Watchorn, F. (1994). Geology of Yemen, In McCombe, D. A., Frentte, G. L. and Alawi, A. J., eds., The Geological and Mineral Resources of Yemen: Yemen Ministry of Oil and Mineral Resources, technical report, 128 p.
2- Geukens, f.(1963). Geology of the Arabian Peninsula: Yemen. USGS ProfessionalPaper 560-B.p. B3.
3- الخرباش صلاح، الانبعاوي محمد، 1999م، جيولوجية اليمن، الطبعة الأولى، مركز عبادي للدراسات والنشر، الجمهورية اليمنية

Electronic Materials and Web Sites *etc.* المصادر الإلكترونية ومواقع الإنترنت

https://www.thefreelibrary.com/The+Geology+of+Yemen.-

Course Policies الضوابط والسياسات المتبعة في المقرر

1	**Class Attendance حضور الفعاليات التعليمية** - Students are expected to attend classes regularly and promptly. - The attendance should not be less than 80%. - If the student has been absent, he is responsible for finding out any missed material by consulting other students or going to the professor's office hours.
2	**Tardy الحضور المتأخر** Attendance and arriving on time for the class are necessary. If the student is late, he will be prevented from class.
3	**Exam Attendance/Punctuality ضوابط الامتحان** - According to the rules the student gets absent in the exam of the course.
4	**Assignments & Projects التعيينات والمشاريع** Papers survey or projects should be submitted by the time detriment by the professor.
5	**Cheating الغش** According to the rules, cheating is a serious offense and will always result in an imposition of a penalty.The penalties that can be started from the range of canceling the result of the course to canceling the student's admission.
6	**Plagiarism الانتحال** Plagiarism is a serious offense and will always result in an imposition of a penalty. The penalties that can be started by making a zero mark for the work.
7	**Other policies سياسات أخرى** The student should by a commitment by the rules inside class and university. Therefore, he is

	expected to show respect for his classmate, instructors &others.

قسم/ برنامج: متطلب كلية

العام الجامعي: 2019- 2020م

خطة مقرر: جيولوجيا اليمن

Course Plan (Syllabus): Geology of Yemen

Information about Faculty Member Responsible for the Course معلومات عن أستاذ المقرر							
الاسم Name	ا.د. عبد الكريم الصباري Prof. Dr. Abdulkarim Al-Subbary ا.م.د. خالد محمد خنبري Associate Prof. Khaled Khanbari	الساعات المكتبية (أسبوعيا) Office Hours					
المكان ورقم الهاتف Location&Telephone No.	جامعة صنعاء Sana'a University	السبت SAT	الأحد SUN	الاثنين MON	الثلاثاء TUE	الأربعاء WED	الخميس THU
البريد الإلكتروني E-mail	aalsubbari@yahoo.com k.khanbari@su.edu.ye						

General information about the course معلومات عامة عن المقرر						
.1	اسم المقرر Course Title	جيولوجية اليمن Geology of Yemen				
.2	رمز المقرر ورقمه Course Code and Number	PNR313				
.3	الساعات المعتمدة للمقرر CreditHours	الساعات المعتمدة CreditHours				الإجمالي Total
		محاضرات Lecture	عملي Practical	سيمنار/تمارين Seminar/Tutorial	تدريب Training	
		2	1	-	-	3
.4	المستوى والفصل الدراسي Study Level and Semester	المستوى الثالث، الفصل الثاني 3rd Level, second Semester				
.5	المتطلبات السابقة للمقرر Pre-requisites	جيولوجية عامة General Geology				
.6	المتطلبات المصاحبة (إن وجدت) Co –requisite	لايوجد Non				
.7	البرنامج الذي يدرس له المقرر Program (s) in which the course is offered	العلوم الجيولوجية Geosciences متطلب كلية				
.8	لغة تدريس المقرر Language of teaching the course	انجليزي English				
.9	مكان تدريس المقرر Location of teaching the course	كلية البترول والموارد الطبيعية Faculty of Petroleum and Natural Resources				

