جامعة الملك سعود
كلية العلوم
قسم الجيولوجيا والجيوفيزياء

King Saud University
College of Sciences
Geology and Geophysics Department

The National Commission for Academic Accreditation & Assessment

Form (O)

Course Specification

GEO 534: Advanced carbonates and evaporites

Course Specification

Institution	**King Saud University**
College/Department	**College of Sciences - Department of Geology and Geophysics**

A Course Identification and General Information

1. Course title and code: **Advanced carbonates and evaporites (GEO 534)**
2. Credit hours: **3 (2+0+1)**
3. Program(s) in which the course is offered.
(If general elective available in many programs indicate this rather than list programs)
Geology (offered in the Department of Geology and Geophysics)
4. Name of faculty member responsible for the course
Dr. Osama Elsayed Ahmed Attia
5. Level/year at which this course is offered
Postgraduate Master courses
6. Pre-requisites for this course (if any)
None
7. Co-requisites for this course (if any)
None
8. Location if not on main campus
- **All courses and labs are given in the Geology and Geophysical Department.**

B. Objectives

1. **Summary of the main learning outcomes for students enrolled in the course.**
- Acquaint students with carbonates and evaporites rocks and the extent of their economic importance (oil, minerals and water).
- Describe different rocks and identify their depositional environments.
- Classification of carbonate rocks and evaporite rocks.
- Demonstrate the importance of diagenesis of these rocks and afford natural economic importance.
- Their importance in building and construction and humans (evaporite) where you must know evaporite minerals extracted for human service such as salt and sodium carbonate for industrial cleaners and many other industries.
- Study the process in the lab, in addition to field trips (If possible).

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)
- Course content review periodically.
- In addition to Arabic references, several English references are provided.

- Students are encouraged to use the computer and search the Web for information on the topics of the decision.
- Students are required to submit search with a slide show, either individually or as a group in case of a large number of students.

C. Course Description (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1. Topics to be Covered			
Week #	**Topic**	**# of weeks**	**Contact hours**
1	Introduction- Theories- Controls.	1	3 (2+0+1)
2	Carbonate (origin and sources): 1- Inorganic. 2- Biogenic.	1	3 (2+0+1)
3	Carbonate (sources and facies distribution): Examples- facies- Mineralogy- Techniques in recent researches.	1	3 (2+0+1)
4	Sulfates origin and sources: 1- Primary. 2- Secondary. 3- Transformations and controlling factors	1	3 (2+0+1)
5	Sulfates sources and facies distribution: Examples- facies variations and transformations- Mineralogy- Techniques in recent researches.	1	3 (2+0+1)
6	Discussions and seminars.	1	3 (2+0+1)
7	Sodium Chloride (origin and sources): 1- Marine and Non-Marine. 2- Salt diapers and doming.	1	3 (2+0+1)
8	Sodium chloride sources and facies distribution: Examples- facies variations and replacements- Mineralogy- Techniques in recent researches.	1	3 (2+0+1)
9	Discussions and seminars (field applications)	1	3 (2+0+1)
10	Bitter salts (origin and sources): 1- Magnesium. 2- Potassium. 3- Complex salts.	1	3 (2+0+1)
11	Bitter salts sources and facies distribution: Examples- facies variations and replacements- Mineralogy- Techniques in recent researches.	1	3 (2+0+1)
12	Discussions and seminars (field applications).	1	3 (2+0+1)
13	Evaporites and Hydrocarbons (Theory and Synopsis).	1	3 (2+0+1)
14	Studied Examples (field applications).	1	3 (2+0+1)
15	Salt production versus industry and Economic Potentialities	1	3 (2+0+1)

2. Course components (total contact hours per semester):

- Lectures: 30 hours/semesters; (2 hrs/ week);
- Laboratory: 15 hrs /semester (one hr/week).
- 2 days field trip (If possible).

3. **Additional private study/learning hours expected for students per week** (This should be an average: for the semester not a specific requirement in each week)

- Students are expected to accomplish an average of 3 learning hours per week.

