



**KING SAUD UNIVERSITY  
COLLEGE OF SCIENCE  
DEPARTMENT OF GEOLOGY AND GEOPHYSICS**

**GEOLOGY AND GEOPHYSICS  
DEPARTMENT HANDBOOK**

**1439H (2017)**

## **PREFACE**

King Saud University was established in 1957 and the Department of Geology, which is one of the departments of the College of Science, was founded in 1958 (1378 H). The Department, upon successfully celebrating its Golden Jubilee in 2008, expanded to incorporate the Geophysics teaching curriculum and was re-named as the Department of Geology and Geophysics. The Department has achieved diversification of teaching and research programs at the University in order to cater for the needs of an ever increasing number of qualified earth science graduates in the Kingdom.

The Department of Geology and Geophysics is housed in a three-storied building in the College of Science (Building-4) in the main campus of King Saud University. It is recognized as one of the distinguished science departments in the Arab World because of its teaching standard, wide range of course options offered in the disciplines of geosciences, intense laboratory and field training, the cultivation of the student's capability for independent thinking and research, the use of modern educational tools for teaching, well equipped laboratories and museum, and the maintenance of a reasonably good teacher-student ratio. Furthermore, the Department contains specialist laboratories for Petroleum Geology, Geophysics, Hydrogeology, GIS, and the Seismic Studies Centre for seismic monitoring at the national level and seismological research studies in Saudi Arabia.

The Department is enriched by its scientific interaction with other academic institutions and agencies in Saudi Arabia, including the Saudi Geological Survey, King Abdulaziz City for Science and Technology, ARAMCO, etc. Moreover, the Department participates actively in academic exchanges with internationally renowned research laboratories in countries like USA., Germany and UK.

The Department of Geology and Geophysics has a group of recognized faculty members with broad specialties in different geological and geophysical branches. The majority of them obtained their Ph.D. degrees from high ranked universities in USA, UK, Germany and France. The faculty members are assisted with staff assistants and non-academic technicians.

The Department follows a generous policy in encouraging sabbatical and study leave as well as other scientific visits by its faculty members. All such measures help sustain a good academic and research environment in the Department. The Department also publishes an Earth Science journal; Arabian Journal of Geosciences, published by Springer (Germany). The journal has already been well acclaimed in the scientific world and is included in the Science Citation Index.

**Dr. Hussain Jaber Alfaifi**  
**Chairman, Department of Geology and Geophysics**

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## CHAIRMEN OF THE DEPARTMENT SINCE 1959

Dr. Ibrahim A. Farag	1959-1961
Dr. Khouda Mohamed	1962-1964
Dr. Hamed M. Al-Badry	1965-1967
Dr. Ibrahim A. Farag	1967-1973
Dr. Abdullah A. Al-Humdan	1974-1976
Dr. Taleb M. S. Obeid	1976-1978
Dr. Abdalmalek A. Al-Khayal	1978-1980
Dr. Fayez Sh. Anan	1980-1982
Dr. Abd Al-Malek A. Al-Khayal	1982-1986
Dr. Ali A. Al-Furaih	1986-1988
Dr. Mohamed A. Meshref	1988-1990
Dr. Ahmed A. Al-Mohandes	1990-1992
Dr. Abdalmalek A. Al-Khayal	1992-1997
Dr. Mohamed E. Al-Dabbagh	1997-2001
Dr. Abdulaziz M. Al-Bassam	2001-2003
Dr. Nasser S. Al-Araify	2003-2007
Dr. Abdullah M. Al-Amri	2007-2010
Dr. Saad M. Al-Mogren	2010-2012
Dr. Abdullah M. Al-Amri	2012-2016
Dr. Hussain Jaber Al-Faifi	2016-present

## ACADEMIC PROGRAMS OFFERED

The Department offers three Undergraduate Programs leading to the B.Sc. Degree in Geology, Geophysics and hydrogeology, as well as two Postgraduate Programs leading to the M.Sc. Degree in Geology and Geophysics. Details of the course modules for these Programs are described in this handbook.

## MISSION

To promote basic geological, geophysical and hydrogeological concepts, skills and creativity within a high caliber environment that provides society with knowledge, trained personnel, and competitive graduates capable of meeting the educational and development of the Kingdom of Saudi Arabia in all domains relevant to Geology, Geophysics and hydrogeology and their applications

## VISION

To be a leader in the fields of geology, geophysics and hydrogeology, their applications, and culture to contribute to building the knowledge society

## OBJECTIVES

1. To achieve excellence in imparting higher education in the fields of earth sciences, with due emphasis on the quality of students at undergraduate and graduate levels.

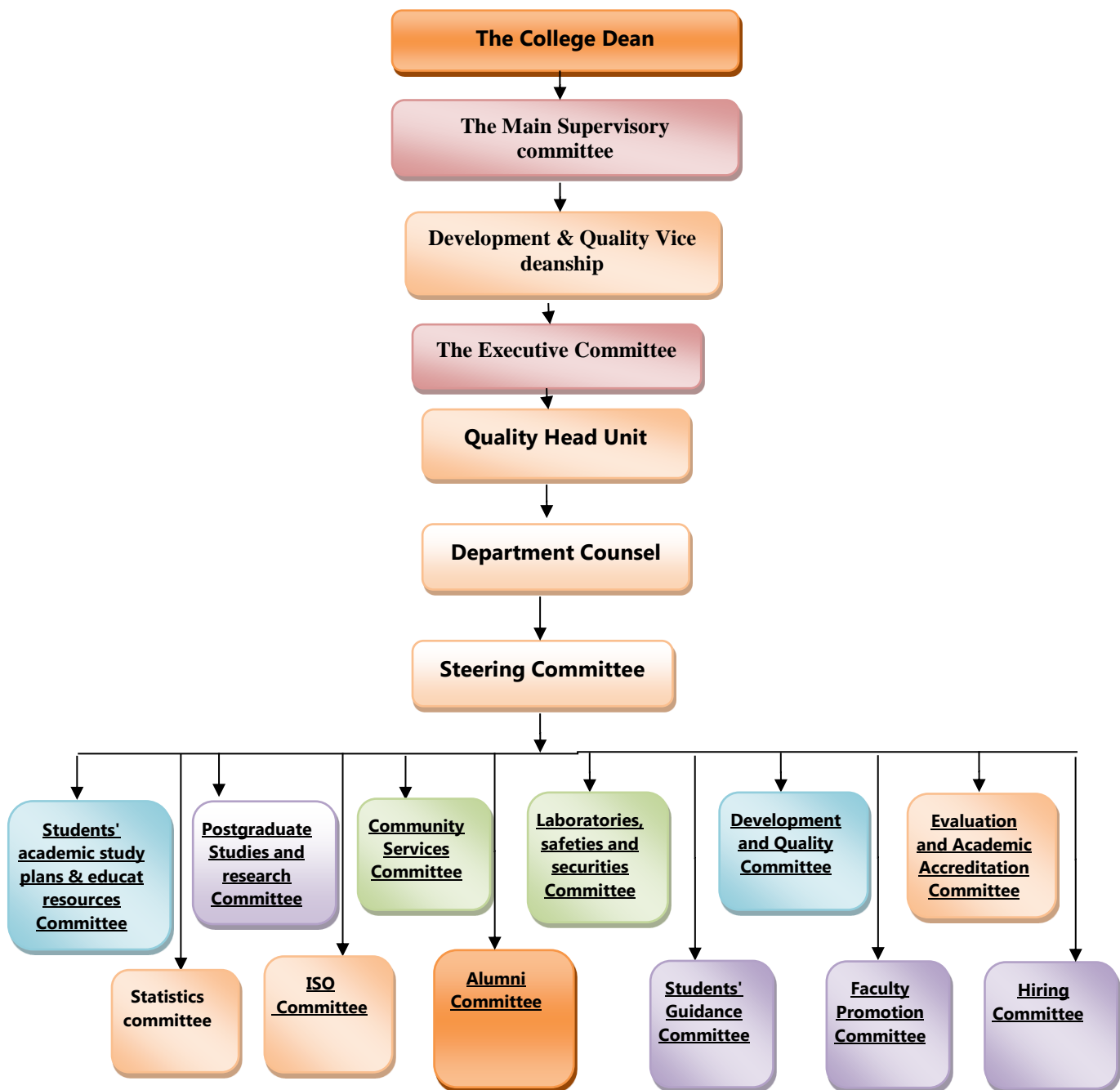
2. To develop applied scientific research through geological, geophysical and hydrogeological projects as per the national plan in the fields of oil, gas, minerals, ground water, environmental and natural hazards investigations.
3. To provide consultations in the field of natural disasters in cooperation with the university based seismic study center.
4. To ensure an optimal use of resources with modern technology to create a place of higher learning in the fields of Earth sciences.
5. To provide a stimulating environment capable of attracting the best students, staff and faculty members.
6. To establish effective partnerships, both locally and globally, with academic institutions and industrial/research organizations in the fields of oil, gas, minerals, and ground water exploration, as well as environmental and natural hazards investigations.

### **SCIENTIFIC SCALES AND BENCHMARKS**

The benchmark for the Department, in both the Geology and Geophysics Programs, is the Department of Geosciences in the University of Calgary, Canada.

The Accreditation agency for degree programs in Engineering, Informatics, Natural Sciences and Mathematics e.V. (ASIIN) has accredited the Bachelor's Degree Programs in Geology and Geophysics at the College of Science, King Saud University, Riyadh. The accreditation was issued on 1<sup>st</sup> April, 2011 by decision of the ASIIN accreditation commission for both the degree programs (Geology and Geophysics) and is valid until 30<sup>th</sup> September, 2016. Upon successful completion of the program, King Saud University awards the degree of "Bachelor of Science".

## QUALITY MANAGEMENT SYSTEM FLOWCHART (COMMITTEE STRUCTURE)



*Quality Management System Flowchart*

## **List of Committees in the department**

- 1./ Steering Committee
- 2./ Students' Academic Study Plans and resources Committee
- 3./ Postgraduate Studies and research Committee
- 4./ Community Services Committee
- 5./ Laboratories, safeties and securities Committee
- 6./ Development and Quality Committee
- 7./ Evaluation and Academic Accreditation Committee
- 8./ Statistics committee
- 9./ Alumni Committee
- 10./ Students' Guidance Committee
- 11./ Faculty Promotion Committee
- 12./ Hiring Committee
- 13./ ISO Committee

## **JOB OPPURTUNITIES**

1. Ministry of Petroleum and Mineral Resources, KSA.
2. Ministry of Agriculture, KSA.
3. Mineral and Oil Companies.
4. ARAMCO and other overseas companies operating for petroleum exploration in the Kingdom.
5. Engineering Companies.
6. Civil Defense, KSA.
7. Military Survey and Meteorological Agencies, KSA.
8. Private Sector companies; e.g. Cement and Ceramic Companies and Agriculture Development Companies.
9. Research agencies; e.g. KACST in Riyadh.
10. Teaching at universities, community colleges and high schools in the Kingdom.



## PROGRAM COORDINATOR AND ACADEMIC GUIDANCE

Program	Program Coordinator	Contact
<b>B.Sc. (Geology)</b>	Dr.Habes Ghrefat	Email: habes@KSU.EDU.SA Phone: +966 11 4676233 Fax: +966 11 4673662, Office n: 2B 133 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia
<b>B.Sc. (Geophysics)</b>	Dr. Chokri Jallouli	Email: cjallouli@ksu.edu.sa Phone: +966 11 4676198 Fax: +966 11 4673662 Office Location: GB 65 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia
<b>B.Sc. (Hydrogeology)</b>	Dr. Oussama Kaoud	E-mail: okassem@ksu.edu.sa Office Phone: +966 11 4676351      Fax: +966 11 4673662 Office Location : AB 64 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia
<b>M.Sc. (Geology)</b>	Dr Mohammed Youssef	E-mail: mymohamed@ksu.edu.sa Office Phone: +966 11 4699644 Fax: +966 11 4673662 Office Location : 1B 58 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia
<b>M.Sc. (Geophysics)</b>	Dr. Ali Kamal	E-mail: aabdelfattah@KSU.EDU.SA Office Phone: +966 11 4676203 Fax: 966 11 4673662 Office Location : 2B 127 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia

Program	Academic Guidance	Contact
<b>Geology</b>	Dr. Hisham A. Gahlan	E-mail: hjhlan@ksu.edu.sa Office Phone: +966 11 4676211 Fax: 966 11 4673662 Office Location : 2B 134 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia
<b>Geophysics</b>	Dr. Mahmoud El-Waheidi	Email: melwaheidi@ksu.edu.sa Phone: +966 11 4676205 Fax: +966 11 4673662 Office Location: 2B 129 Postal Address: PO Box# 2455 College of Science, Building 4, King Saud University, Riyadh-11451, Saudi Arabia Office Location : 2B 110 Address: P.O Box. 2455, Riyadh , 11451, Saudi Arabia

## THE STUDY SYSTEM AT THE COLLEGE OF SCIENCE

Teaching at the College of Science is subject to the following scheme:

1. The academic year consists mainly of two regular semesters and a summer semester, if available.
2. The stage of academic progress is indicated by the academic level since the number of levels to graduate is at least eight levels in conformity with the approved Study Plan.
3. The duration of the level is a full semester (not less than 15 weeks) and this period does not include the periods of registration and final exams.
4. The duration of the summer semester is not less than eight weeks where the teaching time allocated for each course is doubled.
5. A number of courses (subjects) are taught during each academic level according to the program of each specialty in the different departments.
6. Students have to study 136 class units (credit hours) to obtain a Bachelor's Degree as follows:
  - A. The student studies a number of 32 credit hours during the first year as a common year (two semesters in one academic year).
  - B. The student studies 96 credit hours (optional + compulsory) in the Program of Specialization in the various College departments throughout the six semesters following the Common Year (beginning with the third semester)
  - C. University Requirements: The student selects 8 credit hours of the requirements of the University during the period of study at the College.
7. The student chooses the specialty department before the end of the first common Year based on the conditions set by each department.

## THE NEW ACADEMIC SYSTEM (e-Register)

**Registration** is the cornerstone of the academic system, the center of the educational process, and the first step to start university life. The new Academic System (e-Register) offers new students the following opportunities:

1. To create an e-mail through the site of the Deanship of Electronic Transactions and Communications:  
**<http://www.ksu.edu.sa/sites/KSUArabic/Deanships/Computer/Pages/>**
2. To have an access to the academic system by using the link: **<http://edugate.ksu.edu.sa>**; then, entering a user name and a password.
3. **Online Registration** (registration, adding, and dropping): a student can register, in person, from any location during the periods of registration and dropping plus an additional period specified in the academic calendar; thus, without having to visit the College or the Department, the student can perform the following:
  - A. **Registration:** Registration of courses and deciding the required number of credit hours.
  - B. **Adding and dropping:** The student may drop and add courses during the first week of teaching provided that the study load does not go above , or lower than, the allowed course load.

4. To view the course schedule of the College and the available/closed groups.
5. To view the study schedule and print it.
6. To view the Academic Record and print a copy (an unofficial copy).
7. To view the results of the final exams as soon as they are put online.
8. To view the Study Plan, the courses passed by the student, and the ones remaining to be studied.
9. To know about the penalties imposed upon the student.
10. To view the financial rewards.
11. To make suggestions and submit complaints.
12. To write the academic performance evaluation of faculty members.
13. To exchange electronic messages and change the password.

