Level III Geology Courses
Department of Geography and Geology
The University of the West Indies, Mona Campus
Tel: 876-927-2728 or 876-927-2129    Fax: 876-977-6029
Email: geoggeol@uwimona.edu.jm
COURSE TITLE: RESEARCH PROJECT IN FIELD GEOLOGY
COURSE CODE: GEOL3100
CREDITS: 6
LEVEL: III
SEMESTER: 1 YEAR LONG
PREREQUISITES: GEOL2204 (GEOLOGICAL FIELD METHODS), AND any Three of:
   GEOL2201 (PALAEONTOLOGY)
   GEOL2202 (SEDIMENTARY GEOLOGY)
   GEOL2203 (PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS)
   GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
   G GEO2233 (WATER RESOURCES)

RATIONALE
A critical requirement for a 21st century geologist is the ability to undertake independent research
in the field and laboratory and prepare a detailed technical report documenting and interpreting
geologic observations. The course provides students the opportunity to take knowledge gained in
earlier courses and apply it to unique geologic problems, to make their own observations and
interpretations, and present these in oral and written formats.

COURSE DESCRIPTION
This course builds on Levels I and II of the geology curriculum using the skills, techniques and
theories covered in the foundation courses in igneous, metamorphic and sedimentary rocks,
palaeontology, water resources, structural geology and geological field techniques. This course is
a culmination of various techniques for collecting field and laboratory data in geology. Students
assisted by supervisors, will design a project, collect and analyse data independently, and present
their findings in an oral seminar and an extended written report. Potential thesis projects will
cover a range of topics in earth science such as geologic mapping, hydrologic studies,
sedimentologic and palaeontologic analyses of sections, and petrographic studies. Projects will
involve 3 weeks of field and/or laboratory work as approved for the specific research topic
chosen by the student and 2 semesters of work on the collation and analysis of data,
interpretation of results, and preparation of a seminar presentation and the production of a
gеологічного технічного звіту.

LEARNING OUTCOMES
On successful completion of this course, students should be able to:

- Systematically collect and interpret geologic data.
- Prepare a detailed field and lab notebook.
- Synthesize observations of geologic data from the field and laboratory.
- Interpret results in a broader geologic framework and critically compare their results to
  published results.
- Produce a geological report that will include
  1. A rationale for the project
  2. A review of the research literature on the topic
  3. A detailed description of methods, materials and results
4. Interpretation and discussion of the significance of the results in a local and regional context.
5. An extensive citation list using standard geological referencing style.

COURSE CONTENT

Projects will involve 3 weeks of field and/or laboratory work. For field-based projects, students will work in groups of two or three collecting geological data relevant to their project, inclusive of: constructing geological maps, preparing sedimentary logs, recording palaeontologic data, and measuring hydrological data. Laboratory work will include: construction of thin sections and analysis of thin sections using a petrographic microscope; examination of microfossils, using a binocular microscope, staining rocks to identify different minerals, and Geographic Information Systems.

Lecture topics will include: literature searches, scientific report writing, plagiarism, scientific ethics, preparing oral presentations and referencing.

Tutorial sessions will be used for one-on-one liaisons with the student’s supervisor on the development of the project methodologies, interpretations and conclusions.

Students will design a multimedia presentation on their research topic.

Students will prepare a technical report on their research project.

METHODS OF DELIVERY

The course will be delivered by means of 4 interactive, multimedia lecture presentations. Each student will be assigned a supervisor, who will work with students during the tutorial sessions. They will be required to complete fieldwork and/or laboratory analysis, depending on the nature of their project, which must be on an approved geological topic. In addition, students will attend 10 hours of seminars, during which they will give oral presentations on their projects. Each student will be required to design and present a multimedia presentation of their work. Students will be required to produce a technical geological report on the research project. Extensive use will be made of literature from libraries, websites and professional organisations. Difficult to access material will be made available through http://ourvle.mona.uwi.edu/

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<td>Lectures</td>
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<tr>
<td>Field/Lab Practical</td>
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<td>Seminar Presentations</td>
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<td>Tutorials</td>
<td>14</td>
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<td>Total</td>
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METHODS OF ASSESSMENT

Students will be assessed on the individual data they have collected during their field and laboratory work. Each student will prepare and deliver a seminar before the geology staff and their colleagues in the second semester outlining their research and their conclusions. Each
student will submit a technical report on their research project, which should include: an abstract, historical review, methods used, data collected, data interpretation, discussion, conclusion, bibliography. Students will be assessed on this report including the technical quality and on the overall presentation of the report.

Field and laboratory notes: 10%
Multimedia presentation: 10%
Technical report: 80%
Total 100%

REFERENCES

(a) PRESCRIBED


(b) HIGHLY RECOMMENDED


(c) USEFUL WEBSITES

Caribbean Journal of Earth Science: www.caribjes.com

SFMGeology: http://www.sfmgeology.com


Tectonic Analysis: http://tectonicanalysis.com/
COURSE TITLE: CAPSTONE: CARIBBEAN GEOLOGY
COURSE CODE: GEOL3102
CREDITS: 3
LEVEL: III
SEMESTER: 1
PREREQUISITES: GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
   AND One from:
   GEOL2201 (PALAEONTOLOGY)
   GEOL2202 (SEDIMENTARY GEOLOGY)
   GEOL2203 (PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS)
   GEOL2204 (GEOLOGICAL FIELD METHODS)
   GCEO2233 (WATER RESOURCES)

RATIONALE

Earth science graduates in the Caribbean require a detailed understanding of the present state of knowledge of the geology and tectonics of the region, its origin and development through time. A firm grasp of regional geology is crucial for employment in the Caribbean energy or mineral resource industries, in hydrogeology or environmental geology or in government service.

COURSE DESCRIPTION

This course will be an intensive review of the geology of the Caribbean and surrounding regions. The course will focus on the tectonics and geologic history of the Caribbean and its relationship to global tectonic, environmental and evolutionary history. Course content covers modern tectonics of the region as well as the Caribbean’s origin and development through time focusing on particular regions and processes especially as they pertain to the distribution of energy and mineral resources and the susceptibility of the region to geologic hazards.

Caribbean Geology is considered a ‘capstone’ course for the Geology undergraduate degree and students are expected to be able to critically read and understand modern scientific research on the Caribbean.