Course Description وصف المقرر

This course gives an introduction to the geological history and the stratigraphic column of Yemen from the Precambrian until now. Paleozoic-Mesozoic-	يقدم هذا المساق مقدمة للتاريخ الجيولوجي والعمود الطبقي في اليمن من العصر ما قبل الكمبري حتى الآن.كما يغطي أيضاتكتونياتوبنيات والأحواضالرسوبية لليمن عبر العصور

Cenozoic tectonics, structural and Sedimentary Basinsas well as the Rifts of the Red Sea and Gulf of Aden are also covering. The course as well explain, the Basements, volcanic and sedimentary cover with an interest in describing the rock units, their composition, structure, minerals, fossils and their economic importance,to identify and determine the sequence of processesand history of the earth's crust along all Yemeni territories including Socotra island.	المختلفة (الباليوزوي القديم - والميزوزوي المتوسط - والسينوزوي الحديث)، بالإضافة إلى مناطقصدع البحر الأحمر وخليج عدن. كما يشرح هذا المقرر، صخور الأساس والغطاء البركاني والرسوبي مع الاهتمام على وصف الوحدات الصخرية والتكوين والهيكل والمعادن والأحافير والأهمية الاقتصادية لتحديد تسلسل العمليات وتاريخ القشرة الأرضية على امتداد الأراضي اليمنية بما في ذلك جزيرة سقطرى.

Course Intended Learning Outcomes (CILOs) مخرجات تعلم المقرر

After completing the course, the student will be able to:	بعد الانتهاء من دراسة المقرر سوف يكون الطالب قادرا على أن:
a1. Describe the geological history and the stratigraphic column of Yemen	a1 - يوصف التاريخ الجيولوجي والعمود الطبقي اليمني
a2. identify geological field relationships and interpret them in the context of stratigraphic settings	a2– يحدد العلاقات الميدانية الجيولوجية وتفسيرها في سياق الإعدادات الطباقية
b1.Distinguish between the Lithostratigraphic units and the sequence processeswithin the different geological periods.	b1– يميز بين وحدات التتابع الصخريوعمليات التسلسل في الفترات الجيولوجية المختلفة.
b2.create, and assess hypotheses of the earth evolution using field based data sets to solve problems	b2 -ينشئ ويقيم فرضيات تطور الصخور باستخدام مجموعة البيانات الميدانية لحل المشاكل
c1. Interpret geological evolution and processes from field relations	c1 -يفسر التطور الجيولوجي والعمليات من العلاقات الميدانية
c2.explain the development of key concepts in geological thinking	c2 -يشرح تطور المفاهيم الرئيسية في التفكير الجيولوجي
d1.Present geological data on a map and summarize geological interpretations in a written report.	d1 -تقديم بيانات جيولوجية على خريطة وتلخيص التفسيرات الجيولوجية في تقرير مكتوب
d2. Work in a team efficiently to produce a geological map of a region, using appropriate software and report information clearly to thespecialist audiences.	d2 -يعمل في فريق بكفاءة لإنتاج خريطة جيولوجية للمنطقة، باستخدام البرامج المناسبة ويوصل المعلومات بوضوح إلى الجمهور متخصص.

Course Content محتوى المقرر

Theoretical Aspect خطة تنفيذ الموضوعات النظرية

الرقم Order	الوحدات (الموضوعات الرئيسة) Units	الموضوعات التفصيلية Sub Topics	الأسبوع Week Due	الساعات الفعلية Con. H
1	**Introduction**	▪ Geological map of Yemen ▪ Stratigraphy of the geological column	**Week 01**	**2**
2	**Basement (Arabian Shield)**	▪ Rock units ▪ Basement terranes in Arabian Shield ▪ Tectonic evolution	**Week 02**	**2**
3	**Basement rocks of Yemen**	▪ Geological setting of the basement in the northern and western part of Yemen	**Week 03**	**2**