## **RULES AND MECHANISMS FOR REGISTRATION OF COURSES**

- **The Course** is a module that meets the needs of the level specified in the approved Study Plan in each specialty (Program). The Course has a number; a code, a title, and a description depending on the different departments (see the Department's Manual Guide).
- **The Course** is divided into a set of theoretical lectures and practical lessons (study units) taught weekly during the academic level.
- **The Credit Hour** is a weekly theoretical lecture that is not less than fifty minutes, or a practical lesson which is not less than one hundred minutes.
- The registration of the courses for all students is done automatically through the website: **<http://edugate.ksu.edu.sa>**
- The academic levels vary in the number of the units of study, from 12 units to 20 units, for each level.
- The Courses are registered automatically at the beginning of the following semester for the student's convenience. Then, the student can modify the course schedule by adding or dropping.
- The following table shows the student's study load corresponding to the cumulative average:

<b>GPA</b>	2	2.5	3	3.5	4	4.5	5
<b>Hours allowed for registration</b>	14	15	16	17	18	19	20

- **The Processes of dropping and adding** are performed by the student electronically in the first week of the semester by accessing the e-portal of the academic system of the University's Deanship of Admission and Registration (**<https://smr.ksu.edu.sa>**).
- No student has the right to register a course without passing its pre-requisite course.
- Students, who pass all courses without failures, are registered in the courses of the level beginning gradually with the lower levels according to the study plans approved.
- Students, who fail in some courses, are registered in courses that ensure their minimum study load in each semester taking into account the following points:
  - No conflict in the course study schedule.
  - Satisfying the previous requirements of the course or courses to be registered.

## CALCULATING THE AVERAGE AND CUMULATIVE GPA

The Average and cumulative GPA are calculated every semester for the student automatically by the system. To know how to calculate the averages, you should follow the following steps:

### Calculating the Semester Average:

The GPA is calculated considering the following points:

1. Knowing the number of hours of the courses.
2. Knowing the mark obtained in each course.
3. Knowing the corresponding grade of each mark.
4. Knowing the value of each grade.
5. Knowing the points = number of hours of the course × value of the grade.
6. Determining the total points obtained in all courses of the semester.
7. Determining the total number of hours registered in the semester.
8. The average is calculated every semester according to the following equation:

$$GPA = \frac{\text{Total Points (Item 6)}}{\text{No. of hours registered for the semester (Item 7)}}$$

The following table shows the percentage of marks, grade and value obtained by the student in each course, which is used to calculate the points:

Mark	Grade	Letter of Grade	Value of Grade
From 95-100	Excellent +	A+	5.00
From 90 to less than 95	Excellent	A	4.75
From 85 to less than 90	Very Good+	B+	4.50
From 80 to less than 85	Very Good	B	4.00
From 75 to less than 80	Good +	C+	3.50
From 70 to less than 75	Good	C	3.00
From 65 to less than 70	Pass +	D+	2.50
From 60 to less than 65	Pass	D	2.00
Less than 60	Failure	E	1.00
Absence from lectures ( 25% or more)	Debarred	H	1.00

### Calculating the Cumulative Average:

1. The GPA semester average is calculated as follows:
2. The grand total of points (for all semesters that have been studied).
3. The grand total of credit hours (for all semesters that have been studied).

The cumulative average is calculated according to the following equation:

$$GPA = \frac{\text{Grand total of points}}{\text{Grand total of credit hours}}$$

**Here is an example of how to calculate the grades above:**

Calculating the grade of the first semester:

Course	Credit Hours	Mark	Grade	Grade Value	Points
PHYS 101	4	67	D+	2.5	$4 \times 2.5 = 10$
CHEM101	4	73	C	3	$4 \times 3 = 12$
ENG 121	3	77	C+	3.5	$3 \times 3.5 = 10.5$
ARAB 101	2	81	B	4	$2 \times 4 = 8$
	13				40.5
GPA = Total points $\div$ No. of hours registered in semester = $40.5 \div 13 = 3.12$					

Calculating the grade of the second semester:

Course	Credit Hours	Mark	Grade	Grade Value	Points
MATH 101	3	61	D	2	$3 \times 2 = 6$
STAT 101	3	73	C	3	$3 \times 3 = 9$
Computer Science 206	3	80	B	4	$3 \times 4 = 12$
ARAB 103	3	88	B+	4.5	$3 \times 4.5 = 13.5$
ISLAM 101	2	92	A	4.75	$2 \times 4.75 = 9.5$
ENG 122	3	97	A+	5	$3 \times 5 = 15$
	17				65
GPA = Total points $\div$ No. of hours registered in semester = $65 \div 17 = 3.82$					

Calculating the average cumulative:

$$GPA = \text{Total points} \div \text{Total hours of the semester} = 105.5 \div 30 = 3.52$$

## **DROPPING AND ADDING A COURSE**

- The process of dropping and adding is performed through portal (<https://smr.ksu.edu.sa/>) during **the first week of the semester only**; but the number of credit hours registered has to be at least 12 hours.
- The student may drop only one course due to an excuse acceptable to the Dean of the College. This procedure should occur at least five weeks before the final exams begin. The student has the right to apply for such a procedure at a maximum of four courses during the whole period of study at the College.

## **ATTENDANCE, POSTPONING AND DROPPING OUT OF COLLEGE**

- The student must be regular in attendance attending at least 75% of the lectures and the practical classes.
- If any student has a percentage of absence of 25% or more, in any course, he is denied access to the final exam of this course and his result is F.
- A student may apply for postponement of the study before the beginning of the semester for an excuse accepted by the College Board. The postponement should not exceed two consecutive semesters or three intermittent semesters as a maximum limit while studying at the College.
- The University Council may, in case of necessity, exempt the applicant from the previous provision.
- If a student drops out of College for one semester without requesting the postponement of his registration, the University has the right to dismiss his registration. The University Council has the right to do this for a lesser period of time.
- The student is not considered as dropping out of College if he is a visiting student at another university.

## **VISITING STUDENT**

The Visiting Student is a student who studies some courses at another university, or at a branch of the university to which he belongs without being transferred. The courses he studied are accredited according to the following regulations:

- The student has to have a transcript (including a grade point average) for, at least, two semesters at his college before he applies as a visiting student.
- The student must obtain a prior approval from his college permitting him to study as a visiting student while specifying the courses that will be studied. The College has the right to require a specific grade to be achieved by the student to offset the course. The student should obtain an official letter from the Deanship of Admission and Registration directing him to study as a visiting student.
- The student has to join a college or a university officially recognized.
- The courses, under consideration by the student to be studied outside the University, must be equivalent in their description to the University courses, and their course units should be no less than the units of any of the courses contained in the graduation requirements.
- The maximum of the total units of study that can be calculated from outside the University is twenty percent (20%) of the total units required for graduation at King Saud University.
- The courses that are studied by the visiting student are not included in the cumulative average. These courses are recorded in his academic record.
- The student must provide the Deanship of Admission and Registration with the results he obtained during the first two weeks of study in the semester following the period of study as a visitor. If not reported within that period, the student is considered as dropping out of College during those semesters.

## **DISMISSAL FROM UNIVERSITY**

The student is dismissed from the University in the following cases:

- If he receives three consecutive warnings due to a cumulative average below a minimum of 2.
- The student may be given a fourth opportunity by the Council of the University based upon the recommendation of the College Council to raise his cumulative GPA by studying the available courses.
- The University Council may give the dismissed students, due to warnings, an opportunity that does not exceed two semesters as a maximum.
- If the student does not fulfill his graduation requirements at the College in a period of up to half of the period prescribed for graduation in addition to the duration of the Program.
- The student is given an exceptional opportunity by the University Council to meet the graduation requirements during a maximum period not exceeding twice the original term specified for graduation.
- The University Council may allow dismissed students, due to the exhaustion of failure times, to attend twice the duration of the Program. This extension should not exceed a maximum of two semesters.

## **EXAMINATIONS AND GRADES**

- Based on a proposal from the Department Council, the College Council specifies a mark for the student's semester work, varying from 40% to 60% of the final grade of the course.
- The mark of the course's semester work is calculated by one of the following two methods:
  - Oral, practical tests, research, or other forms of classroom activity, or from all the above or some of them, in addition to at least one written exam.
  - Two written exams at least.
- Based on the recommendation of the course teacher, it is permissible for the Council of the Department, that teaches the course, to allow the student to complete the requirements of any course in the following semester and to give the student a grade of I (incomplete) in his academic record. Only the grades achieved by the student are included in the GPA or cumulative after the completion of the requirements of that course.
- If one semester passes without changing the grade incomplete (I), the student is given an F which is calculated in the GPA and cumulative.
- The grades obtained by the student in each course are calculated according to the schedule mentioned above.

## **RESTRICTIONS OF THE FINAL EXAMINATION**

- No student may be tested in more than two courses in one day.
- The student is not allowed to enter the final exam after half an hour of its beginning, and is not allowed to leave the exam room before half an hour after its beginning.
- Based on a recommendation from the relevant Department Council, the College Council specifies the duration of the final written exam to be within a period not less than one hour, and not more than three hours.
- Cheating in the exam, initiating it, or violating the instructions and rules of examination procedures are actions punishable in accordance with the Regulations of the Students' Discipline issued by the University Council.
- In cases of necessity, the College Council, in charge of teaching a course, has the right to approve re-marking of the answer sheets in a period of time not later than the beginning of the following semester in accordance with the following rules:
  - A student may apply for re-marking the answer sheets of only one course per semester.
  - The student, who wishes to re-mark his answer sheets, may apply for re-marking to the department, that teaches this course, not later than one month after taking the final exam.
  - A student, who has already applied for re-marking and proved the invalidity of his application, should never apply for re-marking his answer sheets in any exam in the future.

## **TRANSFERRING**

### **Transferring from one college to another within the University**

- It is permissible, with the consent of the respective deans of the colleges, to transfer from one college to another in accordance with the conditions approved by the College Council to which the student wishes to transfer.
- The student's college academic record has to show all courses previously studied, including grades, semester and cumulative averages throughout the study at the college from which he is transferred.

### **Transferring from one major to another within the College**

- The student may, after the approval of the Dean, transfer to another specialty within the College according to the guidelines established by the College Council.
- The student's college academic record has to show all courses previously studied, including grades, semester and cumulative averages throughout the study at the college from which he is transferred.

## **GRADUATION**

The student graduates after completing successfully the graduation requirements in accordance with the study plan, provided that his cumulative average is no less than 2 (Pass).



**UNDERGRADUATE PROGRAMS**  
**FOR B.Sc.**

## UNDERGRADUATE STUDY PLAN FOR B.Sc. IN GEOLOGY

### Common Year (32 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
LANG 140	English Language (1)	6 (6+0+0)
LANG 150	English Language (2)	6 (6+0+0)
CHEM 101	General Chemistry	4 (3+0+1)
STAT 150	Introduction to Statistics	3 (2+1+0)
ARAB 140	Writing skills	2 (1+1+0)
MATH 150	Differential Calculus	3 (2+1+0)
Method 140	Learning, Thinking & Research Skills	3 (3+0+0)
TECH 140	Computer Skills	3 (0+0+3)
Health 150	Health and Fitness	1 (1+0+0)
ENT 101	Entrepreneurship	1 (1+0+0)

### Elective course from the university requirement (the student selects 8 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
IC 100	Studies in the Biography of the Prophet	2 (2+0+0)
IC 101	Introduction of Islamic Culture	2 (2+0+0)
IC 102	Islam and Building up the Society	2 (2+0+0)
IC 103	Economic System in Islam	2 (2+0+0)
IC 104	Political System in Islam	3 (2+0+1)
IC 105	Human Rights	3 (2+0+1)
IC 106	Islamic Jurisprudence	2 (2+0+0)
IC 107	Ethics of Occupation	2 (2+0+0)
IC 108	Contemporary Issues	2 (2+0+0)
IC 109	Woman and Her Developmental Role	2 (2+0+0)

### Compulsory Courses from other departments (4 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
PHYS 101	General Physics (1)	4 (3+0+1)

**Compulsory Courses from the Department (78 Credit hours)**

<b>Course</b>	<b>Name</b>	<b>Credit (Lecture + Exercise + Practical)</b>
GEO 100	General Geology	4 (3+0+1)
GEO 107	Historical Geology	2 (1+0+1)
GEO 221	Mineralogy	3 (2+0+1)
GEO 237	Stratigraphy & Sedimentology	3 (2+0+1)
GEO 246	Paleontology	3 (2+0+1)
GEO 462	Environmental Geology	2 (2+0+0)
GEO 324	Igneous petrology	3 (2+0+1)
GEO 326	Metamorphic petrology	3 (2+0+1)
GEO 334	Sedimentary Petrology	3 (2+0+1)
GPH 410	Geophysical Well Logging	3 (2+0+1)
GEO 463	Plate Tectonics	2 (2+0+0)
GEO 381	Structural Geology	3 (2+0+1)
GEO 383	Remote Sensing	3 (2+0+1)
GEO 384	Geology survey	2 (1+0+1)
GEO 386	Geology of the Arabian Shield	2 (1+0+1)
GEO 274	Geological Reports	1 (1+0+0)
GEO 393	Field Geology	6 (0+0+6)
GEO 450	Ore Geology	3 (2+0+1)
GEO 454	Mining Geology	2 (1+0+1)
GEO 451	Geochemistry	2 (1+0+1)
GEO 452	Petroleum Geology	3 (2+0+1)
GEO 455	Hydrogeology	3 (2+0+1)
GEO 382	Geographic Information Systems	3 (2+0+1)
GEO 385	Sedimentary Geology of Saudi Arabia	2 (1+0+1)
GEO 497	Graduation Project (1)	3 (0+0+3)
GEO 498	Graduation Project (2)	3 (0+0+3)
GPH 201	Principles of Geophysics	3 (2+0+1)
GPH 301	Geophysical Exploration	3 (2+0+1)

**Elective Courses from the department (the student selects 14 credit hours)**

<b>Course</b>	<b>Name</b>	<b>Credit (Lecture + Exercise + Practical)</b>
GEO 242	Micropaleontology	3 (2+0+1)
GEO 301	Geomorphology	3 (2+0+1)
GEO 341	Paleobotany	3 (2+0+1)
GEO 342	Paleoecology	3 (2+0+1)
GEO 421	Volcanology	3 (2+0+1)
GEO 431	Carbonate Rocks	3 (2+0+1)

GEO 432	Quaternary Geology	3 (2+0+1)
GEO 435	Oceanography	2 (2+0+0)
GEO 441	Vertebrate Paleontology	3 (2+0+1)
GEO 445	Sedimentary Basin Analysis	2 (1+0+1)
GEO 456	Applications in Petroleum Geology	2 (2+0+0)
GEO 457	Engineering Geology	3 (2+0+1)
GEO 483	Regional Geology of the Middle East	2 (2+0+0)
GEO 495	History of Geology	1 (1+0+0)

## IDEAL STUDY PLAN FOR B.Sc. IN GEOLOGY

3 <sup>rd</sup> level		
Course	Name	Credit
GEO 100	General Geology	4 (3+0+1)
GEO 107	Historical Geology	2 (1+0+1)
GPH 201	Principles of Geophysics	3 (2+0+1)
PHYS 101	General Physics (1)	4 (3+0+1)
Elective course from university Requirement		2 (2+0+0)
<b>Total Units</b>		<b>15</b>