LEARNING OUTCOMES

On successful completion of this course, students should be able to:

- Work in small groups to be able to solve geological questions in the Caribbean region.
- Synthesize disparate lithologic, stratigraphic, palaeontologic, structural, and seismic data from the Caribbean region and relate it to broader tectonic and environmental frameworks.
- Compare and contrast the geologic evolution of different regions in the Caribbean.
- Critically assess the strengths and weaknesses of different models for the tectonic origin and development of the Caribbean plate.
- Argue how the regional differences in geotectonic evolution impact and relate to the distribution of geologic energy and mineral resources and the distributions of geohazards throughout the Caribbean.
COURSE CONTENT

Modern Caribbean Tectonics and Seismicity and the geological data behind this understanding.
Structure, Origin and Tectonic History of the Caribbean Sea Floor.
Geotectonic History and Resources of the Greater Antillean Region.
Subduction History of the Lesser Antilles Arc.
Structure and History of the Barbados Accretionary Prism.
Geotectonic Evolution of the Southern Caribbean Deformation Belt and Trinidad and Tobago.
Tectonic Terranes of Central America.
Geologic Overview of the Gulf of Mexico, Florida and Bahamas Region.
Quaternary Sea Level Changes and Caribbean Coastal Geology.
Cretaceous through Recent Historical Biogeography of the Caribbean.
Geologic History of Caribbean Reefs.

METHODS OF DELIVERY

The course will be delivered by means of 24 interactive, multimedia presentations to deliver new material and engage the students into understanding the complex geological evolution of the Caribbean region and its constituent parts.

Students will work as teams in small groups (3 or 4 individuals) and undertake a literature-based research topic on Caribbean geology, which will be delivered as a conference-style presentation with strict time limits for the presentation and questions. Tutorial sessions will be used to review the lecture material and discuss outside reading related to the students’ seminar topics.

Course material will be made available electronically via OURVLE at http://ourvle.mona.uwi.edu/. This will include PowerPoint presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

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<tr>
<th>Contact Hours</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>24</td>
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<tr>
<td>Seminar Presentations</td>
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<tr>
<td>Tutorials</td>
<td>10</td>
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<td>Total</td>
<td>39</td>
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METHODS OF ASSESSMENT

The course assessment will be as follows:

A 2-hour written examination to evaluate the students overall understanding of the Caribbean region and the students in depth awareness of a particular topics. Credit will be given to well-written answers that demonstrate external reading and not just a simple memorization of class material.

An oral seminar presentation presented by each group of students in a ‘mini-conference’ environment with strict presentation time limits and ample time for questions. Students should all be prepared to make the presentation and field
questions; at the time of the presentation, one will be randomly chosen to talk and
the others field the questions.

One 2-hour written examination:  70%
One seminar presentation:  30%
Total  100%

REFERENCES

(a) PRESCRIBED


(b) USEFUL WEBSITES

Caribbean Basins, Tectonics and Hydrocarbons, University of Houston, Department of Earth and
Atmospheric Sciences: [http://cbth.uh.edu/](http://cbth.uh.edu/)

COURSE TITLE: SEDIMENTOLOGY AND FACIES ANALYSIS
COURSE CODE: GEOL3104
CREDITS: 3
LEVEL: III
SEMESTER: 2
PREREQUISITES: GEOL2202 (SEDIMENTARY GEOLOGY)
   AND One from:
   GEOL2201 (PALAEONTOLOGY)
   GEOL2203 (PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS)
   GEOL2204 (GEOLOGICAL FIELD METHODS)
   GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
   G GEO2233 (WATER RESOURCES)

RATIONALE
An understanding of ancient sedimentary systems is important in exploiting natural resources, including industrial minerals, petroleum and water. Sedimentary systems are examined and understood using facies (lithofacies, ichnofacies, microfacies and biofacies) analysis and palaeoecology, which relates ancient sedimentary systems to modern analogues, whereas sequence stratigraphy relates the sedimentary architecture to changes in sea level. This course will train students in understanding and using these techniques, thus enabling them to make an effective contribution to the exploration and exploitation of natural resources, which is of utmost importance in enhancing economic development within the region.

COURSE DESCRIPTION
This course provides advanced skills suitable for understanding how sedimentary rocks were formed. Different types of facies analysis are presented: lithofacies uses the physical features of the rock (grain size, mineralogy, sedimentary structures, colour); ichnofacies involves looking at the trace fossils in a rock; microfacies uses the microscopic features of a rock (particularly for carbonates); and biofacies and palaeoecology uses the fossils present in a rock. Facies models will be introduced for common clastic and carbonate rocks encountered in the Caribbean region. Sequence stratigraphy, as a science, looks at the role that sea-level fluctuations have in controlling the stratal architectures that are formed, and students will undertake laboratory practical exercises on sequence stratigraphy, and will also be able to apply the concepts in the field.

LEARNING OUTCOMES
On the successful completion of this course students should be able to:

- Performa facies analysis of a sedimentary sequence.
- Record, analyse and relate a series of facies to a standard facies model.
- Perform palaeoecological and biofacies analyses of a sequence of carbonate rocks.
- Describe and interpret and critically assess the microfacies of a serious of carbonate rock samples and thin sections.
• Identify trace fossils and place them in an ichnofacies which they can relate to their depositional environment.
• Critically assess the concepts of sequence stratigraphy apply them in laboratory exercises and in the field.

COURSE CONTENT

Lithofacies and facies analysis: the method of facies analysis and the description of lithofacies.
Sequence stratigraphy: the concepts of sequence stratigraphy, as developed by Exxon and its application to laboratory and field problems.
Ichnofacies: the recognition of trace fossils and ichnofacies, and their value in understanding depositional environments.
Microfacies: description and interpretation of allochems and textures under the petrographic microscope, and their use in understanding and distinguishing different carbonate facies models (ramps, rimmed shelves and platforms).
Biofacies: the use of fossils in understanding depositional environments.
Clastic facies models: the development of facies models for selected clastic environments including alluvial systems, deltaic systems, shallow-water shelves and deep-water basins.

METHODS OF DELIVERY

The course content will be delivered by interactive lectures (18 contact hours) using multimedia presentations. Lecture presentations will be used to provide new information and engage the students in the different topics covered by the course.
Laboratory exercises (24 contact hours) will allow students to develop the knowledge they have acquired in the lectures to solve geological problems related to facies and sequence stratigraphy. Laboratory exercises are the primary way of developing skills in recording, analysing and deducing methods of formation of sedimentary rocks.
During the field class (6 contact hours), students will be able to apply the concepts they have learned in the lectures and laboratory exercises to sedimentary successions in the field. The field class will examine a series of fluvial-deltaic and carbonate depositional systems in St. Thomas, Jamaica where students will be able to undertake facies analyses and to apply the concepts of sequence stratigraphy.
Tutorials (6 hours), will involve the examination and discussion of the course material and practical items not directly covered in the lectures or practical exercises in order to develop technical and problem based-learning skills.
Course material will be made available electronically via OURVLE at http://ourvle.mona.uwi.edu/This will include PowerPoint presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.
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<tr>
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<tbody>
<tr>
<td>Lectures</td>
<td>18</td>
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<tr>
<td>Laboratory classes</td>
<td>24</td>
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<td>Tutorials</td>
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<tr>
<td>1-day Field trip</td>
<td>6</td>
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<td><strong>Total</strong></td>
<td><strong>54</strong></td>
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**METHODS OF ASSESSMENT**

A 2-hour written paper will test the degree to which students have grasped the key concepts of the course using short-answer questions and their in-depth understanding of a part of the course through a longer structured answer. Each third practical will have an assessed component; students will learn the concepts and methods of application in the first two practicals and be assessed on a component of the third practical; this formally separates teaching from assessment. Being able to record field observations is a critically important skill, and field observations are used to interpret processes and deduce depositional environments. Students will be assessed on their ability to separate observations, interpretations and conclusions.

