|  |  |  |
| --- | --- | --- |
| **Course Title:** | Igneous Rocks |  |
| **Course Code:** | **Geo320** |  |
| **Program:** | **Geology** |  |
| **Department:** | **Geology and Geophysical** |  |
| **College:** | **Of Sciences** |  |
| **Institution:** | **King Saud University** |  |

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# A. Course Identification

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1. Credit hours:** | | | |  | | | | | | | | | | | | |
| **2. Course type** | | | | | | | | | | | | | | | | |
| **a.** | University | |  | | College | | |  | Department | | | | **X** | Others |  |  |
| **b.** | | Required | | | | **X** | Elective | | |  |  | | | | | |
| **3. Level/year at which this course is offered:** | | | | | | | | | | | | **5/ 1443** | | | | |
| **4. Pre-requisites for this course** (if any)**: (221 Geo) Mineralogy** | | | | | | | | | | | | | | | | |
| **5. Co-requisites for this course** (if any)**:** | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |

## 6. Mode of Instruction (mark all that apply)

| **No** | **Mode of Instruction** | **Contact Hours** | **Percentage** |
| --- | --- | --- | --- |
| **1** | **Traditional classroom** | 75 | 100 % |
| **2** | **Blended** |  |  |
| **3** | **E-learning** |  |  |
| **4** | **Distance learning** |  |  |
| **5** | **Other** |  |  |

**7. Contact Hours** (based on the academic semester)

|  |  |  |
| --- | --- | --- |
| **No** | **Activity** | **Contact Hours** |
| **1** | **Lecture** | 45 |
| **2** | **Laboratory/Studio** | 30 |
| **3** | **Tutorial** | - |
| **4** | **Others** (specify) | - |
|  | **Total** | 75 |

# B. Course Objectives and Learning Outcomes

|  |
| --- |
| 1. Course Description  * The course content includes the description, classification, composition, occurrence, distribution, nature and origin of igneous- and metamorphic rocks. It is designed to provide the basic principles and fundamental concepts of various rocks’ (Igneous, Sedimentary and Metamorphic) petrology ( the study of rocks’ occurrence, composition, structure, and petrogenesis), in light of recent advances on the subject, via lectures and laboratory investigations. * The latter include systematic identification of the various rock groups using both hand samples and thin sections under the polarizing microscope. Weekly laboratory assignments involving the detailed and systematic description of lithologic & petrographic varieties are given. A field report containing observation, analysis and interpretation of geological features introduced during the petrology field trip is required. |
|  |
| 2. Course Main Objective |
| * Describe all basic concepts of modern igneous and metamorphic petrology including   magma types, classification and distribution of igneous & metamorphic rocks.   * Develop an understanding of petrogenetic processes involved in the formation of magmas. * Describe factors controlling the process of metamorphism. * Determine metamorphic zones and facies based on mineral assemblages and interpret the P/T conditions of metamorphism. * Interpret the origin and evolutionary trends of igneous and metamorphic rocks based on chemical and mineralogical data. * Identify, using hand samples, the various rocks within the plutonic/volcanic groups, and identify the various types of thermal and regional metamorphic rocks. * Use the polarizing microscope to identify igneous and metamorphic rocks and their textures, then describe and write scientific petrographic reports. |