4 <sup>th</sup> level		
Course	Name	Credit
GEO 221	Mineralogy	3 (2+0+1)
GEO 237	Stratigraphy & Sedimentology	3 (2+0+1)
GEO 246	Paleontology	3 (2+0+1)
GEO 274	Geological Reports	1 (1+0+0)
Elective course		3
Elective course from university Requirement		2 (2+0+0)
<b>Total</b>		<b>15</b>

5 <sup>th</sup> level		
Course	Name	Credit
GEO 324	Igneous petrology	3 (2+0+1)
GEO 334	Sedimentary Petrology	3 (2+0+1)
GPH 301	Geophysical Exploration	3 (2+0+1)
GEO 381	Structural Geology	3 (2+0+1)
GEO 382	Spatial Information Systems	3 (2+0+1)
Elective course		2
<b>Total</b>		<b>17</b>

<b>6<sup>th</sup> level</b>		
<b>Course</b>	<b>Name</b>	<b>Credit</b>
GEO 326	Metamorphic petrology	3 (2+0+1)
GEO 383	Remote Sensing	3 (2+0+1)
GEO 384	Geological survey	2 (1+0+1)
GEO 385	Sedimentary Geology of Saudi Arabia	2 (1+0+1)
GEO 386	Geology of the Arabian Shield	2 (1+0+1)
Elective course		3
Elective course from university Requirement		2 (2+0+0)
<b>Total</b>		<b>17</b>

<b>Summer Semester</b>		
<b>Course</b>	<b>Name</b>	<b>Credit</b>
GEO 393	Field Geology	6 (0+0+6)
<b>Total</b>		<b>6</b>

<b>7<sup>th</sup> level</b>		
<b>Course</b>	<b>Name</b>	<b>Credit</b>
GEO 450	Ore Geology	3 (2+0+1)
GEO 451	Geochemistry	2 (1+0+1)
GEO 452	Petroleum Geology	3 (2+0+1)
GEO 455	Hydrogeology	3 (2+0+1)
GEO 497	Graduation Project (1)	3 (0+0+3)
Elective course from university Requirement		2 (2+0+0)
<b>Total</b>		<b>16</b>

<b>8<sup>th</sup> level</b>		
<b>Course</b>	<b>Name</b>	<b>Credit</b>
GPH 410	Geophysical Well Logging	3 (2+0+1)
GEO 454	Mining Geology	2 (1+0+1)
GEO 462	Environmental Geology	2 (2+0+0)
GEO 463	Plate Tectonics	2 (2+0+0)
GEO 498	Graduation Project (2)	3 (0+0+3)
Elective courses		6
<b>Total</b>		<b>18</b>

## UNDERGRADUATE STUDY PLAN FOR B.Sc. IN GEOPHYSICS

### Common Year (32 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
LANG 140	English Language (1)	6 (6+0+0)
LANG 150	English Language (2)	6 (6+0+0)
CHEM 101	General Chemistry	4 (3+0+1)
STAT 150	Introduction to Statistics	3 (2+1+0)
ARAB 140	Writing skills	2 (1+1+0)
MATH 150	Differential Calculus	3 (2+1+0)
Method 140	Learning, Thinking & Research Skills	3 (3+0+0)
TECH 140	Computer Skills	3 (0+0+3)
Health 150	Health and Fitness	1 (1+0+0)
ENT 101	Entrepreneurship	1 (1+0+0)

### Elective course from the university requirement (the student selects 8 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
IC 100	Studies in the Biography of the Prophet	2 (2+0+0)
IC 101	Introduction of Islamic Culture	2 (2+0+0)
IC 102	Islam and Building up the Society	2 (2+0+0)
IC 103	Economic System in Islam	2 (2+0+0)
IC 104	Political System in Islam	3 (2+0+1)
IC 105	Human Rights	3 (2+0+1)
IC 106	Islamic Jurisprudence	2 (2+0+0)
IC 107	Ethics of Occupation	2 (2+0+0)
IC 108	Contemporary Issues	2 (2+0+0)
IC 109	Woman and Her Developmental Role	2 (2+0+0)

### Compulsory Courses from other departments

Course	Name	Credit (Lecture + Exercise + Practical)
PHYS 101	General Physics (1)	4 (3+0+1)
PHYS 102	General Physics (1)	4 (3+0+1)
PHYS 201	Mathematical Physics	3 (2+1+0)
PHYS 221	Electromagnetism	3 (3+0+0)
MATH 111	Integral calculus	4 (3+1+0)
MATH 209	Differential Equations	4 (3+1+0)

**Compulsory Courses from the Department (69 Credit hours)**

<b>Course</b>	<b>Name</b>	<b>Credit</b>
GEO 100	General Geology	4 (3+0+1)
GEO 237	Stratigraphy & Sedimentology	3 (2+0+1)
GEO 221	Mineralogy	3 (2+0+1)
GPH 201	Principles of Geophysics	3(2+0+1)
GPH 211	Gravity & Magnetic Exploration	3(2+0+1)
GPH 221	Seismic Exploration	3(2+0+1)
GPH 231	Geoelectric & Electromagnetic Exploration	3(2+0+1)
GPH 313	Seismology	3(2+0+1)
GPH 410	Geophysical Well Logging	3(2+0+1)
GPH 381	Geophysical Reports	1(1+0+0)
GEO 385	Sedimentary Geology of Saudi Arabia	2 (1+0+1)
GEO 386	Geology of the Arabian Shield	2 (1+0+1)
GPH 390	Radiometric and Geothermal methods	2(2+0+0)
GPH 393	Field Geophysics	6(0+0+6)
GPH 401	Physics of the Earth	2(2+0+0)
GPH 411	Geophysical Data Processing	2(2+0+0)
GPH 421	Mining Geophysics	2(2+0+0)
GPH 412	Engineering Seismology	2(2+0+0)
GPH 431	Seismic stratigraphy	2(2+0+0)
GPH 496	Research Project (1)	3(0+0+3)
GPH 497	Research Project (2)	3(0+0+3)
GEO 320	Petrology	3(2+0+1)
GEO 381	Structural Geology	3(2+0+1)
GEO 452	Petroleum Geology	3(2+0+1)
GEO 382	Geographical information systems	3(2+0+1)

**Elective Courses (the student selects 5 credit hours)**

<b>Course</b>	<b>Name</b>	<b>Credit (Lecture + Exercise + Practical)</b>
GPH 317	Time series analysis	2(2+0+0)
GPH 319	Petrophysics	2(2+0+0)
GPH 320	Natural Hazard	2(2+0+0)
GPH 417	Groundwater Geophysics	3(2+0+1)

GPH 424	Environmental and Engineering Geophysics	2(2+0+0)
GPH 444	Marine Geophysics	2(2+0+0)
GEO 463	Plate Tectonics	2 (2+0+0)
GEO 383	Remote Sensing	3(2+0+1)
GEO 455	Hydrogeology	3(2+0+1)

## IDEAL STUDY PLAN FOR B.Sc. IN GEOPHYSICS

3rd level		
Course	Name	Credit
GEO 100	General Geology	4 (3+0+1)
PHYS 101	General Physics (1)	4 (3+0+1)
MATH 111	Integral calculus	4 (3+1+0)
GPH 201	Principles of Geophysics	3(2+0+1)
Elective course from university Requirement		2(2+0+0)
<b>Total</b>		<b>17</b>

4 <sup>th</sup> level		
Course	Name	Credit
PHYS 102	General Physics (1)	4 (3+0+1)
GPH 211	Gravity & Magnetic Exploration	3(2+0+1)
GEO 221	Mineralogy	3 (2+0+1)
GEO 237	Stratigraphy & Sedimentology	3 (2+0+1)
MATH 209	Differential Equations	4 (3+1+0)
<b>Total</b>		<b>17</b>

5 <sup>th</sup> level		
Course	Name	Credit
PHYS 201	Mathematical Physics	3 (2+1+0)
GPH 221	Seismic Exploration	3(2+0+1)
GEO 320	Petrology	3(2+0+1)
GEO 382	Geographical information systems	3(2+0+1)
GEO 381	Structural Geology	3(2+0+1)
Elective course from university Requirement		2(2+0+0)
<b>Total</b>		<b>17</b>



6 <sup>th</sup> level		
Course	Name	Credit
PHYS 221	Electromagnetism	3 (3+0+0)
GPH 231	Geoelectric & Electromagnetic Exploration	3(2+0+1)
GPH 313	Seismology	3(2+0+1)
GPH 381	Geophysical Reports	1(1+0+0)
GEO 386	Geology of the Arabian Shield	2 (1+0+1)
GEO 385	Sedimentary Geology of Saudi Arabia	2 (1+0+1)
Elective course		3(2+0+1)
<b>Total</b>		<b>17</b>

Summer Semester		
Course	Name	Credit
GPH 393	Field Geophysics	6 (0+0+6)
<b>Total</b>		<b>6</b>

7 <sup>th</sup> level		
Course	Name	Credit
GPH 410	Geophysical Well Logging	3(2+0+1)
GPH 411	Geophysical Data Processing	2(2+0+0)
GEO 452	Petroleum Geology	3(2+0+1)
GPH 496	Research Project (1)	3(0+0+3)
Elective course		2(2+0+0)
Elective course from university Requirement		2(2+0+0)
<b>Total</b>		<b>15</b>

8 <sup>th</sup> level		
Course	Name	Credit
GPH 390	Radiometric and Geothermal methods	2(2+0+0)
GPH 401	Physics of the Earth	2(2+0+0)
GPH 412	Engineering Seismology	2(2+0+0)
GPH 421	Mining Geophysics	2(2+0+0)
GPH 431	Seismic stratigraphy	2(2+0+0)
GPH 497	Research Project (2)	3(0+0+3)
Elective course from university Requirement		2(2+0+0)
<b>Total</b>		<b>15</b>

## UNDERGRADUATE STUDY PLAN FOR B.Sc. IN HYDROGEOLOGY

### Common Year (32 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
LANG 140	English Language (1)	6 (6+0+0)
LANG 150	English Language (2)	6 (6+0+0)
CHEM 101	General Chemistry	4 (3+0+1)
STAT 150	Introduction to Statistics	3 (2+1+0)
ARAB 140	Writing skills	2 (1+1+0)
MATH 150	Differential Calculus	3 (2+1+0)
Method 140	Learning, Thinking & Research Skills	3 (3+0+0)
TECH 140	Computer Skills	3 (0+0+3)
Health 150	Health and Fitness	1 (1+0+0)
ENT 101	Entrepreneurship	1 (1+0+0)

### Elective course from the university requirement (the student selects 8 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
IC 100	Studies in the Biography of the Prophet	2 (2+0+0)
IC 101	Introduction of Islamic Culture	2 (2+0+0)
IC 102	Islam and Building up the Society	2 (2+0+0)
IC 103	Economic System in Islam	2 (2+0+0)
IC 104	Political System in Islam	3 (2+0+1)
IC 105	Human Rights	3 (2+0+1)
IC 106	Islamic Jurisprudence	2 (2+0+0)
IC 107	Ethics of Occupation	2 (2+0+0)
IC 108	Contemporary Issues	2 (2+0+0)
IC 109	Woman and Her Developmental Role	2 (2+0+0)

### Compulsory Courses from other departments

Course	Name	Credit (Lecture + Exercise + Practical)
PHYS 101	General Physics (1)	4 (3+0+1)
MATH 111	Integral calculus	4 (3+1+0)

### Compulsory Courses from the Department (79 Credits)

Course	Name	Credit (Lecture + Exercise + Practical)
GEO 100	Physical Geology	4 (3+0+1)
HGEO 201	Principles of Hydrogeology	3 (2+0+1)
GEO 202	Hydrogeology Cycle	2 (1+0+1)
GPH 211	Gravity and Magnetic Exploration	3(2+0+1)
GEO 221	Mineralogy	3 (2+0+1)
GPH 231	Geoelectric & Electromag. Exploration	3 (2+0+1)
GPH 301	Geophysical Exploration	3 (2+0+1)
GEO 237	Stratigraphy & Sedimentology	3 (2+0+1)
HGEO 301	theory of Groundwater flow	3 (2+0+1)
HGEO 302	Groundwater wells	3 (2+0+1)
HGEO 305	Hydrochemistry	3 (2+0+1)
GEO 223	Igneous and metamorphic rocks	3 (2+0+1)
GEO 334	Sedimentary Petrology	3 (2+0+1)
GPH 410	Geophysical Well Logging	3 (2+0+1)
GEO 381	Structural Geology	3 (2+0+1)
GEO 382	Geographical information systems	3(2+0+1)
GEO 383	Remote Sensing	3 (2+0+1)
GEO 386	Geology of the Arabian Shield	2 (1+0+1)
HGEO 391	Hydrogeological Reports	1 (1+0+0)
GEO 399	Field Hydrogeology	6 (0+0+6)
HGEO 410	Groundwater modeling	3 (2+0+1)
HGEO 415	Geostatistics in in Hydrogeology	2 (2+0+0)
HGEO 481	Water resources in Saudi Arabia	2 (2+0+0)
HGEO 491	Seminar	1 (1+0+0)
HGEO 496	Groundwater Pollution	3 (2+0+1)
GEO 385	Sedimentary Geology of Saudi Arabia	2 (1+0+1)
HGEO 498	Graduation Project (1)	3 (0+0+3)
HGEO 499	Graduation Project (2)	3 (0+0+3)

### Elective Courses from the department (the student selects 9 credit hours)

Course	Name	Credit (Lecture + Exercise + Practical)
GEO 462	Environmental Geology	2 (2+0+0)
GEO 301	Geomorphology	3 (2+0+1)
HGEO 311	Development of groundwater resources	3 (2+0+1)
HGEO 384	Applications in remote sensing	3 (2+0+1)
HGEO 406	Water quality control	2 (2+0+0)

HGEO 407	Environmental Isotopes in Ground Water	2 (2+0+0)
HGEO 408	Selected topics in groundwater	2 (2+0+0)
HGEO 411	Groundwater planning & Management	3 (2+0+1)
HGEO 412	Exploration for Groundwater	3 (2+0+1)
HGEO 413	Mine Hydrogeology	2 (2+0+0)
HGEO 416	Hydrogeology in fracture system	2 (2+0+0)
HGEO 429	Applications in GIS	3 (2+0+1)
GEO 445	Sedimentary Basin Analysis	2 (1+0+1)
HGEO 450	Applied Hydrogeology	2 (1+0+1)

## IDEAL STUDY PLAN FOR B.Sc. IN HYDROGEOLOGY

Third Level		
Course Code	Course Title	Credits (Lect. Exre. – Pract.)
Univ. Req.	-----	4(2+0+0)
GEO 100	Physical Geology	4(3+0+1)
PHYS 101	General Physics (1)	4(3+0+1)
MATH 111	Integral Calculus	4(3+0+1)
<b>Total units</b>		<b>16</b>

Fourth level		
Course Code	Course Title	Credits (Lect. Exre. – Pract.)
Univ. Req.	-----	2(2+0+0)
HGEO 201	Principles of Hydrogeology	3(2+0+1)
HGEO 202	Hydrologic Cycle	2(1+0+1)
GPH 211	Gravity and magnetic	3(2+0+1)
GEO 221	Mineralogy	3(2+0+1)
GEO 237	Stratigraphy & Sedimentology	3(2+0+1)
<b>Total units</b>		<b>16</b>