The course assessment will be as follows:

- One 2-hour written examination: 50%
- Four assessed laboratory practicals (10% each): 40%
- Field notebook: 10%
- **Total** 100%

**REFERENCES**

(a) **PRESCRIBED TEXT**


(b) **HIGHLY RECOMMENDED**


(c) **USEFUL WEBSITES**

SFMGeology: [http://www.sfmgeology.com](http://www.sfmgeology.com)
UGA Stratigraphy Lab: http://strata.uga.edu/sequence/seqStrat.html

Slumberger Sequence Stratigraphy site: http://www.glossary.oilfield.slb.com/Display.cfm?Term=sequence%20stratigraphy

SEPM Strat site: http://www.sepmstrata.org/Page.aspx?pageid=1
COURSE NAME: PETROLEUM GEOLOGY
COURSE CODE: GEOL3105
LEVEL: III
SEMESTER: 1
PREREQUISITES: GEOL2202 (SEDIMENTARY GEOLOGY)
    AND One from:
    GEOL2201 (PALAEOONTOLOGY)
    GEOL2203 (PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS)
    GEOL2204 (GEOLOGICAL FIELD METHODS)
    GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
    GGeo2233 (WATER RESOURCES)

RATIONALE

Hydrocarbons are the main source for energy in the world today, and finding and developing new reservoirs employs large numbers of geologists around the world. This course introduces the principles of petroleum geology and how to find petroleum reserves; it is a fundamental requirement for geology students who wish to pursue postgraduate studies in the petroleum geology field and for those who intend to seek employment within the petroleum industry sector.

COURSE DESCRIPTION

This course develops advanced skills suitable to understanding petroleum systems: that is, the formation of petroleum, and the exploitation of resources. The course covers topics of petroleum systems, the formation of source rocks, the chemicals in petroleum, migration and reservoirs, and the processes involved in the search and development of hydrocarbon reserves. The course also examines the classic petroleum systems seen in the Greater Caribbean region including the Gulf of Mexico, Trinidad and Venezuela, and upcoming frontiers in the Caribbean (Cuba, Jamaica and Honduras).

LEARNING OUTCOMES

On the successful completion of this course students should be able to:

- Describe and evaluate the working of an active petroleum system
- Explain and analyse the models of source rock formation and be able to identify source rocks in hand specimen and in the field.
- Characterise the types of hydrocarbon reservoirs, traps and seals and how petroleum is trapped in reservoirs.
- Apply the geophysical tools necessary for successful oil exploration
- Critically assess the steps necessary for the successful search and exploitation of hydrocarbons in the wider Caribbean.
COURSE CONTENT

The concept of the Petroleum System: the fundamental concept in understanding and exploiting petroleum.
Source rock formation and evaluation: how sources rocks are formed and how we evaluate source rocks in terms of class and maturity.
Chemical components of petroleum: the various organic compounds found in petroleum and their geochemical evaluation.
Primary and secondary migration of hydrocarbons: the movement of hydrocarbons from their area of formation to a reservoir rock.
Reservoir traps and seals: the physical barriers to hydrocarbon migration that lead to accumulations in reservoirs.
Searching for hydrocarbons: the role of the petroleum geologist in searching for hydrocarbon reserves.
Geophysical methods: the use of different methods, such as gravity and palaeomagnetics, seismics and wireline logs, in the search for hydrocarbons.
Hydrocarbon provinces of the Caribbean and the Gulf of Mexico: a review of the occurrences of petroleum in the Greater Caribbean region.

METHODS OF DELIVERY

The course content will be delivered by interactive lectures (18 contact hours) using multimedia presentations. Lectures presentations will deliver the new subject matter of the course, and engage the students in the importance of different parts of a petroleum system.
Laboratory exercises (24 contact hours) will support the material delivered in the lectures, and will develop the skills of the student into understanding and interpreting different petroleum systems.
During the field class (6 contact hours), students will be able to examine and record different components of a petroleum system in the field: high-quality source rocks, reservoir rocks and seals. The field class will examine deposits in central Jamaica that have been used to develop Jamaica’s search for petroleum.
Tutorials (6 contact hours). Tutorials will involve interactive discussions on petroleum systems and petroleum exploration in the Greater Caribbean region.
Course material will be made available electronically via OURVLE at http://ourvle.mona.uwi.edu/This will include multimedia presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

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<td>Tutorials</td>
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<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>39</strong></td>
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METHODS OF ASSESSMENT

The 2-hour written examination will test the students’ grasp of the concepts of petroleum geology through a series of short answer questions. A petroleum geologist needs an understanding across the subject, and therefore a large number of short answer questions are a better assessment than a few essay-type questions. Students will develop the important skill of keeping a detailed field notebook and separating observations from interpretations. Each third practical will have an assessed component; students will learn the concepts and methods of application in the first two practicals and be assessed during the third practical; this formally separates teaching from assessment.

The course assessment will be as follows:

One 2-hour written examination: 50%
Field notebook: 10%
Four laboratory practicals (10% each): 40%
Total 100%

REFERENCES

(a) PRESCRIBED


(b) HIGHLY RECOMMENDED


(c) USEFUL WEBSITES

SFM Geology: [http://www.sfmgeology.com](http://www.sfmgeology.com)

Geological Society of Trinidad and Tobago [http://www.gstt.org/](http://www.gstt.org/)


COURSE TITLE: GEOPHYSICS AND SEISMICITY
COURSE CODE: GEOL3107
CREDITS: 3
LEVEL: III
SEMESTER: 1
PREREQUISITES: GEOL2204 (GEOLOGICAL FIELD METHODS)
   AND One from:
   GEOL2201 (PALAEONTOLOGY)
   GEOL2202 (SEDIMENTARY GEOLOGY)
   GEOL2203 (PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS)
   GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
   GGE2233 (WATER RESOURCES)
   OR Two Level II Physics Courses (Physics Majors)

RATIONALE
Geophysics is an interdisciplinary physical science concerned with the nature of the earth and its environment and seeks to apply the knowledge and techniques of physics, mathematics and chemistry to understand the structure and dynamic behaviour of the earth and its environment. Geophysics prepares students for a broad scope in future work and professional career focus in relation to the exploration of resources such as oil, gas, minerals, and water. Geophysics is now used as an important tool in the management of resources and the associated environmental issues and engineering design and assessment.