		▪ Tectonic events of the basement in the northern and western part of Yemen ▪ Lithostratigraphic units of the basement in the northern and western part of Yemen		
4	**Basementrocks of Yemen**	▪ Lithostratigraphic units of the basement in the southern and eastern part of Yemen ▪ Lithostratigraphic units of the basement of Socotra Island ▪ Precambrian Terranes in Yemen ▪ Deformation history and tectonic evolution of the basement rocks	**Week 04**	**2**
5	**Volcanic activities**	▪ Plate tectonics and volcanism ▪ Characteristic magma series associated with specific tectonic settings	**Week 05**	**2**
6	**Yemen Trap Series (Tertiary volcanics)**	▪ Location and thickness ▪ Rock units ▪ Age of Yemen Trap Series ▪ Extension and Magmatsim	**Week 06**	**2**
7	**Mid-Exam**		**Week 07**	**2**
8	**Yemen Volcanic Series(Quaternary volcanic)**	▪ Location and thickness ▪ Lithology and age ▪ Quaternary volcanic fields ▪ Geothermal activities	**Week 08**	**2**
9	**Introduction to the Sedimentary cover of Yemen**	• Stratigraphic Settings of the Sedimentary rocks units and its Economic importance in Yemen • The Sedimentary Basins of Yemen **# Ghabar Group** - (Infra–Cambrian-Earliest Paleozoic): Stratigraphy of the geological column **# Qinab Group** - (Infra-Cambrian -Lowest Cambrian): Volcano–sedimentary succession	**Week 09**	**2**
10	**Sedimentary cover of the Paleozoic Sediments**	• **Wajid Formation** (Cambrian -Carboniferous): Quartz sandstone. • **Akbarah Formation** (Late Carboniferous-Permian): Geological history, Sedimentary Succession and Rock Units	**Week 10**	**2**
11	**Sedimentary cover of the Mesozoic Sediments**	• **Kuhlan Formation** (Lower– Middle Jurassic): Geological history, Sedimentary Succession and Rock Units • **Amran Group** (Middle Jurassic-Lower Cretaceous): Carbonate marl/shale with evaporitic succession.	**Week 11**	**2**
		• **Tawilah Group** (Cretaceous): Geological history, Sedimentary Succession and Rock Units • **Mahra Group** (Cretaceous): Geological history, Sedimentary Succession and Rock Units	**Week 12**	**2**
12	**Sedimentary**	• **Hadramawt Group** (Paleocene-Middle Eocene	**Week 13**	**2**

	cover of the Cenozoic Sediments	Geological history, Sedimentary Succession and Rock Units		
		• **Majzir Formation** (Paleocene-Lower Eocene): A shallow marine-littoral sandstone succession. • **Shihr Group** (Oligocene-Pliocene): Geological history, Sedimentary Succession and Rock Units	**Week 14**	**2**
		• **Tihamah Group** (Middle-Upper Miocene): Geological history, Sedimentary Succession and Rock Units		
13	**The Geology of Socotra Archipelago**	• Geological setting of Socotra island • Stratigraphy and Sedimentary cover of Socotra island • Caves and Paleoclimate of Socotra island	**Week 15**	**2**
15	**Final Exam**		**Week 16**	**2**
عدد الأسابيع والساعات الفعلية **Number of Weeks /and Contact Hours Per Semester**			**16**	**32**

Practical / Training/ Tutorials/ Exercises Aspects خطة تنفيذ موضوعات الجانب العملي

الرقم Order	موضوعات العملي/ المهام / التمارين Practical/Tutorials/ Exercises Aspects	الأسبوع Week Due	الساعات الفعلية Cont. H
1	▪ Interpretation of geological maps of Yemen	Week 01	2
2	▪ Description of Basement rocks (Gneiss unit)	Week 02	2
3	▪ Description of Basement rocks (Meta-volcanic and Meta-sediment belts)	Week 03	2
4	▪ Description of Basement rocks (Granitic Intrusions)	Week 04	2
5	▪ Description of Tertiary volcanic rocks	Week 05	2
6	▪ Mid-exam	Week 06	2
7	▪ Description of Quaternary volcanic rocks	Week 07	2
8	• Geological & Stratigraphic Settings of Yemen, Description of Sedimentary Succession and Rock Units	Week 08	2
9	• Origin andDescription of Sedimentary Succession and Rock Units of the Paleozoic Sediments : Wajid and Akbarah Formations	Week 09	2
10	• One day field practice observation of outcrops	Week 10	2
11	• Origin andDescription of Sedimentary Succession and Rock Units of the Mesozoic Sediments: Kuhlan Formation Amran Group, and Tawilah Group	Week 11	2
12	• Origin andDescription of Sedimentary Succession and Rock Units of the Mesozoic Sediments: Medjzir Formation, Shihr Group and Tihama Group.	Week 12	2
13	Review to the Geological & Stratigraphic Settingsof Yemen: Rock units and its Economic importance.	Week 13	2
14	Final Practical Examination	Week 14	2