Fifth Level		
Course Code	Course Title	Credits (Lect. Exre. – Pract.)
Univ. Req.	-----	2(2+0+0)
HGEO 301	Theory of Groundwater flow	3(2+0+1)
HGEO 302	Groundwater Wells	3(2+0+1)
GEO 323	Igneous and Metamorphic rocks	3(2+0+1)
GEO 334	Sedimentary Petrology	3(2+0+1)
GEO 381	Structural Geology	3(2+0+1)
<b>Total units</b>		<b>17</b>

<b>Sixth Level</b>		
<b>Course Code</b>	<b>Course Title</b>	<b>Credits (Lect. Exre. – Pract.)</b>
GEO 386	Geology of the Arabian Shield	2(1+0+1)
GEO 385	Geology of the Arabian Shelf	2(1+0+1)
GPH 231	Geoelectric & electromag. exploration	3(2+0+1)
GPH 410	Geophysical Well logging	3(2+0+1)
GEO 383	Remote Sensing	3(2+0+1)
HGEO 391	Hydrogeological reports	1(1+0+0)
GEO 382	GIS	3(2+0+1)
<b>Total units</b>		<b>17</b>

<b>Summer Semester</b>		
<b>Course Code</b>	<b>Course Title</b>	<b>Credits (Lect. Exre. – Pract.)</b>
HGEO 399	Field Hydrogeology	6(0+0+6)
<b>Total units</b>		<b>6</b>

<b>Seventh Level</b>		
<b>Course Code</b>	<b>Course Title</b>	<b>Credits (Lect. Exre. – Pract.)</b>
HGEO 305	Hydrochemistry	3(2+0+1)
HGEO 415	Geostatistics in Hydrogeology	2(2+0+0)
HGEO 481	Water Resources in the Saudi	2(2+0+2)
HGEO 491	Seminar	1(1+0+0)
HGEO 498	Research Project (1)	3(0+0+3)
Elective		2
Elective		3
<b>Total units</b>		<b>16</b>

<b>Eighth Level</b>		
<b>Course Code</b>	<b>Course Title</b>	<b>Credits (Lect. Exre. – Pract.)</b>
HGEO 311	Groundwater Resources	3(2+0+1)
HGEO 410	Groundwater Modeling	3 (2+0+1)
HGEO 499	Research Project (2)	3(0+0+3)
HGEO 496	Groundwater Pollution	3 (2+0+1)
Elective		2
Elective		2
<b>Total units</b>		<b>16</b>

## DESCRIPTION OF GEOLOGIC COURSES (GEO)

### **GEO 100: General Geology (E)**

**4(3+0+1)**

Introduction to physical geology and minerals – volcanism and intrusive igneous rocks – weathering, soil, sediments and sedimentary rocks – metamorphism and metamorphic rocks – water courses and groundwater – glaciers and glaciations – deserts and coasts – geological structures – earthquakes – plate tectonics – mountain belts and continental growth – earth resources. (One day field trip)

### **GEO 107: Historical Geology (E)**

**3(2+0+1)**

Essentials of earth history – uniformitarianism – the law of superposition – unconformities – mountain building – stratigraphic units – fossils and fossilization – correlation – absolute time and radiometric ages – plate tectonics – evolution of the lithosphere and biosphere through geologic time. (One day field trip)

### **GEO 221: Mineralogy (E)**

**3(2+0+1)**

Crystallization in solutions and magma – crystal symmetry – crystal forms and habits – crystallographic systems – crystal lattices – chemical and physical properties of minerals – classification and nomenclature of minerals – origin and distribution of minerals - physics of light and its interaction with crystalline matter – the polarizing microscope – thin section preparation – refraction indices – optical indicatrix – optical sign determination – mineral identification – qualitative and quantitative analysis of minerals. (One day field trip)

### **GEO 237: Stratigraphy and Sedimentology (E)**

**3(2+0+1)**

Erosion, transport and sedimentation – grain morphology – porosity, permeability and diagenesis – classification of sedimentary rocks – sedimentary structures – stratigraphic units and correlation – seismic stratigraphy – sequence Stratigraphy – use and interpretation of stratigraphic maps and sections. (One day field trip)

### **GEO 242: Micropaleontology (E)**

**3 (2+0+1)**

Marine ecology and zoning- classification of marine organisms- collection and preparation of samples- study of the most important microfossils including: foraminifera, radiolaria, ostracods and conodonts in terms of soft tissue, shell morphology, ecology and evolution.

**GEO 243: Invertebrate Paleontology (E)****3(2+0+1)**

Introduction – conditions and processes of fossilization – types of preservation – the fossil record – index fossils – biological classification – study of the most important invertebrate phyla: sponges, corals, coelenterates, mollusks, echinoderms, brachiopods, annelids, arthropods and graptolites – trace fossils. (One day field trip)

**GEO 246: Paleontology (E)****3(2+0+1)**

Fossilization and modes of preservation – Fossil record and index fossils – Collection and preparation of fossils - applications of micro-and macropaleontology - study of the most important invertebrate groups: Porifera, Cnidaria, Mollusca, Echinodermata, Bryozoa, Brachiopoda, Ichnology – Classification of vertebrates (Two day field trip).

**GEO 274: Geologic Reports (E)****1(1+0+0)**

Using terms and expressions in their proper geologic context – organizing data - stratigraphic and geographic names - maps and drawings – references and appendices – training on selected local examples.

**GEO 301: Geomorphology (E)****3 (2+0+1)**

Natural processes that create landforms and landscapes - physics and chemistry of weathering and soil formation - dynamics of mass wasting - streams and glaciers - karst processes - topographic response to tectonic and climatic forces - terrain analysis utilizing geomorphic field data, remote sensing imagery, and numerical models - natural hazards. (One day field trip).

**GEO 323: Igneous and Metamorphic Petrology (E)****3(2+0+1)**

Origin and composition of magma – magmatic differentiation – volcanism and its products – emplacement mechanisms of plutonic rocks – geochemistry of igneous rocks and its relationship with their tectonic settings, types of metamorphism- field relations – metamorphic textures – metamorphic zones – metamorphic reactions and P-T-t paths. (Three days field trip)

**GEO 324: Igneous Petrology (E)****3(2+0+1)**

Origin and composition of magma – magmatic differentiation – volcanism and its products – emplacement mechanisms of plutonic rocks – geochemistry of igneous rocks and its relationship with their tectonic settings. (Three days field trip)

**GEO 326: Metamorphic Petrology (E)**

**3(2+0+1)**

types of metamorphism- field relations – metamorphic textures – metamorphic zones – metamorphic reactions and P-T-t paths. (Three days field trip)

**GEO 334: Sedimentary Petrology (E)**

**3(2+0+1)**

Grain morphologies and statistical distribution of grain size – classification of sedimentary rocks - mineral composition of detrital rocks and its relationship to the tectonic setting – diagenesis – carbonate rocks and evaporites – phosphorites – ironstones – siliceous rocks – coal and coalification processes. (Two days field trip)

**GEO 341: Paleobotany (E)**

**3 (2+0+1)**

Fossil record of the plant kingdom – ancient environments and plant diversity through the Geologic record – origin of life in the Archean – cyanobacteria – emergence and diversity of fungi – appearance of ferns and mosses – vascular plants – dominance of angiosperms in the Mesozoic and Cenozoic.

**GEO 342: Paleoecology (E)**

**3 (2+0+1)**

The nature and classification of environments – comparison with living representatives – evidence of biological activity and associated sediments – lateral and vertical variations – geographical distribution of assemblages – trace fossils – biodiversity – environmental changes through Geologic time. (One day field trip).

**GEO 381: Structural Geology (E)**

**3(2+0+1)**

Stress, strain and rock deformation - kinematic analysis – interpretation of geologic maps – stereographic projections - joints – strike-slip faults – dip-slip faults – geometry of folds – foliation and lineation – balanced cross-sections - rheology – microscopic structures – orogenic belts and plate tectonics. (Three days field trip)

**GEO 382: Geographic Information Systems (E)**

**2(1+0+1)**

The concept of GIS – maps and spatial analysis – data entry, storage and retrieval – computer-based processing of geologic data – vector and raster data models and analysis – linking digital maps and attribute information - spatial interpolation - practical application through a real-life GIS project.



**GEO 383: Remote Sensing (E)****3(2+0+1)**

Basics of remote sensing – electromagnetic spectrum – types of sensors and platforms – acquiring and processing primary data – spatial corrections – types of filters - image enhancement - interpretation – classification methods – principal component analysis – thermal and radar imaging - geologic applications.

**GEO 384: Geological survey****2(1+0+1)**

The geological survey course (384 GEO) aims to acquire the students the basic knowledge on the concepts and methods of the geological survey techniques and instruments. Through this course the students will be trained on the geological survey methods and techniques using different survey instruments ranging from the minor instruments such as compass to the major instruments such as DGPS. In this course, the field survey and lab. Exercises are considered very important and the practical reports are given significant weighting.

**GEO 385: Sedimentary Geology of Saudi Arabia (E)****3(2+0+1)**

Sedimentary basins of Saudi Arabia – Phanerozoic stratigraphic units – sedimentary cycles – intra-basin stratigraphic correlations – biostratigraphy – major structural trends – economic geology of the cover rocks. (Three days field trip)

**GEO 386: Geology of the Arabian Shield (E)****2(1+0+1)**

Origin of the Arabian Shield – stratigraphic schemes – igneous and tectonic activity – island arc and microcontinents - allochthonous terranes – ophiolites and sutures – correlation with the Nubian Shield – the Pan-African episode – Archean terranes in the Arabian Shield – ore deposits in the Arabian Shield. (Three days field trip)

**GEO 393: Field Geology (E)****6(0+0+6)**

A 45 day summer field camp devoted to training on mapping and exploration techniques including: field relation of igneous and metamorphic rocks – making stratigraphic sections and traverses – measurement of structures – using global positioning systems – making topographic and geologic maps – report writing.

**GEO 406: Data Analysis in Geology (E)****2(1+0+1)**

Sampling methods – data distributions - precision and accuracy - confidence intervals - least squares methods - correlation - time series analysis - multivariate techniques - cluster analysis – principal component analysis – kriging - using statistical software packages - geologic modeling.

**GEO 421: Volcanology (E)****3 (2+0+1)**

Internal structure of the Earth and magma genesis – distribution of active volcanoes and their relationship to plate tectonics – internal structure of volcanoes – volcanic ejecta – types of eruptions - classification of volcanoes – mid-ocean ridge volcanism – island arcs – intra-plate volcanism – hot spots – volcanic activity in Saudi Arabia. (Three days field trip).

**GEO 431: Carbonate Rocks (E)****3 (2+0+1)**

Types of carbonate rocks - carbonate minerals - classifications of limestones - limestone diagenesis – depositional environments and facies – lacustrine deposits – coral reefs – pelagic sediments - dissolution and transformation – cementation – silicification - dolomitization – evaporites and sabkhas – Geologic record of carbonate rocks. (One day field trip).

**GEO 432: Quaternary Geology (E)****3 (2+0+1)**

Characteristics, distribution, and origin of recent deposits - stratigraphy and chronology - paleosols - formation of landforms – glacial and inter-glacial periods – glacial deposits and landforms - changes in sea level – biodiversity and extinction – appearance of man. (One day field trip).

**GEO 435: Oceanography (E)****2 (2+0+0)**

Physical processes in the oceans – waves, currents and tides – formation of ocean basins – turbidity currents and deep sediment transport – earthquakes and tsunamis – marine chemistry – coastal processes – life in the oceans – ocean mineral resources - changes in the oceanic ecosystem.

**GEO 441: Vertebrate Paleontology (E) 3****(2+0+1)**

Origin and classification of chordates – extraction and study of vertebrate fossils – the main vertebrate classes and the appearance in the Geologic record – fish and amphibians – age of the dinosaurs – birds – appearance of mammals – primates and hominoids – mass extinction.

**GEO 445: Sedimentary Basin Analysis (E)****2 (1+0+1)**

Stratigraphic and facies analysis – sub-surface methods – stratigraphic correlations – biostratigraphy and biozones – sequence stratigraphy - basin maps – paleocurrent analysis - subsidence and burial history – basin models – basin classification – processes generating oil, gas and coal. (Two days field trip).

**GEO 450: Ore Geology (E)****3(2+0+1)**

Basic definitions – morphology of ore bodies – ore textures – theories of ore genesis – classification of ore deposits – orthomagmatic deposits – diamonds and kimberlites – the carbonatite environment – volcanogenic massive sulphides - greisen and skarn – hydrothermal deposits – strata-bound deposits – sedimentary Fe and Mn deposits – metamorphic ores - supergene enrichment – industrial minerals. (Three days field trip)

**GEO 451: Geochemistry (E)****2 (1+0+1)**

Meteorites and origin of the solar system - distribution of elements – isotope Geology and radiometric age determination – basic thermodynamics – reaction kinetics - crystal chemistry – water chemistry – organic geochemistry – oxidation and reduction – chemical evolution of magma – metamorphic reactions - hydrothermal processes and ore genesis.

**GEO 452: Petroleum Geology (E)****3(2+0+1)**

Physical properties of oil, gas and connate water – porosity and permeability and the effect of diagenesis – origin, migration and accumulation of oil – oil traps and seals – drilling methods - oil exploration – formation evaluation – chemistry and grades of crude oil – reserve estimation - oil in Saudi Arabia. (Two days field trip)

**GEO 454: Mining Geology (E)****2 (1+0+1)**

Reconnaissance exploration – remote sensing – Geochemical exploration – Geophysical exploration – drilling methods - evaluation techniques – feasibility studies mine mapping – surface and underground mining methods – mineral processing and metallurgy – mining in Saudi Arabia. (Three days field trip).

**GEO 455: Hydrogeology (E)****3(2+0+1)**

Geologic factors controlling the flow of groundwater – porosity and permeability – groundwater flow - types of aquifers – Darcy's law – groundwater wells – chemistry of groundwater – groundwater exploration – seawater encroachment – groundwater pollution - groundwater resources in Saudi Arabia. (Three days field trip)

**GEO 456: Application in Petroleum Geology (E)****2 (2+0+0)**

Geologic and seismic exploration – methods and problems of production – tectonic settings of oil-producing basins – depositional environments and oil and gas quality – detailed study of hydrocarbon field in and outside the Kingdom. (Two days field trip).

**GEO 457: Engineering Geology (E)****3 (2+0+1)**

Soil physical and engineering properties, types of stresses, compressibility and shear strength, Geotechnical problems associated with soil. Engineering geological considerations while investigating highways, bridges, slopes, dams, tunnels and selected sites for urban areas. Geotechnical problems associated with soil, Engineering geological maps and their applications, Rock and soil improvement (2 days Field Trips).

**GEO 462: Environmental Geology (E)****2(2+0+0)**

Geologic factors influencing the environment – air, water and soil pollution – radioactive waste disposal – geohazards including: earthquakes, volcanoes, floods, soil erosion and landslides – desertification – population expansion and depletion natural resources – pollution associated with the extractive industries. (One day field trip)

**GEO 463: Plate Tectonics (E)****2(2+0+0)**

Geophysical and geological observations related to plate tectonic theory - marine magnetic and paleomagnetic measurements - seismicity and volcanism of plate boundaries - reference frames and absolute plate motions - Interpretations of geologic phenomena in the context of plate tectonics – ocean trenches and island arcs - plate tectonic evolution of the ocean basins and continents.