COURSE DESCRIPTION
This course provides an introduction to the fundamental principles of “solid earth geophysics”, the study of: (1) the physical properties of the Earth’s surface and interior (such as seismological properties of the Earth’s interior, the gravity field, and the magnetic field), and (2) the manner in which internal processes produce features and phenomena that are observed at (or near) the surface of the Earth (such as geology, earthquakes, volcanoes, and the effects on plate tectonics) and (3) the application of geophysical methods to environmental, engineering and urban studies, groundwater, geotechnical investigations and to resource application. The course content and presentation are designed to accommodate those students with interest in environmental, geotechnical and geological subjects but not necessary with strong background in mathematics or physics. Students will be exposed to selected geophysical field techniques to assess real world environmental and engineering problems.

LEARNING OUTCOMES
On the successful completion of this course students should be able to:

- Describe, discuss and explain the principles, applications and limitations of geophysical methods
- Plan and conduct simple geophysical surveys and analyse, process and interpret raw geophysical data
- Critically assess data quality and the significance of data, both geophysically and geologically, in terms of environmental and engineering issues
• Model and interpret geophysical data to provide simple geological solutions to problems and critically assess the limitations of such interpretations.

COURSE CONTENT

Introduction to Geophysics: Applications and techniques; planning a geophysical survey; matching geophysical methods to applications; Forward and Inverse problems.

Gravity Methods: Introduction to gravity methods; physical measurement; gravity meters; correction of gravity data; interpretation of gravity data.

Geomagnetics: Basic concepts and units of geomagnetism; magnetic instruments; survey design; interpretation of data.

Applied Seismology: Introduction and principles; ray path geometry in layered earth; seismic energy source; detection and recording of seismic waves; applied techniques; Refraction and Reflection survey methods.

Electrical Resistivity Methods: Introduction and basic principles; Electrical Resistivity Arrays; survey design and data interpretation.

Electromagnetic Methods: Introduction and principles of EM surveys and Applications.

Ground-Penetrating Radar: Introduction and principles; dielectric properties of earth’s materials; data acquisition modes; survey design and applications; data processing and interpretation.

Case studies: Overview of geophysical techniques in engineering, environmental geology, oil exploration, archaeological studies and forensic applications.

A field trip in which students will use Electrical Resistivity, Ground Penetrating Radar and Seismic Refraction survey techniques to identify subsurface geology, aquifers, lithological boundaries, and other engineering and environmental issues.

METHODS OF DELIVERY

The course content will be delivered by interactive lectures (18 contact hours) using multimedia presentations. In the laboratory sessions (24 contact hours), students will be engaged in the practical applications of geophysics, using real data to solve problems, and applying software and tools for modelling of geophysical and geological problems. Additionally, students will have one field trip (6 hours) to see the real application of some of the techniques, such as electrical resistivity, seismic refraction and GPR to solve an engineering problem and / or an environmental problem, e.g. aquifer boundary, depth to bedrock, shear wave velocity etc. Small group discussions and problem solving will be facilitated though tutorial sessions (6 hours).

Course material will be made available electronically via OURVLE at http://ourvle.mona.uwi.edu/ This will include multimedia presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

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<tr>
<td>Lectures</td>
<td>18</td>
<td>18</td>
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<tr>
<td>Laboratory classes</td>
<td>24</td>
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<tr>
<td>1-day field class</td>
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<tr>
<td>Tutorials</td>
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<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>39</strong></td>
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METHODS OF ASSESSMENT

The assessment for the course will include an in-course test, five laboratory exercises, a field report and a two-hour written examination. The in-course test will be held in week six and will test the subject matter delivered in lectures from Weeks 1-5. Five laboratory exercises will be assessed which cover the content of the course, with the separation of learning and assessment components. Students will submit a report on the field trip, which will include: field methodology, data processing, analysis and conclusions. The written examination will test the key cumulative content of the principles and applications of the course delivered during the semester.

One 2-hour written examination: 50%
One 1-hour in-course test: 20%
Five laboratory assignments (4% each): 20%
Field report: 10%

Total 100%

PRESCRIBED TEXTS

(a) PRESCRIBED


(b) HIGHLY RECOMMENDED


(c) USEFUL WEBSITES

USGS Online Resources. http://water.usgs.gov/ogw/bgas/g2t.html#info

COURSE TITLE: METALLIC ORES AND INDUSTRIAL MINERALS
COURSE CODE: GEOL3108
CREDITS: 3
LEVEL: III
SEMESTER: 1
PREREQUISITES:
   GEOL2203 (PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS)
   AND One from:
   GEOL2201 (PALAEONTOLOGY)
   GEOL2202 (SEDIMENTARY GEOLOGY)
   GEOL2204 (GEOLOGICAL FIELD METHODS)
   GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
   Ggeo2233 (WATER RESOURCES)

RATIONALE

Modern life would be impossible without supplies of metals, industrial minerals and building materials, and an important role for geologists is discovering and exploiting new resources. With an emphasis on the region, it is important for Caribbean geology students to understand the characteristics of metal ores, industrial minerals and building materials; and to be able to understand the methods used in the exploitation of these resources, in order to gain employment within the mineral sector.

COURSE DESCRIPTION

There are many minerals on the planet, and many of these minerals have important value for mankind. These minerals can be divided into three basic groups, ores (minerals from which metals are extracted), industrial minerals (non-metallic minerals that are used in industry) and construction materials (building stones, cement, aggregates, etc.). In this course students will develop their knowledge base about these types of minerals, how to identify them, and their uses, and acquire the skills to evaluate a reserve. The course will particularly emphasize minerals found within the Caribbean region.

LEARNING OUTCOMES

On the successful completion of this course, the student will be able to:

- Recognise, describe and evaluate the different occurrences of metallic minerals.
- Characterise and review the various kinds of industrial minerals and construction materials.
- Present a seminar on a metallic, industrial or construction mineral and field a series of questions that would develop skills in multimedia systems.
- Critically assess a resource of a metallic, industrial or construction mineral occurrence.
- Perform an indicative evaluation of the economic importance of a resource.
COURSE CONTENT

- Definitions for resources and reserves; basic principles of minerals industry finance. Abundances of metals in the Earth’s crust.
- Overview of the natural processes that produce metallic mineral deposits:
  - 1) Intrusive and volcanic rocks;
  - 2) Metamorphic and atmospheric processes.
  - 3) Sedimentary processes and chemical precipitation.
- Exploration methods for metallic minerals:
  - 1) Geology, structure and mineralogy.
  - 2) Geochemistry, geophysics and remote sensing.
- The metallic mineral potential of Jamaica and the Caribbean.
- How a geologist contributes to the development of metallic mineral occurrences: field mapping, sampling, core logging, data/information interpretation from field and laboratory, report writing.
- Rare Earth Elements.
- Construction materials (building stones, aggregates, cement)
- Industrial minerals
- Resource assessments for metallic and industrial minerals.