## 3. Course Learning Outcomes

| **close** | | **Aligned****PLOs** |
| --- | --- | --- |
| 1 | **Knowledge and Understanding** |  |
| 1.1 | **Define basic concepts related to Petrology evolution and its characteristics and processes** | PLO-1 Gain knowledge about the origin (Petrogenesis) of different and rocks’ various types and chemical and mineral’s composition |
| 1.2 | **Recall, describe, analyze, prepare, and revise the concept and understand the different behaviour and forming different rocks type via different stages and processes.** |
| 1.3 |  |  |
| 1... |  |  |
| **2** | **Skills :** |  |
| 2.1 | **List, define and state the magma behaviour via different diagrams as AFM, Igneous rocks classifications and their field relations, Tectonic movement, Volcanism and volcanoes, thermodynamics of the rocks.** | PLO-2Attain skills about different rocks type geologic features in relevant to their initiation environmental conditions |
| 2.2 | **Basic concepts, theories, and observational findings related to igneous, metamorphic and sedimentary rocks and processes as they pertain to the student’s knowledge emphasis** |
| 2.3 |  |  |
| 2... |  |  |
| **3** | **Values:** |  |
| 3.1 | **The ability to work effectively in groups, to exercise leadership, to act responsibly in the personal professional relationship.** | PLO-3 Communicate individually correctly, orally and written as well as acting properly in teamwork or among a groups |
| 3.2 | **Planning and taking responsibility for acquisitive self-learning.** |
| 3.3 |  |  |
| 3... |  |  |

# C. Course Content

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1 | Introduction to Petrology (Igneous, Metamorphic, and Sedimentary) | **4** |
| 2 | Igneous rock-minerals, and igneous rock’s chemistry classification | 6 |
| 3 | Origin and nature of magma, | **6** |
| 4 | Factors influencing magma crystallization | **5** |
| 5 | Petrology of the mantle, igneous rocks of oceanic and continental. | 4 |
| 6 | Sedimentary rocks/environments | **4** |
| 7 | Clastic/detrital and chemical and biological sedimentary rocks | 5 |
| 8 | Metamorphic rocks, classification and descriptions, agents of metamorphism. | **5** |
| 9 | Types of metamorphism | **3** |
| 10 | The Distribution of Igneous, metamorphic and sedimentary rocks in the field | **3** |
| **Total** | | 45 |

# D. Teaching and Assessment

## 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| **Code** | **Course Learning Outcomes** | **Teaching Strategies** | **Assessment Methods** |
| --- | --- | --- | --- |
| **1.0** | **Knowledge and Understanding** | | |
| 1.1 | **Define basic concepts related to Petrology evolution and its characteristics and processes** | *Lecturing, Homework, projects, tests and assignments.* | * **Preliminary qualifying quizzes and Homeworks major and final exams.** |
| 1.2 | **Recall, outline, analyze, prepare, and revise the concept and understand the different behaviour and forming different rocks type via different stages and processes.** | **Lecturing and Lab work** | * **Preliminary qualifying examination.** * **Pertain to the student’s research emphasis.**   **Oral and presenting a small project presentation, Lab’s evaluation Reports.** |
| … |  |  |  |
| **2.0** | **Skills** | | |
| 2.1 | * Compare and state the magma behaviour via different diagrams as AFM, Igneous rocks classifications and their field relations, Tectonic movement, Volcanism and volcanoes, thermodynamics of the rocks. | Homework assignments | * Preliminary qualifying examination.   Oral exams, Quizzes |
| 2.2 | * Explain, and interpret concepts, theories, and observational findings, or phenomena related to igneous, metamorphic and sedimentary rocks initiation processes as they pertain to the student’s knowledge emphasis | Students reading ability of library research, let students work in groups and discuss their ideas in solving complications | Checking through homework assignments, library’s research, writing assignments and carrying small projects. |
| … |  |  |  |
| **3.0** | **Values** | | |
| 3.1 | The ability to work effectively in groups, exercise leadership and write a scientific report. | Writing small project’s assignments, lab’s work reports | * Assignments of research library’s, writing.   Writing and presenting small projects |
| 3.2 | Planning and taking responsibility for grasping self-learning and working in teamwork. | Combining the internet and utilizing the computers technologies in the course necessities | * Reading some articles and summarizing them.   Evaluating the laboratory written reports |
| … |  |  |  |