**GEO 483: Regional Geology of the Middle East (E)****2 (2+0+0)**

Precambrian relationships in the Arabian-Nubian Shield – the Arabian Shelf and its northerly extension – tectonic movements related to the opening of the Red Sea – Arabian Plate movement and the creation of Zagros and Taurus belts – oil and mineral resources of the Middle East.

**GEO 495: History of Geology (E)****1 (1+0+0)**

Beginnings of earth sciences and the contribution of Arab and Muslim scholars – evolution of modern concepts in Geology – emergence of the main disciplines of earth sciences - catastrophism and uniformitarianism – plutonists and neptunists – Geologic controversies on the ice age, granitization and age of the Earth – continental drift and the theory of plate tectonics.

**GEO 496: Specialized Topics (E)****1 (1+0+0)**

Advanced study of detailed aspects of certain Geological problems chosen by the student, which is summarized in a brief report.

**GEO 497: Graduation Project – 1 (E)**

**3(0+0+3)**

Training on geologic research methods through an integrated field and laboratory study of an area or topic chosen by the student and his supervisor. (Three day field trip)

**GEO 498: Graduation Project - 2 (E)**

**3(0+0+3)**

Completing the laboratory work (Lab work) and a written report must be submitted and oral presentation made for evaluation by a committee appointed by the department.

## DESCRIPTION OF GEOPHYSICS COURSES (GPH)

### **GPH 201: Principles of Geophysics**

**3(2+0+1)**

Physical and mathematical laws and its relation to the Earth properties, Elasticity theory and properties of wave propagation in seismic reflections, refractions, wave equations, seismic wave characteristics, Potential field theories, Principles of different exploration techniques, Interpretation of earth's structures from geophysical data.

### **GPH 211: Gravity and Magnetic Exploration**

**3(2+0+1)**

Introduction. Importance of gravity and magnetic exploration methods and its use. Instruments for gravity and magnetic measurements. Gravity and magnetic surveying. Data reduction, and processing. Application of the gravity and magnetic methods to oil, mineral and groundwater exploration. Interpretation of Aeromagnetic maps. Qualitative and quantitative interpretation of gravity and magnetic data. (Field applications – Two days)

### **GPH 221: Seismic Exploration**

**3(2+0+1)**

Introduction. Importance of seismic exploration. Seismic waves and factors affecting its propagation. Seismic velocities. Reflection and refraction. Time-distance relations for reflected and refracted seismic waves in layered media. Instrumentation and field procedures. Seismic sources. Corrections of seismic data, Seismic noise. Multiple seismic reflections. Measurements of seismic velocities. Data reduction and qualitative and quantitative interpretation. Seismic migration. Seismic Stratigraphy. (Field applications – Two days)

### **GPH 231: Geoelectric and Electromagnetic Exploration**

**3(2+0+1)**

Introduction. Importance of the electrical and electromagnetic methods and their applications. Electrical conductivity of rocks. Basic theory of direct current conduction and EM induction. Time domain and frequency domain systems. Transient EM. Induced and spontaneous polarization. Down-hole electric and EM techniques. Instrumentation. Field procedures. Qualitative and quantitative interpretation. (Field applications – Two days)

### **GPH 313: Seismology**

**3(2+0+1)**

Earthquakes: Causes, Types. Historical background. Earthquake measurement instruments. Seismic wave propagation in spherically Earth and travel time graphs. Earthquakes source

parameters, magnitudes, intensity scales. Processing of Earthquakes data. Earthquakes mechanisms. International observatory networks. Internal structure of the Earth. Solutions of Earthquake focal mechanism. Heterogeneity and inelasticity.

**GPH 317: Time Series Analysis**

**2(2+0+0)**

Different types of Fourier series analysis. Digital filtering. Matrix processing techniques. Waves polarity analysis. Application of inverse linear and non-linear theories in solving geophysical problems.

**GPH 319: Petrophysics**

**2(2+0+0)**

A review of rocks (sedimentary, igneous and metamorphic), Physical properties of rocks and fluids that affect the distribution and movement of fluids such as oil, gas, water, or contaminants in porous media including porosity, permeability, capillary pressure, surface and interfacial tension, Wettability, and viscosity. Darcy's law for anisotropic porous media.

**GPH 381: Geophysical Reports**

**1(1+0+0)**

Writing scientific papers, theses and reports. Methods of criticism. Geophysical terminologies. Geophysical data presentation. Structure of a geophysical report. How to write an ideal technical report and scientific paper. Manifestation of results.

**GPH 390: Radiometric and Geothermal methods**

**2(2+0+0)**

Rocks radiation. Theory of radioactivity and half life. Instruments for measuring natural radiation. Radiometric survey on land and from air. Interpretation of radiation readings. Temperature of the Earth and its relation to the radioactive materials. Theory of Heat flow. Temperature gradient with depth and its change with time and location. Geothermal measurements. The use of radiometric and geothermal methods in modern applications.

**GPH 393: Field geophysics**

**6(0+0+6)**

Field study in a summer field camp for forty five days. Introduction to different geologic and geophysical techniques for topographic and geologic mapping. Developing subsurface geologic maps for selected areas under study. Basic geologic relationships with emphasis on geologic structures and stratigraphic correlation for different types of rocks. Geophysical field measurements, data collection, reduction, analysis and interpretation, weekly reports and a final project team report.

**GPH 401: Physics of the Earth****2(2+0+0)**

Structure of the Earth as deduced from geophysical methods: the crust, mantle and core, their physical and chemical properties. Terrestrial heat flow, convection currents and phase transitions. Geomagnetism and paleomagnetism. Relation between seismology, global gravity, densities, earth's magnetism and the structure of the Earth. Plate tectonics. Hydrostatic sphere. Free oscillations of the Earth. Principle of the isostasy.

**GPH 410: Geophysical Well Logging****3(2+0+1)**

A review of rocks (sedimentary, igneous and metamorphic), Physical properties of rocks and fluids that affect the distribution and movement of fluids such as oil, gas, water, or contaminants in porous media including porosity, permeability, capillary pressure, surface and interfacial tension, Wettability, and viscosity. Darcy's law for anisotropic porous media. (Field applications – Two days)

**GPH 411: Geophysical Data Processing****2(2+0+0)**

Theory of frequency filtering. Separation techniques for regional and residual fields in space and frequency domain. Methods to calculate the second vertical derivatives for potential fields. Downward and upward Modeling magnetic data. Ambiguities in interpretation of potential fields data interpretation. Linear analysis theory for digital data. Fast forward and inverse Fourier analysis and its application in data processing. Seismic data enhancement. Advanced seismic data interpretation. Seismic stratigraphy and direct detection of hydrocarbons

**GPH 412: Engineering Seismology****2(2+0+0)**

Probabilistic and deterministic theory. Different kinds of earthquake sources and its relation to faulting mechanism. Seismic risk and hazard, Seismic zoning. Attenuation relations, soil liquefaction. Earthquake response of structures, design of earthquake - resistant structures.

**GPH 416: Seismotectonics of the Middle East****2(2+0+0)**

A comprehensive study of the tectonics of the Middle East. Arabian plate boundaries, Correlation between earthquake occurrences and tectonically active regions. Red Sea spreading , Dead Sea transform fault system . Atlas Mountains, Afar triangle, and Arabian Gulf. Crustal Structures.

**GPH 417: Hydrogeophysics****3(2+0+1)**

Introduction, Cross-hole hydraulic tests (slug or pump testing), Hydrostratigraphy, Hydraulic



conductivity, Surface hydrology, Seismic Refraction Tomography, Ground Penetrating Radar, Electrical Resistivity Tomography, Airborne & remote sensing hydrogeophysics. Applications and case studies (2 days Field Trips).

**GPH 424: Environmental Geophysics**

**2(2+0+0)**

The use of all geophysical methods (seismic, gravity, magnetic, ground penetrating radar, electric, and radiometric) in solving environmental problems. Pollution determination and monitoring. Site selection for waste disposal. Geophysical impact assessment of engineering structures to ensure its safety and suitability for environment protection.

**GPH 431: Seismic stratigraphy**

**2(2+0+0)**

Introduction, Velocity and resolution, Processing for stratigraphic interpretation, Seismic sequence analysis, Seismic facies analysis, Reef patterns, Seismic trace modeling, Reflection character analysis, Hydrocarbon indicators.

**GPH 444: Marine Geophysics**

**2(2+0+0)**

Introduction, Marine Geophysics: An Overview, Marine Geotechnique, An Overview, Echo Sounders, Side Scan Sonar, Subbottom Profilers, Seismic Sources, Marine Magnetometers

**GPH 496: Graduation Project (1)**

**3(0+0+3)**

Senior student's engagement in individual/independent research project with faculty supervision. Investigation of any selected problems in applied or theoretical geophysics. Determine the subject of research and development of systematic planning to conduct research - a review and study of previous studies - studies and field data collection and measurement.

**GPH 497: Graduation Project (2)**

**3(0+0+3)**

Analysis and discussion of data - data processing - interpretation of results - a written report must be submitted and oral presentation made for evaluation by a committee appointed by the department.

## DESCRIPTION OF HYDROGEOLOGIC COURSES (HGEO)

### **HGEO 201 Principles of Hydrogeology**

**3(2+0+1)**

Study of hydrogeological principles includes simple description of the hydrological cycle to enable the calculation of natural recharge to the aquifer. Study the groundwater flow theory through porous media. Study of chemical and physical properties of water. Introduction to the basic principles of groundwater occurrence, physical characteristics of aquifers, Darcy's law, groundwater movement and flow, water quality, and exploration and development of groundwater resources. (Field work -3 days).

### **HGEO 202 Hydrologic Cycle**

**3(2+0+1)**

Detailed description of the Hydrologic cycle includes quantitative analyses of the hydro-meteorological data that affect the natural recharge such as precipitation, temperature, humidity, wind speed and direction, sunlight, evaporation, and transpiration. The study of basin drainage and water divide, run-off and open channel flow measurements. Developing the ability for hydrograph analyses, calculation of natural recharge using the hydrologic budget, calculation of the base flow recession, and the monitoring of groundwater level fluctuations as a result of recharge.

### **HGEO 301 Theory of Groundwater flow**

**3(2+0+1)**

Physical and mathematical description of groundwater flow and movement in porous media include the study of Darcy's law, hydraulic conductivity, permeability, transmissivity, storage coefficient and specific yield, Derivation of solution of the second order partial differential equations that describe groundwater flow and well hydraulics steady flow, transient flow, and boundary conditions. Measurement of aquifer parameters in both field and laboratory. (Field work -3 days).

### **HGEO 302 Groundwater Wells**

**3(2+0+1)**

Detailed study of well design and construction which starts with the determination of well site. The study of water well drilling methods and their equipments. The supervision of sampling procedure, casing and screen setting, well development and completion, sanitary of wells, pump setting, monitoring of corrosion and incrustation, maintenance of groundwater wells. In addition, the training on conducting pumping tests. Improving production efficiency wells and well well maintenance. Developing the ability for preparing groundwater well contracts and specifications. (Field work - 3 days).

**HGEO 305 Hydrochemistry****3(2+0+1)**

Study of physical chemistry of aqueous solution includes sample collection and analyses, hydrochemical parameters measurement and calculation. Graphic representation of hydrochemical data. Hydrochemical classification of groundwater. Study of equilibrium and chemical reaction within the water or between the water and the solid material of the aquifer. Study of trace elements in groundwater, their sources, problems and solutions, hydrochemical models. Introduction to water quality criteria and environmental isotopes and their uses in groundwater studies. (Field work -3 days).

**HGEO 311 Groundwater Resources Development****3(2+0+1)**

The study of hydrogeologic survey and calculations in water management and the impact of different geological and hydrographic factors on the development of aquifers. Exploration for aquifers includes defining aquifer location, extension and interrelation with other aquifers. Defining the aquifer recharge and discharge areas. Well evaluation includes response of ideal aquifers to pumping, measurements of aquifer parameters. Optimum use and exploitation of wells, aquifers, and basins. Prediction of aquifer yield by numerical and analogue simulation. Management of known groundwater resources and exploration for new resources. (Field work -3 days).

**HGEO 384 Applications in Remote Sensing****4(0+0+4)**

Studying how different remote sensing data are processed and integrated into spatial information systems, correcting, improving and enhancing aerial images and satellite imagery. Extract information from remote sensing data using a variety of manual and automated techniques. Assess the strengths and weaknesses of remote sensing and satellite devices to suit different combinations of different applications. Develop multi-step methods for the workflow of remote sensing visualization to solve many environmental problems. Apply knowledge gained and critical thinking skills to solve real problems by using and processing remote sensing data in appropriate ways. (Field work -3 days).

**HGEO 391 Hydrogeological Reports****1(1+0+0)**

Knowledge and coordination of hydrogeological terms and methods of different uses, coordination of geographical and geological names, knowledge of methods of reasoning and the use of different types of maps, and knowledge of methods of writing references and processing annexes for hydrogeological reports. As well as to identify the different presentation methods of hydrogeological data and to highlight the results and link them with different studies in an integrated manner. How to prepare and write technical reports, and master's dissertation, posters and scientific research that can be published in local and international journals. (Field work -3 days).

**HGEO 399 Field Hydrogeology****6(0+0+6)**

Introduction to exploration methods, field techniques and instrumentation. Field training on the methods of collecting, analyzing and interpretation of hydrogeological data and information, in addition to supervising drilling operation. Students are trained in the basics of mapping, preparation and analysis. Field visits to major wadies and drainage systems. Monitoring of water quality and collected some samples to detect chemical analysis for some areas in the Kingdom. Direct application of field studies to the aquifers of the Kingdom of Saudi Arabia. (Field work -3 days).

**HGEO 406 Water Quality Control****2(1+0+1)**

Study of water quality criteria for drinking, irrigation and industrial purposes, monitoring the behavior of contaminants whether dissolved suspended, organic, or inorganic constituents. The study of solute transport processes such as ion-exchange, dispersion, and partitioning. Interrelation between water quality and aquifer geochemistry. Monitoring sources of pollution and preventing their effect on the groundwater quality. Sewage disposal treatment, water desalination plants. Sanitary and protection of groundwater supplies. (Field work -3 days).

**HGEO 407 Environmental Isotopes in Groundwater****2(1+0+1)**

Study of environmental isotopes includes carbon-14, tritium, deuterium, oxygen isotopes, and sulphur isotopes, their occurrence and distribution. Principles and uses of environmental isotopes in hydrogeological studies. Case history of isotope uses in hydrogeology. Statistical analysis of isotopes, interpretations, study of the environmental applications of isotopes to determine the recharge and discharge of groundwater. (Field work -3 days).

**HGEO 408 Selected Topics in Hydrogeology****2(2+0+0)**

The course will guide the student towards the latest developments in the field of hydrogeology and related topics. These topics will be changed according to specialization and short visits to some professors in the field of hydrogeology. Advance readings and intensive studies in a selected hydrogeological topic aims training the student to conduct advanced research and to gain the experience of previous studies. For example, environmental problems associated with floods, excessive water pumping, drought study, water level decline, study of depressions and landslides, study of sea water intrusion.