METHODS OF DELIVERY

The course is delivered using interactive lectures, laboratory assignments, tutorials, a visit to a laboratory working with minerals and a seminar series. The lectures will deliver material to develop the students’ knowledge base, and provide them with the skills needed to enter into the various different mineral industries. Laboratory exercises during the 6 practical classes will give a hand on approach, allowing students to study different minerals, and also to undertake resource evaluations; this will culminate with a visit to a laboratory undertaking mineral testing and analysis. The course will also involve a series of seminars, where each seminar will involve a presentation by a small group of students on an assigned topic (with each student delivering a part), following which there will be an interactive class discussion. The seminar series will allow students to develop team work skills.

Course material will be made available electronically at http://ourvle.mona.uwi.edu/. This will include PowerPoint presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

<table>
<thead>
<tr>
<th>Contact Hours</th>
<th>Credit Hours</th>
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<td>Laboratory visit</td>
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<td>Seminars</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
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</tbody>
</table>
METHODS OF ASSESSMENT

The course will be assessed by a 2-hour written examination covering the key concepts delivered in the course, a seminar and class discussion, and two assessed practicals. The practicals will have distinct learning and assessment components, the latter comprising an assessed mineral identification exercise and a resource assessment exercise.

One 2-hour written examination 50%
One 2 hour- seminar 30%
Laboratory exercise on mineral identification 10%
Laboratory exercise on resource assessment 10%
Total 100%

REFERENCES

(a) PRESCRIBED


(b) RECOMMENDED


(c) USEFUL WEBSITES


British Geological Survey: [http://www.bgs.ac.uk/](http://www.bgs.ac.uk/)
Limestone terrain (karst topography) is a significant component of many landscapes within the Caribbean region. Karst is terrain with distinctive landforms and drainage arising from the greater rock solubility in natural waters than other rock types and landscapes. The process is dominated by chemical activity, and true karst landforms result largely from the dissolution, while many karst areas are associated with subterranean drainage systems. Karst terrain is therefore sensitive to environmental change, and knowledge of how karst systems work is essential, not only to a scientific understanding of the interaction between karst form and process, but also in order to improve land management practices in karst terrain. An understanding of how karst works is also critical to its sustainable development, while preserving its unique ecological and environmental characteristics.

Coastal systems are also a critical component of the Caribbean landscape. Many key urban centres and ports across the Caribbean are located on the coast. Coastal environments are therefore an essential component of the economic well being of many Caribbean islands, through such activities as tourism, shipping, fisheries and mining. Coasts are also dynamic environments, sensitive to stresses from sea-level change, storm impacts and human-induced coastal change. An understanding of how coastal geomorphic systems work is therefore essential to the sustainable development of the Caribbean coastline and to minimize the impacts of natural and human-induced disturbance of the coast.

COURSE DESCRIPTION

This advanced course provides an in-depth examination of the key concepts in critical aspects of karst and coastal geomorphology. The course builds on the core ideas and concepts in modern geomorphology from Level 2, and also develops the applied aspects of karst and coastal systems. The course further prepares UWI geosciences graduates for the 21st century, by exposure to critical thinking, effective communications and self-motivated learning. The course provides students with wide-ranging knowledge of karst and coastal geomorphic systems and landform interpretation.

The course examines modern approaches to the analysis and interpretation of karst and coastal geomorphic processes and landforms, with emphasis on Caribbean material. The first part of the course is an in-depth examination of karst geomorphic systems and landscapes. It examines the material properties of Caribbean carbonate rocks in relation to their interaction with the environment. Both lithological and environmental controls on limestone dissolution are also examined. Karst landform assemblages are further analyzed and interpreted within the Caribbean
context. Applied Karst geomorphology is also explored through limestone terrain land management problems, and both natural and anthropogenic karst hazards. The second part of the course is an examination of coastal geomorphology from a Caribbean perspective. It examines the geomorphic legacy of late Quaternary and Holocene sea-level change. The major energy sources for Caribbean coastal change and contemporary coastal processes are also discussed. Advanced analysis of natural and human-induced coastal management problems is also examined.

LEARNING OUTCOMES

On successful completion of this course, students should be able to:

- Describe and analyze the interaction between rock material properties, karst processes and karst terrain systems.
- Describe and analyze the major types of karst terrain systems within the wider Caribbean region and interpret their modes of formation.
- Examine the geomorphic legacy of sea-level change, particularly within the Caribbean region.
- Examine contemporary coastal processes and landforms, and analyze the relationship between process and form within Caribbean coastal geomorphic systems.
- Apply their scientific and theoretical knowledge of karst and coastal systems to an examination of natural and anthropogenic hazards in limestone terrain and natural hazards at the coast.
- Develop a strategy for the sustainable development of karst and coastal systems, while preserving their unique ecological and environmental characteristics.

COURSE CONTENT

KARST GEOMORPHOLOGY

Karst Rocks and Material Properties: an examination of the main carbonate rock characteristics; a description and explanation of the phenomenon of case-hardening; an examination of the importance of small- and large-scale structural characteristics carbonates to landform development.

Karst Processes and Controls: examination and analysis of carbonate dissolution and physical processes within karst terrain; examination of the environmental and geological controls on karst processes.

Karst Landform Systems: examination and interpretation of doline, cockpit and tower karst, together with other karst topography, with particular emphasis on Caribbean landscapes; an analysis of karst using morphometry and modeling.

Applied Karst Geomorphology: examination and analysis of the natural and anthropogenic hazards in karst; an analysis of karst terrain in the context of land management and sustainable development.
COASTAL GEOMORPHOLOGY

The Geomorphic Legacy of Sea-level Change and Paleo-Coastal Environments: an examination of the landform features preserving evidence of sea-level change during the late Quaternary and Holocene, with emphasis on the Caribbean Basin; an interpretation of the geomorphic evidence, in terms of the extent and timing of the sea-level change.

Coastal Forces and Processes: an examination of tides, waves and nearshore currents, with emphasis on the Caribbean; the importance of storms to coastal change within the Caribbean; in-depth analysis of the main geomorphic processes operating at the coast.

Coastal Landform Systems: a detailed examination of coastal landforms within the Caribbean region; cliffs and rocky shorelines; analysis of attached and detached beach systems.

Applied Coastal Geomorphology: an examination of the geomorphic impact of coastal hazards; an analysis of coastal management problems inherent within the Caribbean region.

METHODS OF DELIVERY

This course will be delivered through a combination of 24 hours of interactive lectures, 9 hours of tutorials to compliment and further develop topics covered in the lectures. During the tutorials, students will also be required to make a group presentation on an assigned topic (with each student delivering a part), following which there will be an interactive tutorial discussion. Students will be given one tutorial written assignment to test their factual knowledge, and to develop their problem solving abilities and critical thinking skills. The fieldtrip will expose students to the practical and field aspects of the course, through field observations, field notebook writing, data collection, compilation and analysis, and team skills. The field trip project is also designed to advance their critical thinking skills in terms of landform evolution, and to enhance their scientific report writing.