4. **Development of Learning Outcomes in Domains of Learning For each of the domains of learning shown below indicate:**

- A brief summary of the knowledge or skills that the course is intended to develop.
- A description of the teaching strategies to be used in the course to develop that knowledge or skill and the ability of student to be active in an academic team.
- Education by lectures, practical sessions and field training (If possible).
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

a. Knowledge

(i) Description of the knowledge to be acquired

- Recognition of the different carbonate rocks and evaporites.
- Classification the rock samples according to their depositional environments.
- Distinguish between carbonate rock samples and various evaporite samples in hand samples in the lab and in sectors and rock slides.

(ii) Teaching strategies to be used to develop that knowledge

- Course materials are delivered through a sequential delivery of lectures.
- Interactive learning process through questions and answers in class and lab.
- Laboratory work, engaging students to plan and coordinate tests.
- Field trip (if possible) is required to give the student a direct look and contact with the different rocks. During the field trip the student has to collect samples for the class and for his own collection.

(iii) Methods of assessment of knowledge acquired

Exams, homework and lab reports are used to assess the acquired knowledge on the subject.

Oral presentation is given to examine the students' ability to perform and to show their knowledge of the subject.

b. Cognitive Skills

(i) Cognitive skills to be developed

- Ways of modern application in the Earth Sciences.
- The student will be able to apply the knowledge acquired and become acquainted with the carbonate rocks and evaporites and Diagenesis affecting these rocks.
- Student learn the latest techniques used in the study of these rocks.
- The student will be able to note the diversity of these rocks and recognize the methods of their classification.

(ii) Teaching strategies to be used to develop these cognitive skills

- Lectures are supported by illustration, hand outs and sometimes with presentation.
- Lectures are followed by numerous examples, some of which are practical in nature, to illustrate the application and use.
- Laboratory work is planned to teach the student how to recognize easily and to distinguish between the different rocks, in the field, in hand specimen and under the microscope as well.
- Engage students in classroom and laboratory discussion with questions and answers.

(iii) Methods of assessment of students cognitive skills

- Exams and homework are the basic way to assess students.
- Some exams focused on the rocks containing natural resources such as oil, water and minerals.
- Some exams issues requiring resolution critical thinking.
- Laboratory study focuses on the student's understanding of diagenesis of these rocks.

c. Interpersonal Skills and Responsibility

(i) **Description of the interpersonal skills and capacity to carry responsibility to be developed**

- Punctual attendance of classes and laboratory session is required for the students..
- Students will take the responsibility to accomplish any given assignment or home work on their own and submit them on time.
- Students learn to manage their time in self study of the coarse material.

(ii) Teaching strategies to be used to develop these skills and abilities

- Assignments are given to the students at regular intervals to give them time to accomplish and submit on time. Late or no submission of assignments carries penalties or loss of part of the grade points.
- Laboratory reports are to be written in the prescribed format and are to be submitted on time.
- Field trip (if possible) attendance is required for the course. Some questions about the field are given at least in one of the exams.
- Participation of students in classroom discussion is encouraged.

(iii) **Methods of assessment of students interpersonal skills and capacity to carry responsibility**

- Class attendance of students at the beginning of the lecture is recoded.
- Lab attendance is imperative and it is recorded.
- Submission of assignment and home work is also recorded.

d. Communication, Information Technology and Numerical Skills

(i) Description of the skills to be developed in this domain.

- Ability of students to apply the basic information for the earth sciences in general and carbonate rocks and evaporites in particular.
- The use of computers in the study, whether theoretical or laboratory.
- Learning to write reports and prepare and present lectures.

(ii) Teaching strategies to be used to develop these skills

- Questions of exams and assignments require students' knowledge of important subjects.
- Questions include important English terms to familiarize the students to the foreign language.
- Students should be encouraged to studying seriously. Some assignments include some computer search.

(iii) Methods of assessment of students numerical and communication skills

- Assigned grades for each assignment, report, and exams are recorded.
- Lab assignments are graded and recorded.
- Extra grades might be added for good participation in class and lab.
- All grades are added and the total is given after the finals

e. Psychomotor Skills (if applicable)

(i) Description of the psychomotor skills to be developed and the level of performance required

Not applicable

(ii) Teaching strategies to be used to develop these skills

(iii) Methods of assessment of students psychomotor skills

5. Schedule of Assessment Tasks for Students During the Semester

Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final Assessment
1	Homework	Weekly	10%
2	13 lab reports, each for a new test	Weekly	30%
3	First mid-term exam	7^{th} week	10%
4	Second mid-term exam	13^{th} week	10%
5	Final Exam	As scheduled by the registrar	50%

D. Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)

- I am available in the office to devote as much as it takes to answer any question related to the course. I am also available for any academic advice and consultation.
- Office hours are posted, but I am available almost the entire working day.