**HGEO 410 Applied Groundwater Modeling 3(2+0+1)**

Introduction to mathematical equations of groundwater, Introduction to modeling techniques and methods of simulation of groundwater which include analogue models, physical models, electrical models, and numerical models (finite difference, finite elements). Simple application of numerical models with emphasis on finite difference method. Use of computer to solve the second order partial differential equations that govern groundwater flow using simple computer programs. Study the methodology of modeling, correction, verification and prediction for future scenarios and comparing between different solutions and model solutions. (Field work -3 days).

**HGEO 411 Groundwater planning and management 3(2+0+1)**

Concept of planning and management, concepts and domains of water resource planning and management, water system, ground water resource data, principles and steps of ground water planning, planning constrains, optimum water system, water system analysis and economic feasibility of water projects, Analysis of Multi-objective water systems, tools and methods of Water conservation. (Field work -3 days).

**HGEO 412 Exploration for Groundwater 3(2+0+1)**

Hydrogeology of fluvial, Aeolian, and glacial deposits. Hydrogeology of sedimentary, igneous and metamorphic rocks. Techniques used in groundwater exploration and surveys which include surface and subsurface, geological, geophysical, geochemical, and geothermal surveys, The use of aerial photography, Landsat images, and test drilling in the exploration for groundwater. (Field work -3 days).

**HGEO 413 Mine Hydrogeology 2(2+0+0)**

This course focuses on how underground water flows in mining areas, surface and non-surface mining, practices and requirements for open drilling, deep drilling, underground mines, washing platforms, rock dumps, and reservoir waste. Hydraulic will also include groundwater and its relationship to the design and implementation of mines and the extension of drainage channels and implement programs to control and protect groundwater and surface water from pollution by mining operations.

**HGEO 415 Geostatistic in Hydrogeology 2 (2+0+0)**

The course will include data collection and hydrographic measurements, data analysis, calculation of descriptive statistics, normal distribution test, correlation coefficients, regression, alternative methods of regression, trend analysis, variance analysis, regression analysis and simple and multi-linear and nonlinear analysis, Confidence levels, time series analysis and

modeling, graphical representation, implementation of various statistical models, and implementation of many applications.

**HGEO 416 Hydrogeology in Fracture system 1(1+0+0)**

Types of fractured rocks, study of water flow found in rocks containing cracks and fishers. Porosity and permeability in fractured systems. Carbonate rocks, karsts. Fractured media in igneous, metamorphic and detrital rocks. Testing wells in fractured systems. Groundwater movement. Exploration of groundwater in fractured systems. Contamination hazards. Groundwater management and modeling of fractured systems. Applications. (Field work -3 days).

**HGEO 450 Applied Hydrogeology 2(1+0+1)**

Study of hydrochemical and isotope indicators, flow net, artificial recharge, land subsidence, sea-water intrusion, and conservation of groundwater. The equilibrium of water balance and its applications, spatial and temporal distribution of surface water and its effect on groundwater. Definition of the problem of sea water intrusion and methods of resistance. (Field work -3 days)

**HGEO 481 Water Resources in the Saudi Arabia Kingdom 3(2+0+1)**

Study of the geography and climate of the Kingdom. Quick review for the geology of Saudi Arabia (The Arabian shield and stratigraphic section overlying the shield). The study of major wadies, drainage systems, and major springs. Detailed study of important formations with emphasis on their potential and production capacity. Study of major agricultural and water resource development projects. Study of problems related to water demand in the Kingdom. A study of some water projects in the major cities in the Kingdom in addition to the study of some major agricultural projects in terms of hydrogeology National Water Plan and Investment Projects in Natural Water Resources and their Economic Impacts. Brief introduction to the use of seawater desalination in the Kingdom of Saudi Arabia. (Field work -3 days)

**HGEO 491 Seminar 1(1+0+0)**

Presentation of a scientific report and/or a research in selected hydrogeological topic.

**HGEO 496 Groundwater pollution 3(2+0+1)**

Study the sources of water pollution with different types of physical pollution and chemical and biological pollution. Groundwater pollution sources, types and, characteristics, and sources of pollutants, Radioactive pollution, traces and toxic elements pollution, organic, and non organic pollution, shape and movement of pollutant in different media, Methods of control and

monitoring of pollutants. Pollution in various media, pollutant removal, remediation and control. Pollution in different environments, study of physical and mathematical models of water pollution and the movement of these pollutants, study methods of treatment of this pollution and remove and control contaminants. Case studies of pollution. (Field work -3 days)

**HGEO 498 Research Project (1)**

**3 (0+0+3)**

A hydrogeological study carried out by the student in the laboratory or field or both under the supervision of a faculty member. This hydrological study is carried out in the form of an integrated scientific research in which the student applies the hydrogeological information he has studied on some of the hydrogeological phenomena in the Kingdom of Saudi Arabia (Field work - 3 days).

**HGEO 499 Research Project (2)**

**3 (0+0+3)**

Training of students on hydrogeological research methods, completion of field and laboratory studies of the student's research project, training of scientific writing from introduction, characterization of the problem, compilation of previous studies, method of work, presentation of results and discussion, conclusions and training in writing research, references and supplements. (Field work -3 days).

**GRADUATE PROGRAMS**  
**FOR M.Sc.**



## **GRADUATE PROGRAMS LEADING TO M.Sc. GEOLOGY AND M.Sc. GEOPHYSICS**

Graduate courses for Master's Degree studies have various domains, e.g. studies on minerals, fossils, structural, geophysical and hydrogeological studies. These studies enrich the way of thinking of the students towards working in a variety of geosciences professions such as exploration and production in companies dealing with petroleum, mineral, mining, ground water, geological mapping, site selection and engineering projects; besides the teaching profession.

### **PROGRAM OBJECTIVES**

1. To offer M. Sc. courses in Geology as well as in Geophysics.
2. To prepare the graduate student for Ph.D. programs in various fields of Geology and Geophysics.
3. To develop the graduate's academic capability to carry out independent scientific research and to present the research results in both applied and academic fields.
4. To ensure the availability of highly trained indigenous scientific manpower in the fields of geosciences.
5. To cultivate interest on geo-scientific problems faced by the Kingdom of Saudi Arabia and its neighbors.
6. To train the student on the uses of advanced technology.

### **ADMISSION REQUIREMENTS**

1. The admission requirements stipulated in the Unified Graduate Studies Statutes for Saudi universities.
2. Candidates should hold a Bachelor's Degree (B.Sc.) in Geology or a related field from universities in Saudi Arabia or their equivalent.
3. Candidates must qualify to specific other departmental requirements such as appearing in an interview arranged by the Department's Admission Committee.

### **DEGREE REQUIREMENTS**

1. A successful completion of 24 credit hours of graduate courses which the student can select from the offered courses with the help of the Student's Guidance Committee.
2. Completing a successful thesis.

## GRADUATE STUDY PLAN FOR M.Sc. IN GEOLOGY

The graduate studies leading to a M.Sc in Geology offers specialization in five subjects. The study plan for each specialization is as follows

### M.Sc in Geology with specialization in Sedimentology and Stratigraphy

Level	Course	Name	Credit (Lecture + Exercise + Practical)
<b>First</b>	GEO 501	Advanced Geology of Saudi Arabia	3(2+0+1)
	GEO 532	Advance Stratigraphy	3(2+0+1)
	GEO 533	Advanced Sedimentary Petrology	3(2+0+1)
<b>Second</b>	GEO 534	Carbonate Rocks and Evaporites	3(2+0+1)
	GEO 536	Recent Sediments	2(2+0+0)
	GEO 550	Advanced Paleoecology	2(2+0+0)
	GEO 598	Seminar Geology	1(1+0+0)
<b>Third</b>	GEO 573	Interpretation of Well Logging	3(2+0+1)
	GEO 586	Geodynamics	3(2+0+1)
	GEO 599	Special Topics	1(1+0+0)
<b>Fourth</b>	GEO 600	Research Project	6(0+0+6)
Total Credit Hours			30

### M.Sc in Geology with specialization in Petroleum Geology

Level	Course	Name	Credit (Lecture + Exercise + Practical)
<b>First</b>	GEO 501	Advanced Geology of Saudi Arabia	3(2+0+1)
	GEO 532	Advance Stratigraphy	3(2+0+1)
	GEO 533	Advanced Sedimentary Petrology	3(2+0+1)
<b>Second</b>	GEO 534	Carbonate Rocks and Evaporites	3(2+0+1)
	GEO 556	Advanced Petroleum Geology	3(2+0+1)
	GEO 572	Applied Geophysics	3(2+0+1)
<b>Third</b>	GEO 573	Interpretation of Well Logging	3(2+0+1)
	GEO 586	Geodynamics	3(2+0+1)
<b>Fourth</b>	GEO 600	Research Project	6(0+0+6)
Total Credit Hours			30

### M.Sc in Geology with specialization in Hydrogeology

Level	Course	Name	Credit (Lecture + Exercise + Practical)
<b>First</b>	GEO 501	Advanced Geology of Saudi Arabia	3(2+0+1)
	GEO 532	Advance Metamorphic Petrology	3(2+0+1)
	GEO 533	Advanced Sedimentary Petrology	3(2+0+1)
<b>Second</b>	GEO 512	Carbonate Rocks and Evaporites	(1+0+2)3
	GEO 555	Advanced Hydrogeology	(0+0+2)2
	GEO 572	Applied Geophysics	(0+0+1)1
<b>Third</b>	GEO 573	Interpretation of Well Logging	(1+0+2)3
	GEO 586	Geodynamics	(1+0+2)3
<b>Fourth</b>	GEO 600	Research Project	(0+0+6)6
Total Credit Hours			30

### M.Sc in Geology with specialization in Economic Geology

Level	Course	Name	Credit (Lecture + Exercise + Practical)
<b>First</b>	GEO 501	Advanced Geology of Saudi Arabia	3(2+0+1)
	GEO 522	Advance Igneous Petrology	3(2+0+1)
	GEO 523	Advance Metamorphic Petrology	3(2+0+1)
<b>Second</b>	GEO 554	Mining Geology	3(2+0+1)
	GEO 561	Advanced Geochemistry	3(2+0+1)
	GEO 564	Geochronology	2(2+0+0)
<b>Third</b>	GEO 566	Mineral Geochemistry	2(1+0+1)
	GEO 586	Geodynamics	3(2+0+1)
	GEO 598	Seminar Geology	1(1+0+0)
	GEO 599	Special Topics	1(1+0+0)
<b>Fourth</b>	GEO 600	Research Project	6(0+0+6)
Total Credit Hours			30

**M.Sc in Geology with specialization in Palaeontology Geology**

<b>Level</b>	<b>Course</b>	<b>Name</b>	<b>Credit (Lecture + Exercise + Practical)</b>
<b>First</b>	GEO 501	Advanced Geology of Saudi Arabia	3(2+0+1)
	GEO 532	Advance Metamorphic Petrology	3(2+0+1)
	GEO 542	Invertebrate Paleontology (I)	3(2+0+1)
<b>Second</b>	GEO 534	Carbonate Rocks and Evaporites	3(2+0+1)
	GEO 543	Invertebrate Paleontology (II)	3(2+0+1)
	GEO 547	Advanced Microfossils	3(2+0+1)
	GEO 544	Vertebrate Paleontology	3(2+0+1)
<b>Third</b>	GEO 550	Advanced Paleoecology	2(2+0+0)
	GEO 551	Advanced Biostratigraphy	1(0+0+1)
<b>Fourth</b>	GEO 600	Research Project	6(0+0+6)
<b>Total Credit Hours</b>			<b>30</b>

## **COURSE DESCRIPTION FOR M.Sc. IN GEOLOGY**

### **GEO 501: Advanced Geology of Saudi Arabia**

**3(2+1)**

Study of Precambrian with emphasis on the development structure and correlation of the Arabian Shield. Correlation, Paleogeography of the Paleozoic, Mesozoic and Cenozoic sedimentary formations. Field applications.

### **GEO 522: Advance Igneous Petrology**

**3(2+0+1)**

Evolution and development of igneous rocks, illustrating the magma behavior by different diagrams as AFM. Igneous rocks classification and their field relations. Tectonic movements. Volcanism and Volcanoes. Thermodynamics of rocks. Special reference on problems about the origins of selected rock types from the Arabian Shield. Field work.

### **GEO 523: Advance Metamorphic Petrology**

**3(2+0+1)**

Origin and classification of metamorphic rocks textures, structures and reactions and their relationship. Physical and chemical principles of the metamorphic minerals, rocks and paragenesis. Metamorphism, metamorphic belts, problems associated with the reactions, progress of metamorphism, and relation to tectonism and tectonic theory. Cataclastic metamorphism and its significance. Facies and subfacies of metamorphic rocks illustrating metamorphism and origin by diagrams e.g., FMA, AKF, ACF. Field work.

### **GEO 532: Advance Stratigraphy**

**3(2+0+1)**

Latest developments, chronologic and chronostratigraphic records, principles and applications of correlation. Stratigraphic maps, biostratigraphy, lithofacies changes. Correlation in important sedimentary basins. Field applications.

### **GEO 533: Advanced Sedimentary Petrology**

**3(2+0+1)**

Bedding and depositions, Sedimentary structures, of eolian, alluvial deposits, shallow and deep marine deposits, and the interaction with wave, tides, and oceanic currents. Field applications.

### **GEO 534: Carbonate Rocks and Evaporites**

**3(2+0+1)**

Carbonate sedimentation, marine evaporities, Carbonate facies, diagenesis facies, facies models and case histories.

**GEO 536: Recent Sediments** **2(2+0+0)**

Weathering, Denudation and rates of disposition. lithification and diagenesis of alluvial. Eolian, glacial and marine sediments.

**GEO 542: Invertebrate Paleontology (I)** **3(2+0+1)**

Systematic Paleontology, Morphology, Origin, Classification, The concept of species, Phylogeny, Organic evolution. Stratigraphy and the use of Paleontologic data, Field excursions.

**GEO 543: Invertebrate Paleontology (II)** **3(2+0+1)**

Systematic description of Cnidaria, Bryozoa, Brachiopoda, Annelida, and Arthropoda. Paleocology, Paleobiogeography. Origin and Evolution. Field applications.

**GEO 544: Invertebrate Palaeontology (III)** **3(2+0+1)**

Systematic description of the chiton, Gastropoda, Bivalvia, Cephalopoda, Echinodermata and Graptolithina. Paleocology, Paleobiology, Origin and evolution, Field applications.

**GEO 547: Advanced Microfossils** **3(2+0+1)**

Advanced study of Microfossils with special emphasis on the most important stratigraphic groups and their Taxonomy.

**GEO 550 : Advanced Palaeoecology** **2 (1+0+1)**

General view on Paleocology - Principals of ecological concepts – Diversity – Marine ecosystem – Ecological evidences from preservation - Ecological evidences from evolution – Structural evidences – Distribution of living organisms – Reef communities – Deep communities – Continental communities – Microfacies – Fossil communities – Evolution and fossil record – Extinction – Rate of evolution and extinction – Mass Extinction – Examples of evolution and extinction, Present and past comparison for organisms – Paleogeographic distribution of extinct organisms – Field applications.