Course material will be made available electronically via OURVLE at http://ourvle.mona.uwi.edu/. This will include multimedia presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

<table>
<thead>
<tr>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Lectures:</td>
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METHODS OF ASSESSMENT

A 2-hour written paper will test the degree to which students have grasped the concepts of the course through two structured essay-type answers. The tutorial assignment is designed to further develop and hone their scientific writing skills, through a detailed, well referenced and critical
examination of a topic within the karst or coastal discipline. The Mid-Semester Test will be a short answer paper to test the key concepts covered in the first six weeks of the course. Being able to record field observations in geomorphology is a critically important skill, and field observations are used to interpret processes and deduce landform development. For the field project report, students will be assessed on their ability to separate observations, interpretations and conclusions, and to be able to form a coherent and well referenced discussion.

One 2-hour theory examination:  
Coursework: 
   Field project report:  
   Tutorial essay assignment:  
One 1-hour in course test:  
Total

REFERENCES

(a) PRESCRIBED


(b) HIGHLY RECOMMENDED


(c) USEFUL WEBSITES

National Cave and Karst Research Institute: [www.nckri.org](http://www.nckri.org)
National Speleological Society: [www.caves.org](http://www.caves.org)
British caving Association: [www.british-caving.org.uk](http://www.british-caving.org.uk)
Jamaican Caves Organisation: [www.jamaicancaves.org](http://www.jamaicancaves.org)
Journal of Coastal Research: [www.jcronline.org](http://www.jcronline.org)
COURSE TITLE: CLIMATE CHANGE IN THE TROPICS
COURSE CODE: GGOE3232
CREDITS: 3
LEVEL: III
SEMESTER: 1
PREREQUISITES: GEOG2232 (ENVIRONMENTAL CHANGE),
OR any One of:
GEOL2201 (PALAEONTOLOGY)
GEOL2202 (SEDIMENTARY GEOLOGY)
GEOL2203 (IGNEOUS AND METAMORPHIC PETROLOGY)
GEOL2204 (FIELD METHODS FOR GEOLOGY)
GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN)
HOD Permission (e.g. other Majors)

RATIONALE

This course enables students to develop a critical consideration of the causes and impacts of climate change and provide an opportunity to gain field and laboratory skills used in the analysis of natural archives of environmental change. With an emphasis on examples from the tropics, students will be armed with a combination of theoretical and practical skills ensuring they are well placed to address the physical, economic and social challenges facing the Caribbean Region in response to predicted 21st Century climate change.

COURSE DESCRIPTION

This course provides a theoretical and practical basis for understanding present-day tropical environments and the causes of global environmental change as well as for assessing the scale of human interference in natural environmental processes. While the causes and effects of climate change are global in scale, the course focuses on aspects directly relevant to the Caribbean Region, which include sea-level change, the influences of El Nino Southern Oscillation (ENSO) and tropical cyclone activity.

Indicative topics include: documentary records of past climate change; biological 'proxy' records of climate variations and their quantification; the record of climate variability in the tropics; low-latitude/high altitude ice-core records; oceanic records and past history of oceanic circulation and sea surface temperatures; role of atmosphere-ocean interactions (e.g. ENSO) on global climate change; sea level change; palaeo-tempestology; General Circulation Models (GCMs) of the global climate system; the concept of climate 'determinism' and human ecodynamics.
LEARNING OUTCOMES

On the successful completion of this course, students should be able to:

- Describe the causes and impacts of climate change at different temporal and spatial scales
- Explain the complexities of measuring the pattern, sequence and magnitude of past environmental changes, as well as of predicting future climate variations
- Describe strengths and limitations of reconstructions of past environments
- Analyze the reciprocal relationships between physical and human environments
- Examine past environmental change through fieldwork and laboratory analyses
- Apply standard laboratory techniques used in the analysis of natural archives of past environmental change
- Demonstrate an ability to handle complex data-sets, and be familiar with methods for locating, compiling and analyzing climate data-sets
- Abstract and synthesize information to develop reasoned arguments
- Identify, read, summarize and critically evaluate relevant literature on a specified topic, both from conventional printed sources and, where appropriate, web-based sources
- Communicate complex scientific information to a non-expert audience by means of an oral presentation employing appropriate visual aids

COURSE OUTLINE

Tropical records of past climate change
  Sedimentary and coral records
  Oceanic Record (Cariaco Basin and Amazon Fan)
  Low-latitude Ice core records (Quelccaya and Sajama Ice caps)
  Holocene sedimentary record in Jamaica

Field and Practical Component: Techniques in palaeoenvironmental research.
  This component of the course is based around a specific site investigation in Jamaica. Students are given instruction in field evaluations and lake and/or peat sediment records are then used for a series of laboratory investigations (practical class work) designed to establish the history of environmental changes in the immediate vicinity of the site.

El Nino Southern Oscillation, past and present
  Present day impacts of ENSO variability: global climate, Indian monsoon, African drought, tropical cyclone activity.
  Holocene coral record of ENSO variability.
  Global sedimentary records of ENSO variability.

Palaeotempestology:
  Instrumental and geological records of past tropical cyclone activity
Coral rubble ridges
Barrier wash over deposits
Case studies: Australia and Puerto Rico

The Quaternary record of past sea-level change.
  Relative and absolute sea-level changes
  Eustatic sea-level
  Reconstructing past sea-levels
  Mangrove palaeoecological records

Human Ecodynamics
  Human-environment interactions
  Climate ‘determinism’
  Quaternary records of human impact

METHODS OF DELIVERY

This course will be delivered through a combination of 20 hours of interactive lectures, 3 hours of tutorials and 24 hours of practical classes to compliment and further develop topics covered in the lectures. During the tutorials, students will also be required to make a group presentation on an assigned topic (with each student delivering a part), following which there will be an interactive tutorial discussion. The lectures will cover the theoretical aspects of the course, while the practical sessions will allow students to reconstruct the last 1000 years of climatic change in Jamaica based on sediment cores from a nearby lake. Students will be given two written assignments. The first will test their practical and laboratory skills in the form of a laboratory report and the second will test their factual knowledge, to develop their problem solving abilities and critical thinking skills. The fieldtrip will expose students to the practical and field aspects of the course, through field observations, field notebook writing, data collection, compilation and analysis, and team skills. The field trip project is also designed to further advance their critical thinking skills and scientific report writing.

Course material will be made available electronically via OURVLE at http://ourvle.mona.uwi.edu/. This will include PowerPoint presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.
### Contact Hours | Credit Hours
---|---
Lectures: | 20 | 20
Practical classes: | 24 | 12
Tutorials: | 3 | 3
1-day field trip: | 8 | 4
**Total:** | **55** | **39**

**METHODS OF ASSESSMENT**

A 2-hour written paper will test the degree to which students have grasped the concepts of the course through two structured essay-type answers. The tutorial assignment (Critical Review) is designed to further develop and hone their scientific writing skills, through a detailed, well referenced and critical examination of a contemporary topic in climate change. During the tutorials, students will be expected make a presentation on an assigned climate change topic. For the laboratory report, students will be assessed on their ability to separate observations, interpretations and conclusions, and to be able to form a coherent and well referenced discussion.