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Assoc.Prof. Huda Al-Emad

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Prof. Dr. Al Qaseem Mohammed Abas

اجمالي الأسابيع والساعات الفعلية Number of Weeks /and Contact Hours Per Semester	14	28

Teaching Strategies استراتيجيات التعليم والتعلم

- المحاضرات التفاعلية
- تمارين عملية
- التعلم الذاتي
- التعلم التعاوني

Learning Assessment تقويم التعلم

م No	أساليب التقويم Assessment Method	موعد(أسبوع) التقويم Week Due	الدرجة Mark	الوزن النسبي% Proportion of Final Assessment
1	الحضور والنشاط في المعمل Lab attendance and activities	Weekly	5	3.3%
2	تطبيقات، تقارير وكويز (عملي) Exercises, reports and Quiz (practical)	Bi-weekly basis	5	3.3%
3	اختبار نصف الفصل (عملي) Mid-Term Exam(practical)	Week 6	10	6.6%
4	اختبار نهاية الفصل (عملي) Final Exam (practical)	Week 14	30	20%
5	حضور و نقاشات المحاضرات (نظري) Lecture attendance and class discussion (theoretical)	Weekly	5	3.3%
6	Quizzes (theoretical)(عملي) كويز	Bi-weekly basis	5	3.3%
7	اختبار نصف الفصل (نظري) Mid-Term written exam (theoretical)	Week 7	15	10%
8	تقارير ومشروع (نظري) Project and Report (theoretical)	Week 10	5	3.3%
9	اختبار نهاية الفصل (نظري) Final Exam (theoretical)	Week 16	70	46.7%
Total المجموع			150	100 %

Learning Resources مصادر التعلم

توثق المراجع حسب نظام APA (اسم المؤلف، سنة النشر، اسم الكتاب، دار النشر، بلد النشر).

Required Textbook(s) المراجع الرئيسة(لا تزيد عن مرجعين)

1. Beydoun, Z.R., Mustafa A.L. As-Saruri, Hamed El-Nakhal, Ismail N. Al-Ganad, Rasheed S. Baraba, Abdul Sattar O. Nani and Mohammed H. Al-Aawah, (1998). International Lexicon of Stratigraphy, Asia, IUGS Publication No. 34, Volume III, pp 6-46.

Essential References المراجع المساندة

1. Menzies, M., Al-Kadasi, M., Al-Khirbash, S., **Al-Subbary**, A., Baker, J., Blakey., S., Bosence, D., Davison, I., Dart, C., Owen, L., McClay, K., Nichols, G., Yelland, A. and Watchorn, F. (1994). Geology of Yemen, In McCombe, D. A., Frentte, G. L. and Alawi, A. J., eds., The Geological and Mineral Resources of Yemen: Yemen Ministry of Oil and Mineral Resources, technical report, 128 p

2. Geukens, f.(1963). Geology of the Arabian Peninsula: Yemen. USGS ProfessionalPaper 560-B.p. B3.
3. الخرباش صلاح، الانبعاوي محمد، 1999م، جيولوجية اليمن، الطبعة الاولى، مركز عبادي للدراسات والنشر، الجمهورية اليمنية

Electronic Materials and Web Sites *etc.*المصادر الإلكترونية ومواقع الإنترنت

https://www.thefreelibrary.com/The+Geology+of+Yemen.-

Course Policies الضوابط والسياسات المتبعة في المقرر

Class Attendance حضور الفعاليات التعليمية

- Students are expected to attend classes regularly and promptly.
- The attendance should not be less than 80%.
- If the student has been absent, he is responsible for finding out any missed material by consulting other students or going to the professor's office hours.