**GEO 551: Advanced Biostratigraphy** **1(1+0+0)**

Introduction to biostratigraphy – Biostratigraphical units – Biozones – Correlation by fossils – Stratigraphic range and biozones – Fossil record and Faunal communities – Index fossils – Morphological characters – Ecological models – Quantitative and qualitative correlation methods

– Time and lithostratigraphic units – Correlation of strata according to their faunal content and facies changes – Recognizing of geological structures using Index fossils – Using computer in fossil application.

**GEO 554: Mining Geology**

**3(2+0+1)**

Application of Geologic Methods of Exploration and prospecting Mining Methods. Mapping Study of Geologic setting and structures of ore deposits. Evaluation and Estimation of ore reserves. Study of major associations of ore deposits.

**GEO 555: Advanced Hydrogeology**

**3(2+0+1)**

Study of the climatic factors that affect the aquifer recharge. Estimation of the amount of recharge reaching the saturated zone. Determination of the physical properties which control the flow through aquifers, such as porosity, permeability, hydraulic, conductivity, and storage. Analysis of pumping test data. Study of the partial differential equation that describe ground water flow through porous medium. Solving the flow equation by using numerical methods and simple computer models. Study of the chemicals dissolved in water and their thermodynamic equilibrium status in order to solve some related problems.

**GEO 556: Advanced Petroleum Geology**

**3(2+0+1)**

Sedimentary processes and accumulation of organic matter. Transformation of organic matter, Kerogen - Oil shales and petroleum. Nature of petroleum reservoirs Oil exploration. case histories.

**GEO 561: Advanced Geochemistry**

**3(2+0+1)**

The Phase Rule. Phase Relations and its relationship with textures and fine structures. Thermometry. Barometry. Mineralization, Deposition, and Replacement reactions. Magmatic Evolutions. Mineralizing solution, and distribution of chemical elements and complex Ions. Stable isotopes and their cycles. Late stage magmatic processes. Sedimentation, chemical sediments, and Hydrous solutions under low temperatures. Hydrogeochemistry. Application problems

**GEO 564: Geochronology**

**2(2+0+0)**

Absolute estimation and measuring geologic times. Study of fundamental measurements used in geologic research. Radioactive isotopes and their analytical methods. Potassium - Argon, Rubidium - Strontium, Uranium - Lead, Lead - Lead, and Carbon 12 - Carbon 14 systems and their Application to study the absolute ages of rocks especially in Precambrian Shields. Application problems.

**GEO 566: Mineral Geochemistry****3(2+0+1)**

Stability of minerals, Geochemistry of Transition and Trace Elements. Application of thermodynamic laws and crystal chemistry to study minerals and rocks Phase Equilibrium. Application problems.

**GEO 572: Applied Geophysics****3(2+0+1)**

Application of the reflection seismic and the gravity methods for prospecting of oil. Application of resistivity and refraction seismic methods for search of ground water. Application of the magnetic and electromagnetic methods for mineral exploration.

**GEO 573: Interpretation of Well Logging****3(2+0+1)**

Principles of well logging (self-potential and resistivity, neutron and sonic logs; applications in determining rock porosity, fluid content, type of rocks thickness, dip and strike of formation; utilization of logging data in determining production pay - zone, producing applications.

**GEO 586: Geodynamics****3(2+0+1)**

Study of earth major structures. Principles of isostasy. Orogenic movements, Continental drift, Sea - floor spreading potential causes of earth deformation. Methods of study. Gained results, Data processing. Recent hypothesis and theories.

**GEO 598: Seminar Geology****1(1+0+0)**

Discussion of various topics in geology, given by graduate students under faculty supervision.

**GEO 599: Special Topics****1(1+0+0)**

Lecturing and discussion of different geologic topics selected and given by the faculty member holding the class.

**GEO 600: Research Project****6(6+0+0)**

M. Sc. Thesis research project prepared by the student including field work, laboratory experiments and writing the thesis.



## GRADUATE STUDY PLAN FOR M.SC IN GEOPHYSICS

Level	Course	Name	Credit (Lecture + Exercise + Practical)
<b>First</b>	GPH 513	Advanced Seismic Exploration Methods	3 (2+0+1)
	GPH 521	Geophysical Applications in Groundwater	3 (2+0+1)
	GPH 565	Seismotectonics of the Arabian Plate	2 (2+0+0)
<b>Second</b>	GPH 531	Potential Field Theory	3 (2+0+1)
	GPH 553	Geophysical Data Processing	2 (1+0+1)
	GPH 575	Selected Topics in Geophysics	2 (2+0+0)
<b>9 credit hours to selected by the students from the following courses in the third level</b>			
<b>Third</b>	GPH 517	Quantitative Seismology	3 (3+0+0)
	GPH 519	Seismic Hazards	3 (3+0+0)
	GPH 535	Geodesy	3 (3+0+0)
	GPH 541	Environmental Geophysics	3 (3+0+0)
	GPH 543	Engineering Geophysics	3 (3+0+0)
	GPH 555	Advanced Hydrogeology	3 (2+0+1)
	GPH 586	Dynamic Geology	3 (2+0+1)
<b>Fourth</b>	GPH 593	Earthquake Engineering	3(3+0+0)
	GPH 600	Research Project	6 (0+0+6)
Total Credit Hours			30

### COURSE DESCRIPTION FOR M.Sc. IN GEOPHYSICS

#### **GPH 513: Advanced Seismic Exploration Methods**

**3(2+0+1)**

Review of theories of seismic waves, recording, and data acquisition. Land and marine refraction procedures. Analog and digital data processing of refraction and reflection. Digital filtering and computer techniques in seismic data processing. Time and depth sections in model interpretation. Case histories.

#### **GPH 517: Quantitative Seismology**

**3(3+0+0)**

Elastic theory. Application of differential equations in three dimension media. Studies of sources of earthquake mechanisms and dynamics. Solutions of focal mechanism, free oscillation of the earth. Application of inverse problems in seismology. Design and analysis of digital seismic networks.

**GPH 519: Seismic Hazards****3(3+0+0)**

Earthquake prediction. Mapping of maximum intensity and acceleration of earthquakes. Quantitative and qualitative studies on earthquake risk sources and modeling. Field expedition . Programs for assessment of earthquake risk.

**GPH 521: Geophysical Applications in Groundwater****3(2+0+1)**

The use of advanced geoelectrical, electromagnetic and radiometric methods in delineating surface and groundwater. Intercalation of fresh water and salt water. Determination of three dimension of aquifers. Observation of groundwater pollution. Interpretation of subsurface models . Selected world groundwater aquifers and case histories.

**GPH 531: Potential Field Theory****3(2+0+1)**

Potential field theory. Uses of the potential theory in gravity, magnetic and electrical methods. Upgraded technology in the interpretation of Free air, Bouguer, isostatic, and magnetic anomalies. Advanced technologies in the interpretation of electromagnetic curves and modelling of different gravity and magnetic maps.

**GPH 535: Geodesy****3(3+0+0)**

Determination of Geoid from gravity methods. Reference spheroid-absolute gravity observations and gravimeters. the earth's internal structure-attraction of standard bodies. Green's and Clairant's theories. Reference spheroid and standard gravity formulae. Stocke's integral masses outside the geoid, gravity anomalies . Geoid surveys, gravity as a guide to internal densities. Determination of the recent movements of the earth's crust.

**GPH 541: Environmental Geophysics****3(3+0+0)**

Uses of Geophysical methods (seismic, gravity, ground penetrating radar, electrical and radioactive) in solving environmental problems. Detection locations and follow-up of pollution. Determination of the suitability of sites for dumping all kind of wastes. Determination of current displacement and fracture zones. Geophysical assessment for insuring the safety of engineering structures and their environmental conservation. Case histories.

**GPH 543: Engineering Geophysics****3(3+0+0)**

Theory of rock mechanics. Applications of shallow geophysical techniques (seismic refraction and electrical resistivity) in investigating geological characteristics of building foundations, dams and hidden channels as well as determining mechanical behavior of soil. Using electrical methods in delineating fresh water/salt water interface. Applications of geothermal reservoir as an energy source.

**GPH 553: Geophysical Data processing****2(1+0+1)**

Review of Fourier Transforms, Fast Fourier Transforms and time series analysis. Fast Fourier transform application in window functions. Computer techniques in spectral analysis for global, regional and local data. Numerical solutions and digital applications of transforms and filters in the treatment of geophysics data. Examples and case histories.

**GPH 555: Advanced Hydrogeology****3(2+0+1)**

Lithostratigraphic investigation of water-bearing zones. Mechanics of water flow in porous media which includes water flow net and delineating of hydrogeological zones. Pumping tests. Design of groundwater wells. Chemical analysis and thermodynamics of ground water. Applications of geophysical methods in determining thickness of water-bearing zones. Case histories.

**GPH 565: Seismotectonics of the Arabian Plate****2(2+0+0)**

Studies on tectonics of the Arabian shield and plate. Historical and recent seismicity and its relation to active faults. Crustal deformation studies using global positioning system. Examples and case histories of crustal structures.

**GPH 575: Selected Topics in Geophysics****2(2+0+0)**

Discussion of recent and case history of research projects in geophysical domain and its application, variable subjects will be presented according to current research projects and the visiting professors.

**GEO 586: Geodynamics****2(2+0+0)**

Studies on earth structure. Isostasy of earth's crust. Geosynclines and continental drift. Ocean bottom spreading. Application of modern theories in interpretation of the probable reasons of earth movement.

**GPH 593: Earthquake Engineering****3(3+0+0)**

Earthquake motions and their engineering interpretations. Earthquake effect on foundations. Dynamic stability of earth structures. Earthquake codes for design and construction. Liquefaction and cyclic conditions.

**GPH 600: Research Project****6(0+0+6)**

M. Sc. Thesis research project prepared by the student including field work, laboratory experiments and writing the thesis.

## **FIELD & TEACHING FACILITIES**

Over the years the Department has developed the basic infrastructure and laboratories for imparting education to students as well as for faculty research. The Department maintains well equipped geological, hydrogeological and geophysical instrumentation laboratories, Geological Museum, educational tools including projection and reprographic facilities, multimedia projectors, well-furnished classrooms, seminar hall for graduate students, library, computational laboratories and e-Lab etc. These details are listed on the Department's website. Examples of these equipment and instruments are: Polarizing Microscopes, Scanning Microscope, XRF, XRD, Microprobe, GIS system, Absolute Gravity meter, Proton Precession Magnetometer, Broadband Seismometers, etc. The Library of the Department maintains a good collection of both Topographical and Geological Maps for greater part of Quadrangles in the Kingdom. The Department also has the basic infrastructure arrangement for Summer Field Training of the students.

## **DEPARTMENT LIBRARY**

The Department of Geology and Geophysics has a small library that is located on the second floor of building-4 of the College of Science. The library has a small reading hall surrounded by shelves that carry a good collection of textbooks, journals, geological and topographic maps. This library serves the students of the Geophysics Program in parallel with the University Central Library (Prince Salman library). Regarding the Geophysics Program, both libraries suffer from the lack of up-to-date geophysics books. However, this shortcoming is overcome by the use of the digital library that is made available to the University staff and students.



The library contains a good collection of textbooks, journals, geological and topographic maps.

## **GEOLOGICAL MUSEUM**

The Department maintains a Geological Museum for students' training and other educational programs where different types of rocks and minerals, identifying the earth's constituents, are maintained. The Museum was founded in 1406 H (1986) and is a valuable resource for students, research workers, and other enthusiasts with an interest to learn about geology in general, and Saudi Arabia in particular. This is more so, since Saudi Arabia encompasses a stable shield, huge sedimentary basins and a large igneous province where a wide variety of rocks, minerals and fossils are found. Moreover, geologists view Saudi Arabia as the gateway between Africa and mainland Asia; a fact of high importance in studying the natural history of the earth. The Museum supports teaching and research in Earth Sciences and Natural History at the University. It also supports active fossil-research program in the Department. Furthermore, as a museum of Practical Geology, it illustrates the application of geology to the useful purposes of life.

The Museum contains a large number of rock samples and fossils collected from Saudi Arabia and the regions worldwide; these are cataloged as rock, mineral and fossil specimens. It includes collections of minerals, rocks and fossils of more than 20,000 samples. Meteorites and their effects on the earth surface are also considered within the main topics of the museum. Mineral collections are exhibited according to the crystal chemical classification whereas geological processes form the basis of the rock and ore collections. Paleontological collections provide an introduction to the development of life on earth. The museum collection is furnished with modern show-cases.

The Museum is housed on the second floor in the Department. It is open to visitors daily for two hours between 10-12 a.m., from Saturday to Wednesday. Visits are organized by the Museum Supervisor, and arrangements for visits can be made by contacting the Chairman of the Department (Tel. 467-6212).



## Dinosaur model in the geological museum



Oil well model

## LABORATORY/RESEARCH FACILITIES

1. Petrographic Preparation Laboratory: equipped with Rock Cutting Machines, Polishing and Thin-section preparation.
2. Petrologic research microscopes with attached photographic facilities.
3. GIS Laboratory with a server, 5 terminals, one A0 scanner, one A0 plotter, and 3 color laser printers.
4. Geophysical exploration equipment, including 24-channel Seismometer, Magnetometer, Gravimeter, Resistivity meter and Ground Penetrating Radar.
5. Borehole logging and Video Imaging Systems.
6. Petroleum Geology Laboratory.
7. Surveying equipment, which include three electronic total station units, Hand GPS – 20 numbers, Theodolites - 2 numbers.
8. Computer Laboratory for processing and interpretation of geological, geophysical and hydrogeological data.