## 2. Assessment Tasks for Students

| **#** | **Assessment task\*** | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | **Attendance, Homeworks (Questions, research on topics or literature reviews), and assignments** (class quizzes, scientific reports, field trip) | ***weakly*** | ***5%*** |
| **2** | **First Assessment Exam** | **6** | **10%** |
| **3** | **Presentation of Projects** | **8** | **5%** |
| **4** | **Practical exam** | **4 – 8 - 12** | **30%** |
| **5** | **Second Assessment Exam** | **13** | **10%** |
| **6** | **Final Exam** | **15** | **40%** |
| **7** | **Total** |  | 100% |
| **8** |  |  |  |

**\*Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

# E. Student Academic Counseling and Support

|  |
| --- |
| **Arrangements for the availability of faculty and teaching staff for individual student consultations and academic advice :** |
| * ***The faculty member by role and college regulation has to allocate six consultation office hours per week.*** * ***These consultation office hours should be scheduled, timed and to be put or hung on the front of the faculty member’s office door for seeking the students’ attention.*** |

# F. Learning Resources and Facilities

## Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | * ***Halder, S. K. and Josp Telstar. (2014). Introduction to mineralogy and petrology, Radarweg Amsterdam the Netherland.*** * ***Mauce, E. T. and Tisljar, J., (2001). Sedimentary petrology: an introduction to the origin of sedimentary rocks, Blackwell Science.*** |
| **Essential References Materials** | * ***Roland, B. F. (2014). Essentials of igneous and metamorphic petrology, Cambridge, University Press*** * ***Gatum S. (2014). Petrology: principals and practice, Springer Heidelberg New York Dordrecht London.*** |
| **Electronic Materials** | * **Teaching Phase Equilibria** * **John Winter home page** * **Atlas of Igneous and metamorphic rocks, minerals, and textures** * **Journal of Metamorphic Geology** * **THERMOCALC program and data set.** * **MetPetDB: A database for metamorphic petrology**. |
| **Other Learning Materials** | * **Basic Geochemistry: Origin and Distribution of the Elements** * **Basic Petrography** * **Crystallography** * **Ocean Crust and Ophiolites** * **Arc Magmatism** * **Phase Diagrams in Igneous Systems** * **Petrogenesis of Granitic Rocks** * **Radiogenic Isotopes in Geological Sciences.** * ***learning material (Videos, software … etc.).*** |

## 2. Facilities Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**  (Classrooms, laboratories, demonstration rooms/labs, etc.) | * **Classroom equipped with smart boards connected with networks, overhead projector.** * **The Lab equipped with a blackboard, data show projectors are aligned with the computer.**   **The Lab facilitated scientific materials such as hand specimens of rocks, rock-forming minerals, optical microscope, ……etc.** |
| **Technology Resources**  (AV, data show, Smart Board, software, etc.) | * ***Computer Lab should be equipped with at least 15 hardware, assisted with suitable software, one data show, and one smartboard. at least 15 systems.*** |
| **Other Resources**  (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | * ***Availability of chemicals, glassware and equipment relevant to the course material.*** * ***Safety facilities.*** |

# G. Course Quality Evaluation

| **Evaluation**  **Areas/Issues** | **Evaluators** | **Evaluation Methods** |
| --- | --- | --- |
| *Student* course questionnaire evaluation | students | Direct evaluation |
| -peer review | Faculty members | Direct evaluation |
| *Periodical departmental revisions of its methods of teaching.* | * + Faculty members get-together for and course discussion.   Program Coordinator. | Direct evaluation |
| *Course Coordinator assessment and course’s efficiency of teaching delivery.* | *Course Coordinator* | Direct evaluation |
| Committees of quality system review all deficiencies based on the students and faculty evaluation, | Program Coordinator. | Direct evaluation |
|  |  |  |
|  |  |  |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

# H. Specification Approval Data

|  |  |  |
| --- | --- | --- |
| **Council / Committee** |  | |
| **Reference No.** |  |
| **Date** | 4 / 6 / 1443 |