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INTRODUCTION

PURPOSE
This booklet explains departmental procedures and requirements in the Department of Geology and Geophysics of the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawaii. General rules of the University's Graduate Division are stated in the current General and Graduate Information Catalog and the Graduate Division Manual (www.hawaii.edu/graduate/download/list.htm).

THE COMMUNITY AND UNIVERSITY
Perceived by many as the paradise of the Pacific, Hawaii abounds with experiences in multicultural living. Honolulu, the capital, is a modern, cosmopolitan, tropical metropolis with a population of approximately 371,000. The University of Hawaii was founded in 1907 as a land-grant institution and is now also a sea-grant and space-grant institution. The principal campus is located in Manoa Valley, about 5 kilometers from downtown Honolulu and 3 kilometers from Waikiki Beach. The Manoa campus has about 18,000 students.

SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
The School of Ocean and Earth Science and Technology was formed in 1988 and combines the departments of Geology and Geophysics, Oceanography, Meteorology, and Ocean Resources Engineering with several research institutes (Hawaii Institute of Geophysics and Planetology, Hawaii Institute of Marine Biology, and the Hawaii Natural Energy Institute) and research centers (Hawaii Undersea Research Laboratory, International Pacific Research Center, International Center for Climate and Society, Joint Institute for Marine and Atmospheric Research and the Marine Bioproducts Engineering Center) to promote and enhance educational and research opportunities in these fields.

THE DEPARTMENT OF GEOLOGY AND GEOPHYSICS
The department has a large faculty with diverse research interests; most faculty members teach regularly. Additional researchers in or associated with the department may advise and employ graduate students. The department offers programs of research and study leading to the MS and PhD degrees. Currently the department offers graduate programs in six fields and has approximately 60 graduate students in residence.
CURRENT RESEARCH AREAS/CONCENTRATIONS

HIGH-PRESSURE GEOPHYSICS AND GEOCHEMISTRY/MINERAL PHYSICS
This program offers exciting opportunities for studying the physio-chemical, thermodynamic, and structural properties of earth materials, including minerals, rocks, silicate melts, ceramic, metals, and alloys under high pressure and temperature. The mineral physics laboratories are used for both basic and applied research. Current research programs include high-pressure, high-temperature x-ray diffraction studies using a diamond-anvil cell for elucidating phase transitions and equations of state (EOS) of mantle minerals, ultrasonic studies for elastic, anelastic and EOS properties; Brillouin and Raman scattering studies on the interrelationship of elastic and structural properties in mantle minerals under high pressure, electrical conductivity studies to understand the role of partial melting in the transport properties of upper mantle rocks, and acoustic studies on marine sediments for developing geoacoustic models.

HYDROGEOLOGY AND ENGINEERING GEOLOGY
This program provides students with an opportunity to address both practical and theoretical problems in geology, with a focus on physical processes that operate in the Earth's crust and impact society. The types of phenomena currently under study include fluid-flow through rocks and soils, groundwater quantity and quality (with an emphasis on groundwater problems in the Hawaiian Islands), subaerial and submarine landslides, three-dimensional rock fracture processes, geothermal processes, and fault mechanics. Research characteristically involves a combination of field work, laboratory research, and computer modeling. Owing to the interdisciplinary nature of the problems being addressed, students can expect to interact with investigators in the Water Resources Research Center, the College of Engineering, and in the Department of Tropical Plant and Soil Sciences. The graduate curriculum is largely elective so that it can be best tailored to the particular needs of the individual.

MARINE GEOLOGY AND GEOPHYSICS
The focus of this program is to provide students with a background that combines geology, geochemistry, and geophysics for technical and professional work in marine science at industrial, governmental, and academic institutions. The combination has also been useful for students entering a career in resource exploration and management.

The program provides instructional and research opportunities in a wide range of topics including sedimentology, stratigraphy, micropaleontology, paleoceanography, carbonate petrology, geological and geophysical investigations at sea, stable and radiogenic isotope geochemistry, organic geochemistry, chemical oceanography, coastal geology, littoral processes, sea-level change, geochemistry of marine sediments, geology of Pacific islands and atolls, crustal and upper-mantle structure, geophysical instrumentation, marine acoustics, marine gravity, geomagnetism and paleomagnetism, geodynamics, petrography of volcanic islands and ocean crust, physical properties of sediments and crustal rocks, reflection and refraction seismology, and plate tectonics at accreting and subducting plate margins. These diverse research efforts involve several marine expeditions each year. Graduate students in the program are encouraged to participate in these voyages as a part of their career training.