**Rock cutting laboratory**



**Thin sections prepared in rock cutting lab ready for examination in the petrographic laboratory**



**Mineralogy and Optics laboratory**





**Differential Global Positioning System (DGPS)**



**Resistivitymeter**



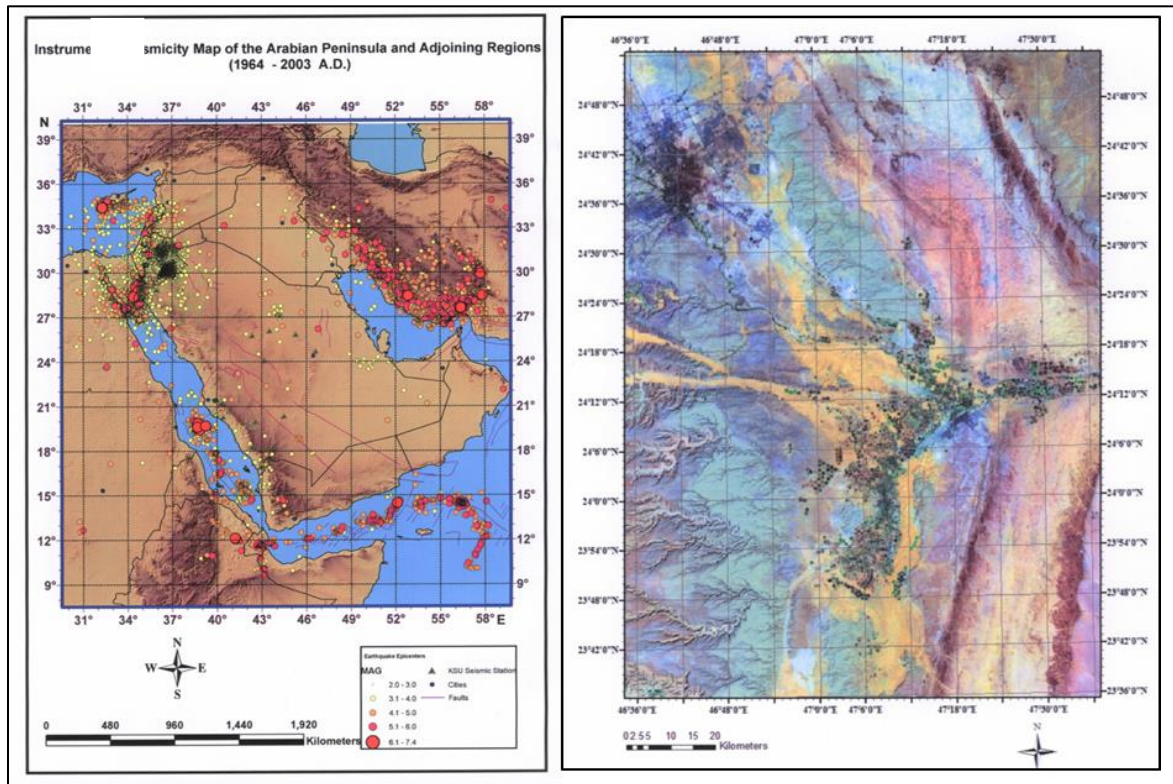
**Instruments for analyzing water quality**



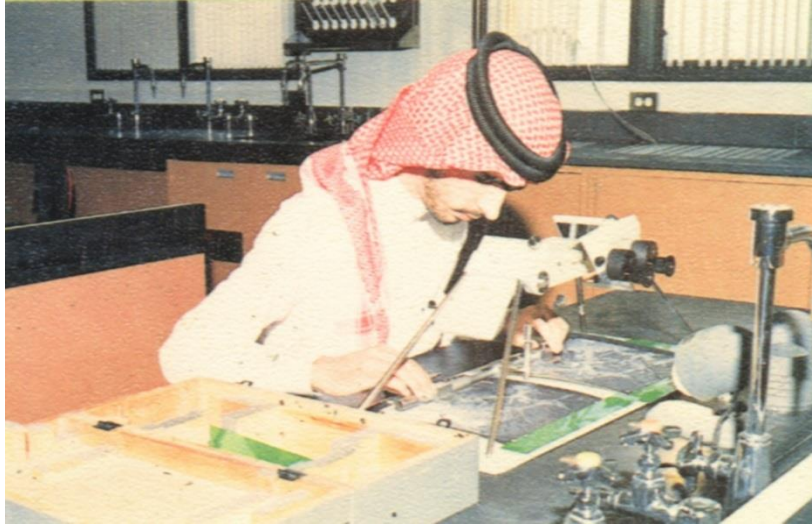
**Borehole logging and Video Imaging Systems**



**Geographic Information System (GIS) laboratory**



**GIS outputs: Distribution of earthquakes in the Arabian plate and Kharj satellite image**



**Stereoscope**



**Electromagnetic Survey Field Instrument (TEM54)**



**Rock magnetism unit (AF and Thermal demagnetization units, Spinner magnetometer)**



**Magnetometers and seismograph unit**



**Ground penetrating Radar (GPR) and its antennas**

## **TEACHING CLASSROOMS**

While The Department of Geology and Geophysics shares lecture halls with other College Programs within the College of Science, it also contains many laboratories, that are used as lecture classrooms and they are located in the Department. The capacity of the lecture classrooms varies from 20 to 40 students per classroom. Most of these classrooms are equipped with audiovisual facilities as follows Other than the normal classrooms with data show facility there are 3 smart classroom which provide and interactive learning environment for the students

<b>Lecturing classrooms</b>	<b>Location</b>	<b>Capacity</b>	<b>Facilities</b>
54 1B	Department	30	Data show
60 1B	Department	30	Data show
62 1B	Department	30	none
68 1B	Department	30	none
70 1B	Department	30	Data show
72 1B	Department	30	none
80/1 AB	Department	30	Smart Classroom
80/2 AB	Department	20	Smart Classroom
80/3 AB	Department	20	Smart Classroom
41 1B	College	40	audiovisual facilities
48 1B	College	40	audiovisual facilities

## **FIELD ACTIVITIES**

The field experience in the Geology and Geophysics Programs is achieved through short field trips (up to three days) and one long field training course (35 days). The field activities supervision staff help in planning and scheduling activities for the students, provide students with material support (geophysical tools, maps, air photos, software), moral support (advice, teaching, knowledge, experience, encouragement, etc), and assessment of performance, practices, activities and aptitude. The Students are thoroughly prepared, through briefings and descriptive material, for participation in the field activities through the following procedures:

1. Make an announcement to the students to join the field trip before at least the mid of the 2<sup>nd</sup> semester.
2. Study the students' applications and their academic applicability to join the trip.
3. Offer lectures to explain the plan and targets of the field trip and the students' duties and responsibilities.
4. Offer lectures on safety aids.
5. Distribute notices about the requirements the field (e.g. camp gear, clothing, shoes, drafting supplies, etc.).
6. Distribute notices about safety in the field and risks.
7. Arrange follow up meetings and classes with staff and students at least one week before the beginning of the field trip to allow the students to reflect on, and explore, the knowledge vistas of their field experience.

The Department arranges a summer field training camp for students in areas of geological interest within the Kingdom where the students are trained on geological and topographic mapping techniques, to study geologic relationships with emphasis on stratigraphic interpretations of rocks. The students are trained to identify, describe, classify and interpret the different faunal contents and different geological structures.

The students are also trained, in the field, on how to carry out different geophysical surveys including the seismic (refraction and reflection), gravity, magnetic, electrical, and electromagnetic methods. Training is also imparted to students on geophysical data analysis and their geologic interpretation. For effective training purposes, the students are grouped and guided by the Department's faculty and staff. Students are required to prepare written field reports upon completion of field training for evaluation.



Students studying the Cretaceous Aruma Formation during the field training



Geophysical survey during the field training



## **PROVISION OF FACILITIES AND EQUIPMENT**

Each year King Saud University Council assigns a budget for the provision of equipment to the College of Science and consequently the Dean of the College divides the received amount equally among the College departments and requests from the chairmen of the departments to submit their needs for equipment in relation to the available budget. The Equipment and Laboratory Committee in the Department submits to the Chairman a list of the required equipment in accordance with the priorities agreed upon by the Committee in the light of the questionnaire collected from the Department's faculty members.

The budget allocated for the Geological and Geophysical Programs depends on the available budget at the University to be distributed equally among the different departments, and not on the needs of the specific program. However, the program manager could ask for more funds, if he has a good specific reason, and within the availability of more funds in the University, this request could be met.

The Equipment and Laboratory Committee in the Department is responsible for setting the financial planning and management, and formulating the evaluation scheme, in coordination with the Chairman of the Department and with the previous the Chairman, to reach practical and realistic conclusions.

## **RESEARCH**

Faculty members have several research activities extending to the participation in projects supported and funded by international and national organizations. Furthermore, the University Research Centre annually calls for the submission of small research projects and funds them. Besides there are a number of recently completed, ongoing and approved projects under the National Program for Science and Technology (NPST) funded by the King Abdulaziz City for Science and Technology (KACST). All these projects are of strategic importance to the kingdom providing valuable scientific inputs. Most of the research is published in cited scientific journals and most faculty members supervise students' research projects both at the undergraduate and postgraduate levels, in addition to the field studies incorporated in these programs. Moreover, the Department is actively involved in enhancing the role of faculty members in conducting studies and projects for the community in the light of the expertise of the Department in offering solutions to local problems.

## **COLLABORATING INSTITUTIONS**

Regular contact is maintained with international scientists, keeping them abreast with developments and research in the Department, inviting their participation in scientific activities, and encouraging them to cooperate and participate in solving problems through joint projects and/or consultation.

In addition, the Department of Geology and Geophysics is very keen to invite specialists from industry to part- time teaching. Furthermore, specialists from industry and other governmental institutions co-supervise, jointly with faculty members, postgraduate research and undergraduate field studies. The matter of inviting a member from industry and/or government institutions to attend the meetings of the Department Council, to contribute to the teaching and the research policies, is being discussed by the different committees in the Department.

## **REVIEW OF COURSES**

A Course Planning Committee has been formed by the Department Council to study feedback received from the institutions that have employed the Department's graduates, and to summarise the important changes required in the courses. Also all course reports are reviewed to find out difficulties facing some lecturers in completing their course objectives due to lack of knowledge or skills.

The graduate surveys also give some indication of the missing areas that that should be included in the courses curricula. Finally, each faculty member was asked to rewrite his course syllabus to suit the results of this feedback, and some new courses were suggested by the Committee and the setting of the new syllabi was assigned to specialized faculty members.

The desired benchmark, for the course content in the Geology and Geophysics Programs, is that of the University of Calgary, Canada. All course contents have been updated and some new courses have been added to the study plans as part of the development plan in the Department.

## **STUDENTS' EVALUATION**

Each course taught by the Department undergoes students' evaluation. These evaluations are served electronically through the Deanship of registration and admission of King Saud University. An example of the forms used, and a full description of the evaluation process, can be found on the Deanship website. The numerical results of the course evaluations are made available to the University Council (University Rector, Dean, Head of Department), while the numerical scores and the comment sheets go directly to individual faculty members. The University Council uses these data to keep tabs on how students perceive the quality of the courses, and to look for problematic patterns with certain courses or faculty members. Individual faculty members use the evaluations to monitor the students' perception of their courses, and to make improvements and adjustments as appropriate.

## **GRADUATE STUDENT QUALITY AND PREPARATION**

The Department of Geology and Geophysics works closely with a fair number of its own students and other students from other universities, who pursue their postgraduate studies in the Department. This means that the Department has frequent opportunities to see how its own students' preparation compares with that of students educated elsewhere. This has long provided an implicit feedback loop with regards to observing our own graduates' preparation for advanced study.

## **EDUCATIONAL ASSISTANCE FOR STUDENTS**

The Department of Geology and Geophysics, College of Science and King Saud University systems provide the students with a comprehensive range of students' support services that help the students to achieve the optimal results from their studies. Here is a brief mention of such support services:

1. Every faculty member has at least two hours per week to meet the students in his office. These hours, which are called "office hours", are designed to provide the students with an opportunity to meet the course instructor during teaching days, help the students to make a regular review of their academic progress, and offer academic advice to the students.
2. Disabled students receive good care and attention from the University and the College by offering them suitable tools and facilities to simplify matters and make their study life easier.
3. A Student Handbook is provided to the new students. This handbook contains the essential information concerning departments, programs, courses, grading system, registration system and other available services. In addition, each department provides its own handbook helping the students with the available programs, courses, student assessment methods and grading system.
4. An academic advisor is available in order to monitor the progress and offer assistance and/or counseling the individual students especially those facing difficulties.
5. Librarian Facilities where there Prince Salman Library presents a strong research and learning base for all staff and students. In addition, the department's small library provides staff and students with periodicals, maps, Atlas, and geophysical and geological reports and textbooks.
6. The Students' activities such as sports, cultural, arts and social activities are available to students. These activities are fully supported and supervised by the students' administration.
7. The Students' accommodation: The students who come from outside Riyadh are offered accommodation in KSU students' hostels.
8. Medical and health support to the students is available at the University educational hospitals which are located on the University Campus.

## **RESEARCH CHAIRS**

The Research Chair Program at KSU is a key element in promoting the transition of the Kingdom to a knowledge-based economy. Research Chairs at the King Saud University have the mission of developing scientific research and to generate the knowledge and to adapt it to contribute in the national development and the creation of a distinguished generation of researchers and graduate students. A step in this direction was the establishment of two research chairs at the Department namely the Water Resource Exploration Chair in the Empty Quarter (Rub al Khali) and the Saudi Geological Survey Research Chair for Natural Hazards

### **Water Resources Exploration Chair in the Empty Quarter (WRECEQ)**

Water Resources Exploration Chair in the Empty Quarter (WRECEQ) is utilizing modern geophysical techniques to conduct water research and was established in 2009. Dr. Abdullah Al-Amri, Chairman of the Department and Director of the Seismic Studies Center, is the supervisor of the WRECEQ, which has encouraged KSU students to pursue new scientific water exploration research through specialized graduate programs and research centers at KSU. In addition, the Chair works to create national and international channels of communication in water exploration.

### **Saudi Geological Survey Research Chair for Natural Hazards (SGSRC)**

The Saudi Geological Survey Research Chair for Natural Hazards (SGSRC) was established in the year 2010 at the Geology and Geophysics Department of the King Saud University with the objective of strengthening and spreading innovative research in the field of geological hazards and related domains to support the distinctive participation in national and international research activities and to encourage the scientific publications related to this research in internationally renowned journals/periodicals. The chair is supervised by Prof Abdulaziz M. Al-Bassam and since its inception in 2010, its scientific committee members have published numerous research articles on reputed and peer reviewed international journals.

### **SAUDI SOCIETY FOR GEOSCIENCES**

Saudi Society for Geosciences is a scientific association, administratively and financially independent and is based in the Department of Geology and Geophysics, King Saud University and aims at achieving the following objectives

1. Development of scientific thought in the field of the Assembly and its development.
2. Achieving scientific communication to the members of the Assembly.
3. The provision of scientific advice in the Assembly.
4. Development of scientific and professional performance of members of the Assembly.
5. To facilitate the exchange of scientific production, and scientific ideas in the interests of the assembly between the relevant bodies and organizations within and outside the Kingdom.

More information about the society can be found at <http://www.geoscience.org.sa>

### **ARABIAN JOURNAL OF GEOSCIENCE**

The Arabian Journal of Geosciences (AJG) is the official refereed publication of the Saudi Society for Geosciences and is co-published quarterly with Springer, Germany. AJG is an international medium for the publication of significant original research studies, case studies, short communications, comprehensive and book reviews in all fields of geosciences, environmental sciences and related engineering and geographic subjects. AJG has been published since July 2008. Editor-in-Chief is Prof. Abdullah M. Al-Amri, Present Chairman of the Department. The Editorial Board of AGJ consists of academicians drawn from UAE, Kuwait, Egypt, Morocco, Turkey, Bahrain, France, U.K., Russia, U.S.A. and Germany, besides Saudi Arabia. The journal is listed in the Science Citation Index Journals.

The journals content, scope and online submission information can be obtained at <http://www.springer.com/earth+sciences+and+geography/journal/12517>


## **SEISMIC STUDIES CENTER**


The seismological observatory established in 29/12/1404H was renamed as the Seismic Studies Centre by the Higher Education Board on 29/3/1419H. The center is housed in the Department of Geology and Geophysics. Prof. Abdullah Al-Amri is the present Director of the Center. The vision of the center is to create earthquake database to support research and to assist the governmental authorities in Saudi Arabia for undertaking precautionary and mitigation measures in case of an earthquake. The main objectives of the center include:


1. To alleviate the risk of earthquakes by providing safety measures.
2. Coordination with the concerned authorities to set forth the standard specifications for earthquake resistant buildings, structures, bridges, supply lines, etc.
3. Conducting seismic hazard and environmental studies for densely populated areas, and regions of industrial and economic importance.
4. To create scientific and technical manpower in the field of earthquake studies.


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