- **One 2-hour theory examination:** 50%
- **Coursework:**
  - One laboratory report (about 2500 words): 20%
  - One critical review (about 2500 words): 20%
  - One oral presentation: 10%
- **Total:** 100%

**REFERENCES**

(a) HIGHLY RECOMMENDED


(b) RECOMMENDED


(c) SOME RECOMMENDED JOURNALS


(d) USEFUL WEBSITES

Caribbean Environments: [www.caribbeanenvironments.com](http://www.caribbeanenvironments.com)
Intergovernmental Panel on Climate Change (IPCC) webpages: [www.ipcc.ch](http://www.ipcc.ch)
National Hurricane Centre: [www.nhc.noaa.gov](http://www.nhc.noaa.gov)
Climate change pages of the Royal Society: [http://royalsociety.org/landing.asp?id=1278](http://royalsociety.org/landing.asp?id=1278)
COURSE TITLE: HYDROLOGY AND HYDROLOGICAL MODELLING
COURSE CODE: GGE03233
CREDITS: 3
LEVEL: III
SEMESTER: 1
PREREQUISITE: GGE0233: WATER RESOURCES

RATIONALE

Water resources are increasingly becoming an important issue to the Caribbean with an increasing population and climatic change leading to changes in rain-fall patterns. Hydrological studies involve both surface water and underground water resources and there is an increasing use of modelling to understand and predict these systems, and students who seek job opportunities in water resources need to have an advanced understanding of hydrology and the skills to undertake hydrological modelling.

COURSE DESCRIPTION

The course builds on the core Level II training in Water Resources course and provides in-depth study of the hydrological cycle, water resource assessment and management, hydro-meteorological hazards and concepts, and includes a practical component developing hydrological models. Different statistical methods for determination of rainfall and flood return periods, as well as analysis of long term flow data for base flow determination and estimation of water resources will also be covered. The course will also examine and analyse groundwater flow for different types of the aquifer (confined and unconfined) under different hydraulic conditions (steady and unsteady). Techniques of hydrogeological investigation will be presented, including drilling and pump testing. The course will cover the details of different types of hydrological models, involving the calculation of rainfall and runoff for both gauged and non-gauged watersheds. Flooding and flood models, concepts, development and applications will also be covered as a part of the course. The use of geophysical tools will be introduced to identify new groundwater resources as well as to delineation salt-fresh water boundaries.

LEARNING OUTCOMES

On the successful completion of this course, students should be able to:

- Interpret and analyze long term rainfall and stream flow data and estimate return periods for rainfall and floods using different statistical methods.
- Analyze aquifer properties from pump test data of water wells and determine the potential of the aquifer for long term sustainability.
- Develop hydrological models for gauged and non-gauged watersheds using modelling software HEC HMS using different methods of runoff estimation incorporating rainfall, soil and land use.
- Develop flood plain maps using GIS based 1D HEC models.
- Critically analyze geophysical data and calculate depths of fresh-salt water boundaries and sub-surface properties of aquifers in potential groundwater zones.
• Analyze different climate change scenarios and impact on rainfall patterns of the island and predictions for flood and drought.
• Evaluate the present water resources of the island, demand and supply and future predictions based on different predictions from the GCM or PRECIS climate prediction models.

COURSE CONTENT

• Spatial and temporal variations in precipitation. Creation of rainfall maps using isohyetal, arithmetic mean and Theissen polygon method.
• Statistical methods for calculating return periods for rainfall and flood data.
• Hydrograph separation using computational methods and calculation of baseflow, inter and overland flow.
• Types of flooding and flood hazards in Jamaica. Climate change and hydrological hazards.
• Hydrologic Simulation models, steps in watershed modelling, description of models, principles, mainly HEC HMS models.
• Floodplain hydraulics – principles and concepts of HEC RAS (1D) model including case studies.
• Hydraulic properties of aquifers and their methods of determination.
• Groundwater flow calculations and flow variation under different climatic and non-climatic conditions.
• Geophysical and geological investigations for groundwater sources.
• Groundwater contamination and transport model.
• Groundwater wells: types and methods of drilling.
• Water resources of the Caribbean, with special emphasis on Jamaica.
• Climate change and challenges in the water sector: Jamaica and the Caribbean.

METHODS OF DELIVERY

The course uses a combination of interactive lectures, tutorials, practical classes and a field trip. The 21 lectures, involving PowerPoint presentations and face-to-face discussions, cover the entire range of topics in groundwater flow, transport, surface water hydrology, and contamination of groundwater, methods of investigation for new sites for drilling water wells, and hydrological models for rainfall-runoff and flood models. There will be a 2-hour practical class and a 1-hour tutorial each week. Students will deal with real data sets of groundwater and surface water flow, compute the aquifer parameters from the data, interpret the nature of the flow, and calculate discharge from flow data. They will also get hands-on experience in handling hydrological modelling software, compute runoff for different rainfall events as well as create flood models simulating flow under various hydraulic conditions. A 6-hour field trip is included in the course. The students will go to pump sites, collect pump test data, measure water levels in the wells, and do a hydrological study of the area. They would also be involved in measuring stream flow data, determining river cross-sections and calculating discharge and other river basin geometry.
Course material will be made available electronically at http://ourvle.mona.uwi.edu/ This will include PowerPoint presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

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<th>Contact Hours</th>
<th>Credit Hours</th>
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<td>Lectures</td>
<td>21</td>
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<tr>
<td>Practical classes</td>
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<tr>
<td>Tutorials</td>
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<tr>
<td>1-day field trip</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>54</strong></td>
<td><strong>39</strong></td>
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**METHODS OF ASSESSMENT**

The course will be assessed using a 2-hour written examination and a laboratory project. The examination will cover the key aspects of the course, including testing their knowledge base and their ability to apply their knowledge and skills to solving hydrological problems. Students will employ modelling software to deal with hydrological problems, watershed analysis, flood assessment and rainfall-runoff analysis. At the end of the course they will produce a laboratory project which will include in a hydrological assessment of a particular watershed, in order to determine runoff from both extreme and non-extreme rainfall, as well as assessing the flooding hazards and water resource potential for the watershed. A report detailing their findings will be submitted at the end of the project. The field trip will be assessed on a written field report including: introduction, outline of geology, hydrology, field data collection, analysis, synthesis and conclusion.