Tardy الحضور المتأخر

Attendance and arriving on time for the class are necessary. If the student is late, he will be prevented from class.

Exam Attendance/Punctuality ضوابط الامتحان

- According to the rules the student gets absent in the exam of the course.

Assignments & Projects التعيينات والمشاريع

Papers survey or projects should be submitted by the time detriment by the professor.

Cheating الغش

According to the rules, cheating is a serious offense and will always result in an imposition of a penalty.The penalties that can be started from the range of canceling the result of the course to canceling the student's admission.

Plagiarism الانتحال

Plagiarism is a serious offense and will always result in an imposition of a penalty.The penalties that can be started by making a zero mark for the work.

Other policies سياسات أخرى

The student should by a commitment by the rules inside class and university. Therefore, he is expected to show respect for his classmate, instructors &others.

Department: Petroleum and Natural Gas Engineering

Course Specification of: Petroleum Enhanced Oil Recovery

I. General information about the course

1	Course Title	Enhanced Oil Recovery الطرق المحسنة للإنتاج				
2	Course Code and Number	PNGE 453				
3	Credit Hours	Credit Hours				Total
		Theoretical	Practical	Seminar/Tutorial	Training	
		2		1		3
4	Study Level and Semester	Level Four – First Semester				
5	Pre-requisites (if any)	PNGE 351				

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6	**Co-requisites (if any)**	N.A.
7	**Program (s) in which the course is offered**	Petroleum and Natural Gas Engineering
8	**Language of teaching the course**	English
9	**Study System**	Semester wise
10	**Location of teaching the course**	Faculty of Petroleum and Natural Resources
11	**Prepared by**	Dr. Khaled Saeed Ba-Jaalah
12	**Date of Approval**	

II. Course Description:

Basic theoretical and design aspects of water flooding processes. Review of capillary phenomena and relative permeability characteristics of reservoir rocks. Theory of immiscible displacement including piston-like and frontal advance mechanisms. Injectivity analysis and performance prediction of linear and pattern flooding. Principles of thermal recovery, chemical flooding and miscible gas displacement methods, performance prediction. Advantages and drawbacks of each displacement methods. Selection criteria for target reservoirs.

III. Course Intended Learning Outcomes (CILOs):

After completing the course, the student will be able to:

a1.	Understand the general rock properties and its relation to fluid flow in porous media.
a2.	Understand of the technical and economic constraints that govern the performance of a water flooding project.
a3.	Understand the basic features and technical foundations of the most common EOR methods.
b1.	Compute the various rock properties.
b2.	Perform the principle of math, science and engineering to predict the performance of a linear or pattern water flood in a homogeneous reservoir.
b3.	Select an optimum EOR method.
c1.	Analyze and interpret water flooding data and EOR data.
c2.	Develop recovery expectations and choose appropriate methods for improving oil recovery.
d1.	Improve leadership skills and work effectively in teams.
d2.	Improve communication skills through writing and presenting an engineering report.

IV. Alignment of CILOs (Course Intended Learning Outcomes) to PILOs (Program Intended Learning Outcomes) :

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Course Intended Learning Outcomes		Program Intended Learning Outcomes	
a1.	Understand the general rock properties and its relation to fluid flow in porous media**.**	**A1**	Demonstrate the concepts of basic science and mathematics related to field of petroleum engineering**.**
a2.	Understand of the technical and economic constraints that govern the performance of a water flooding project.		
a3.	Understand the basic features and technical foundations of the most common EOR methods.		
b1.	Compute the various rock properties.	**B1**	Use the principles of engineering in developing solutions to practical petroleum engineering and select appropriate computer software for modeling**.**
b2.	Perform the principle of math, science and engineering to predict the performance of a linear or pattern water flood in a homogeneous reservoir.		
b3.	Select an optimum EOR method.	**B2**	Evaluate well logs and well test operations to identify maps of reservoir and select the best method of petroleum recovery.
c1.	Analyze and interpret water flooding data and EOR data.	**C1**	Carry out special engineering design in all petroleum engineering projects.
c2.	Develop recovery expectations and choose appropriate methods for improving oil recovery**.**	**C3**	Deal with the high level of uncertainty in definition and solution of petroleum reservoir problems.
d1.	Improve leadership skills and work effectively in teams.	**D1**	Collaborate effectively within multidisciplinary teams under stressful environment and within constraints.
d2.	Improve communication skills through writing and presenting an engineering report.	**D3**	Prepare technical petroleum reports.