E. Learning Resources

1. Required Text(s):

1- *Tucker, M.E., Carbonate sedimentology, 2002, Blackwell Publishing Company, 473 p.*

2- *Selley, R.C., 2000,* Applied Sedimentology (Second Edition), Elsevier Inc. ISBN: 978-0-12-636375-3

2. Essential References

1- Seawater (Second Edition) Its Composition, Properties and Behaviour, 1995, Elsevier Ltd. All rights reserved. *Edited by: Mark A. Suckow, Steven H. Weisbroth and Craig L. Franklin.* ISBN: 978-0-7506-3715-2

2- Sedimentary Basins of the World, African Basins (Volume 3), 1997, Edited by: R.C. Selley, Pages 3-394, ISBN: 9780444825711

3- Sedimentary Basins of the World, The Sedimentary Basins of the United States and Canada, (Volume 5), 2008, Edited by: Andrew D. Miall, Pages 1-610 , ISBN: 9780444504258

4- Sodium Sulfate, Handbook of Deposits, Processing, Properties, and Use, 2001, *Author(s): Donald E. Garrett*, Copyright © 2001 Elsevier Inc., ISBN: 978-0-12-276151-5

5- Developments in Marine Geology, Shore Processes and their Palaeoenvironmental Applications, 2008, Edited by: Edward J. Anthony, Elsevier B.V, ISBN: 9780444527332. 4 volumes.

6- Developments in Sedimentology, Diagenesis, IV, 1994, Edited by: K.H. Wolf and G.V. Chilingarian, Elsevier B.V., ISBN: 9780444885173, Pages: 1-529.

3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List):

The instructor will provide a list of references for the students, as the course contains diverse topics.

4-.Electronic Materials, Web Sites etc.

- Among many recommended sites are: Saudi Geological Survey, Saudi Armco, Ministry of Petroleum and Minerals, United States Geological Survey, Maaden, Geo-Arabia, Saudi Geological Society and all related journals and periodicals.
- Search through Google for related topics.

5- Other learning material such as computer-based programs/CD, professional standards/regulations

- Instructor offers lectures on LMS (learning management system) of the university.
- The faculty member represents the collected samples collected from geologicfiels trips various rocks and structures.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)

1. Accommodation (Lecture rooms, laboratories, etc.)

- Lecture room is equipped with a black board, overhead projector, data show, and computer.
- Fully equipped laboratories with binoculars, polarizing microscopes and other needed equipments.

2. Computing resources

- An easily accessible computer lab in the department and in the college.

3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list)

- The laboratory is equipped with binoculars, polarizing microscopes and other needed equipments. Some labs are equipped with data show and computer.
- Brunton compass, hand level, lens, hammer, chisel, and sample bags are required for the field trip.
- Samples of different rocks and minerals are available in the lab.

G. Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- The student is evaluated for all the achievements and performance.
- Grades are calculated obtained from home works, reports and practical lessons and monthly tests and field trip.
- By the end of the course added to the above degree final exam. Student course evaluation at the conclusion of the course.

2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Faculty assessment of the course and effectiveness of teaching delivery.
- Periodic self- assessment of the program.

3 Processes for Improvement of Teaching

- A committee assigned by the department will review deficiencies based on the student evaluation, faculty input, course file, and program assessment.
- Feedback from employers and alumni surveys and graduating students' input are used to identify any deficiencies in students' ability in applying knowledge.
- Workshops are organized on effective teaching methods to enable instructors to

improve their teaching skill.

- Teaching method will focus on students' learning and on course learning outcomes.

4. **Processes for verifying standards of student achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)**
   - A committee assigned by the department will review samples of student work in this course to check on the standard of grades and achievements.
   - A committee of faculty members can evaluate the course material and the students' work to compare the standard of grades and achievements compared to other known universities. This evaluator will also comment on the laboratory facilities and the adequacy of the equipment used in the lab.

5. **Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.**
   - The department intend to apply periodical self- assessment and might rely on external assessment by an invited faculty member or consultant.
   - The feedback received from these assessments will be used to plan for further improvement in the course syllabus, teaching method, and delivery of course materials.