One 2-hour written examination: 50%
Laboratory Project: 40%
Field Trip: 10%
Total 100%

**REFERENCES**

(a) PRESCRIBED


(b) RECOMMENDED

(c) USEFUL WEBSITES

USGS publication site http://pubs.er.usgs.gov/
Water Resources Authority of Jamaica http://www.wra.gov.jm
Water and Sewage Authority of Jamaica http://www.wasa.gov.tt
COURSE TITLE: DISASTER MANAGEMENT
COURSE CODE: GGE0332
CREDITS: 3
LEVEL: III
SEMESTER: 2
PREREQUISITES: GEOG2231 (EARTH SURFACE PROCESSES) AND GEOG2232 (CLIMATE CHANGE), OR Any Two of: GEOL2201 (PALAEONTOLOGY) GEOL2202 (SEDIMENTARY GEOLOGY) GEOL2203 (IGNEOUS AND METAMORPHIC PETROLOGY) GEOL2204 (FIELD METHODS FOR GEOLGY) GEOL2205 (PLATE TECTONICS AND THE CARIBBEAN) OR HOD permission

RATIONALE

The Caribbean region is exposed to natural hazards and disasters associated with flooding, landslides, earthquakes and hurricanes in particular. Disaster management is governed by principles associated with the mitigation of, preparedness for, response to, and recovery from the impact(s) of hazards. The course aims to impart knowledge on each of these principles in relation to the processes associated with natural hazards and disasters, and to teach students how this knowledge may be applied to improve the state of preparedness and reduce the vulnerability of livelihoods and infrastructure in case of natural disasters. Given the relatively low levels of economic and social development in the region, and the need to raise these levels, risk reduction on the part of individuals and governments and other organizations should be a key part of each country’s development goals.

COURSE DESCRIPTION

The course will cover and build upon basic concepts of geology, geomorphology, tectonics, oceanography and geophysics in relation to the study of natural hazards, with special reference to the Caribbean region. It will examine hazards and risks related to volcanic and seismic activity, mass movement, hydro-meteorological phenomena, and coastal processes. An important focus will be on the mapping and analysis of hazards, vulnerability and risk. The course will examine theory, hazards, vulnerability, response capability, risk assessment, disaster scenarios, disaster management, preparedness, prevention, emergency response, and simulation. It will also cover natural hazards and related anthropogenic effects. It will deal with geotechnical and other approaches to natural hazard loss-reduction and management, as well as medical/health aspects of natural hazards and disasters. Case studies and examples of best-practice and failures in addressing disaster risk-reduction worldwide will be used to illustrate themes presented in the course.

LEARNING OUTCOMES

On the successful completion of this course, students should be able to:
• Identify natural hazards and their impacts, especially in the Caribbean region, with emphasis on the relationships between natural hazards and internal/external earth processes, geological materials and landforms, human activities and interventions, and the influence of environmental/climate change.
• Explain the principles of hazard and disaster management, vulnerability, response capability, risk assessment, preparedness, prevention, and emergency response, including the importance of communicating information to the public.
• Formulate and appraise approaches for natural hazard loss-reduction and management of emergencies and disasters.
• Prepare a public education programme based on local hazard identification.
• Prepare a proposal for national stakeholders (central government agencies, local government authorities) on planning and policy for disaster management.
• Present a disaster management simulation exercise.

Students will also be exposed to a number of practical and transferable skills as follows:
• Evaluate/assess the impact of different natural hazards in different settings.
• Compile, collate, summarize and analyze data (primary or secondary) and present them as lab reports or project reports.
• Learn how to work effectively in a team, by collaborative work in the lab and in the field.
• Improve time management skills by learning to organize and submit lab and field reports by stipulated deadlines.

COURSE CONTENT
• Volcanic hazards: types of volcanic eruptions; impacts.
• Seismic hazards: intensity; ground motions; tsunami.
• Coastal hazards: wave action; erosion; impact of pollution.
• Floods: types of floods; impacts; abatement measures.
• Karst hazards and mass wasting hazards.
• Climate change and related hazards.
• Disaster preparedness: vulnerability and risk identification and management.
• Disaster response and recovery.
• Disaster management at the community level: public awareness.
• Disaster management at the community level: public education based on local hazard identification.
• Disaster management at the national level: planning and policy; political issues.

Practical exercises will deal with:
• Hazard mapping: components and tools.
• Volcanic hazard identification and mapping.
• Mapping and analysis of seismic hazards.
• Mapping and analysis of coastal hazards.
• Mapping and analysis of flood hazards.
• Mapping and analysis of karst and mass wasting hazards.
• Measuring vulnerability.
• Critical facilities, escape routes and logistics planning.
• Data collection and reporting on public hazard knowledge.
• Preparation of public education material.
• Disaster management simulation exercise.

METHODS OF DELIVERY

The course will be delivered through a combination of 24 hours of lectures, 6 two-hour practical exercises, 6 hours of tutorials and a six-hour field class. The practical exercises will teach students how to map and analyze different types of hazards, and how to collect data on, and report on hazards. The field class will expose students to the practical and field aspects of the course, through field observations, field notebook writing, data collection, compilation and analysis, and team skills. The tutorials will complement the interactive lectures and include student presentations of a public education programme and disaster simulation exercise using a virtual disaster scenario.

Course material will be made available electronically via OURVLE at [http://ourvle.mona.uwi.edu/](http://ourvle.mona.uwi.edu/). This will include multimedia presentations/lecture notes, scientific articles, links to scientific articles on websites, and websites.

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<td>1-day field class</td>
<td>6</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
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METHODS OF ASSESSMENT

A two-hour written paper will test the degree to which students have grasped the concepts of the course through two structured essay-type answers. Three practical exercises will be graded counting equally towards the final mark. A notebook of observations recorded during the field class will be graded and students will be required to present an individual written report. For the tutorial assessment, students will work on an approved project related to a public education programme and disaster simulation exercise in 4-person groups, and then make a multimedia presentation (team effort) and submit a project report (individual), which will be assessed on their ability to work as a team as well as to present a coherent, well-referenced report and review of the virtual disaster scenario.

One 2-hour written examination: 50%

Coursework:

  - Three practical exercises (5% each) 15%
  - Fieldwork (field notebook and written report (1,000 words) 15%
  - Multimedia presentation (team presentation) 10%
  - Project report (individual) 10%

**Total** 100%
REFERENCES

(a) PRESCRIBED


(b) RECOMMENDED


(c) USEFUL WEBSITES


OAS Primer on Natural Hazard Management in Integrated Regional Development Planning. [http://www.oas.org/dsd/publications/Unit/oea66e/begin.htm](http://www.oas.org/dsd/publications/Unit/oea66e/begin.htm)

Caribbean Disaster Information Network website. [http://www.mona.uwi.edu/cardin/home.asp](http://www.mona.uwi.edu/cardin/home.asp)

Unit for Disaster Studies, Department of Geography and Geology, UWI, Mona. [http://www.uwimona.edu.jm/uds](http://www.uwimona.edu.jm/uds)

Marine Geology Unit, UWI, Mona. [http://www.mona.uwi.edu/geoggeol/mgu/index.htm](http://www.mona.uwi.edu/geoggeol/mgu/index.htm)


Seismic Research Unit, UWI, St Augustine. [http://www.uwiseismic.com](http://www.uwiseismic.com)


Additional course reading material will also be available in the UWI Library, the DOGG Map Library and/or the Internet on a weekly basis.