V. Alignment of CILOs to Teaching and Assessment Strategies

First: Alignment of Knowledge and Understanding CILOs

Knowledge and Understanding CILOs		Teaching Strategies	Assessment Strategies
a1-	Understand the general rock properties and its relation to fluid flow in porous media**.**	- Lecture - Discussion - Independent readings	- Quiz - Oral questions - Participation of

a2-	Understand of the technical and economic constraints that govern the performance of a water flooding project.	- Videos	students - Examinations
a3-	Understand the basic features and technical foundations of the most common EOR methods.		

Second: Alignment of Intellectual Skills CILOs

Intellectual Skills CILOs		Teaching Strategies	Assessment Strategies
b1 -	Compute the various rock properties.	- Lecture - Tutorial - Discussion - Problem solving	- Quiz - Home work - Examinations
b2 -	Perform the principle of math, science and engineering to predict the performance of a linear or pattern water flood in a homogeneous reservoir.		
b3-	Select an optimum EOR method.		

Third: Alignment of Professional and Practical Skills CILOs

Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1-	Analyze and interpret water flooding data and EOR data.	- Lecture - Tutorial - Discussion - Problem solving	- Quiz - Home work - Examinations
c2-	Develop recovery expectations and choose appropriate methods for improving oil recovery.		

Fourth: Alignment of Transferable (General) Skills CILOs

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1-	Improve leadership skills and work effectively in teams.	- Project - Oral presentation - Group discussions - Small group working	- Project evaluation - Oral presentation evaluation - Project report evaluation
d2-	Improve communication skills through writing and presenting an engineering report.		

VI. Course Content:

A. Theoretical Aspect:

Order	Topic List / Units	Sub Topics List	Number of Weeks	Contact Hours	(CILOs)
1	Introduction	- Stages of recovery. - Development of water flooding.	1	2	a2
2	Fundamentals of Rock and Fluid Interaction	- Review of rock properties	1	2	a1, b1
		- Reservoir types.	1	2	
3	Flow of Immiscible Fluids	- Types of flow. - Fluids Permeabilities. - Residual Oil Saturations.	1	2	a1, b1
4	Prediction of Linear Immiscible Displacement	- Fractional flow curve. - Frontal advance theory.	1	2	a2,b2,c1
		- Linear water flood performance prediction.	1	2	
5	Mid-term Exam		1	2	a1,a2,b1,b2,c1
6	Areal Sweep Efficiency and Flood Patterns	- Injection patterns and areal sweep efficiency.	1	2	b2,c1,c2
		- Pattern water flood performance prediction.	1	2	
7	Thermal EOR Methods	- Steam Injection - Hot Water Injection - In-Situ Combustion	1	2	a3,b3,c2
8	Miscible Gas Displacement Methods	- HC Miscible Flooding. - CO2 Miscible Flooding.	1	2	a3,b3,c2
		- N2 & Flue Gas Flooding.	1	2	
9	Chemical Flooding Methods	- Polymer Flooding. - Alkaline Water Flooding.	1	2	a3,b3,c2
		- Alkaline Water Flooding. - Surfactant Flooding.	1	2	
Number of Weeks /and Contact Hours Per Semester			14	28	

B. Practical Aspect (if any)

Prepared by	Quality Assurance Unit	Dean of the Faculty	Dean of the Development & Quality Assurance Center
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Order	Practical / Exercises/ Tutorials topics	Number of Weeks	Contact Hours	Course ILOs
1	Calculate the various rock properties:- - Fluids Permeabilities - Residual Oil Saturation - Wettability calculation - Capillary Pressure calculation	2	4	b1
2	Estimating Displacement Performance - Oil Displaced, N_p - Production Rates, q_o & q_w - WOR, F_{wo} - Time Required for Displacement	2	4	b2,c1,c2
3	Prediction of Displacement Performance - Estimating Injection Rates	1	2	b2,c1,c2
4	Immiscible Displacement in Two Dimensions – Areal:- - Displacement in a Five-Spot Pattern - Correlations Developed From Scaled Laboratory Models - Streamtube Models	2	4	b2,c1,c2
5	Reservoirs with Vertical Heterogeneity:- - 2D Displacement in Uniform Stratified-Reservoirs-Layered Reservoirs. - Approximation of 2D Flow With Thickness-Averaged Properties . - Vertical Equilibrium of Capillary & Gravity Forces .	2	4	b2,c1,c2
6	Injectivity and Injection Rates:- - Injection Rates of Liquid Filled Patterns – M=1 - Injection Rates of Liquid Filled Patterns – M≠1 - Injection Rates of Depleted Reservoirs – M≠1	2	4	b2,c1,c2
7	Small project *presentation*	2	4	b1,b2,b3, c1,c2,d1,d2
8	Practical Exam	1	2	b1,b2,b3,c1,c2,
Number of Weeks /and Contact Hours Per Semester		**14**	**28**	

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VII. Teaching Strategies:

1. Discussion
2. Group discussions
3. Independent readings
4. Lecture
5. Oral presentation
6. Problem solving
7. Project
8. Small group working
9. Tutorial
10. Videos

VIII. Tasks and Assignments :

No	Assignments/ Tasks	Type of Assignment	Mark	Week Due	CILOs (symbols)
1	**Exercises & Home works**	personal	5	By-weekly basis	b1,b2,b3,c1,c2
2	**Small project**	Cooperative	10	12	b1,b2,b3, c1,c2,d1,d2
	Total Score إجمالي الدرجة		**15**		

IX. Learning Assessment :

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs (symbols)
1	**Exercises & Home works**	**By-weekly basis**	15	10 %	b1,b2,b3,c1,c2
2	**Quiz (1)**	W6	5	3.3 %	a1,a2,b1,b2,c1
3	**Midterm Exam**	W8	25	16.7 %	a1,a2,b1,b2,c1
4	**Quiz (2)**	W12	5	3.3 %	a3,b2,b3,c1,c2
5	**Final Exam (practical)**	**W 15**	30	20 %	b1,b2,b3,c1,c2,d1,d2
6	**Final Exam (theoretical)**	**W16**	70	46.7 %	b1,b2,b3,c1,c2
Total			**150**	**%100**	

X. Learning Resources :

1- Required Textbook(s) :

1. Don W Green and Willhite G P, 1998, Enhanced Oil Recovery, SPE International, 553 pp.

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2. G. Paul Willhite, 1986,'' Waterflooding'', Society of Petroleum Engineers, Textbook Series, Vol. 3, Richardson, Texas.

2- Essential References :

1. F. F. Craig, 1993, 'The Reservoir Engineering Aspects of Waterflooding', Monograph Series Vol. 3, Society of Petroleum Engineers, Richardson, Texas.
2. Larry W. Lake, Russell Johns, Bill Rossen & Gary Pope, 2014, Fundamentals of Enhanced Oil Recovery, SPE, 496 pp.

3- Electronic Materials and Web Sites *etc.* :

1. Sites of society petroleum engineers. https://www.spe.org/en/
2. Journal of Petroleum Science and Engineering. https://www.journals.elsevier.com/journal-of-petroleum-science-and-engineering

XI. Course Policies :

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject, otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
4	**Assignments & Projects:** In general one assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
5	**Cheating**: For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed,

otherwise the student will be asked to leave the lecture room.
- Mobile phones are not allowed in class during the examination.
- Lecture notes and assignments might be given directly to students using soft or hard copy.