PLANETARY GEOSCIENCES
Instruction and research in this program are focused on the study of the surfaces and interiors of planetary bodies in order to understand their origin and evolution. Such studies apply principles of geomorphology, geophysics, mineralogy, petrology, and geochemistry to the analysis of remotely acquired planetary data, meteorites, and laboratory and field analogues. The program also studies Earth in the context of other planets, and seeks to develop and utilize remote-sensing techniques and instruments for application to planetary and terrestrial (including submarine) science. Several faculty members are actively involved in NASA spacecraft missions studying terrestrial, inner, and outer planet (and planetary satellite) locations. Students from a wide range of backgrounds in geology, astronomy, and engineering, focus their studies in one or more of the following areas: a) application of geological techniques using laboratory studies of planetary materials (meteorites and returned lunar samples) to understand the origin and evolution of planets, b) studies of the Earth in the context of comparative planetology, and/or c) the utilization of remote sensing data and the development of remote sensing techniques and instruments for planetary and terrestrial (including submarine and volcanological) science.
GEOPHYSICS (Seismology/Solid Earth Geophysics)

The Geophysics program covers the disciplines of seismology, geodesy, and geodynamics, and other applications of physics to the study of the Earth. In seismology, students study propagation, attenuation, and scattering of waves from earthquakes, explosions, and shipboard sources. Data from ocean bottom and borehole seismometers, as well as from land-based stations, help us to understand the structure and seismicity of passive and active plate margins and the growth of undersea volcanoes. Inversion and seismogram synthesis procedures aid in the interpretation of crustal structure and rock physics. In geodesy, students study crustal motion using the Global Positioning System (GPS). Current GPS research involves volcano deformation studies in Hawaii, plate motion studies in the South Pacific and South America, and measurements of atmospheric water vapor (in collaboration with the Department of Meteorology). In geodynamics, emphasis is on laboratory and computer modeling of heat flow and deformation in a continuum. Current research includes studies on mantle convection and the structure of plate margins. The Geophysics program and Marine Geology and Geophysics program work in concert. The two programs share students and faculty, and many studies straddle the disciplinary boundaries.

VOLCANOLOGY, GEOCHEMISTRY, AND PETROLOGY

The University of Hawaii is well placed to study volcanoes. The Hawaiian Islands are volcanic and include Mauna Loa, the world’s largest volcano, and Kilauea, one of the world’s most prodigious lava producers. Other Hawaiian volcanoes are deeply dissected by erosion, providing access to stratigraphic sequences suitable for studies of volcanic evolution. The Pacific Ocean contains a great number of volcanic islands, the Galapagos, Tahiti, Samoa, and Marianas among them, but also conceals an immense number of submerged volcanoes. Hawaii’s geographic position makes the volcanoes of Alaska, the Cascades, Mexico, Central America, the Philippines, and Japan, as well as the submarine rifts of the East Pacific Rise and western Pacific back-arc basins relatively accessible. This program’s studies are varied in nature: the petrology and geochemistry of basalts and their fractionation products in Hawaii and at other mid-plate volcanoes, mid-ocean ridges, volcanic arcs, and the back-arc basins; the chemical and isotopic variability of mantle and crustal magma sources; the mechanisms of explosive eruptions that generate silicic ash-flow tuffs (ignimbrites); lava flow morphology; the hazards arising from volcanic eruptions; the origin and emplacement mechanisms of oceanic and continental flood basalts; the nature and dynamics of magmatic plumbing systems; and the characteristics and products of underwater volcanism. Much of the volcanological research on Hawaii is conducted by the Hawaii Center for Volcanology, formed in 1992.
RESEARCH FACILITIES

GENERAL

Departmental faculty normally conduct research projects within the department in conjunction with one or more of its six research areas. In addition, the research institutes within SOEST and also the Water Resources Research Center have goals aimed at applied research, and can be sources of funding and guidance for graduate students. The University’s Space Grant and Sea Grant programs, International Pacific Research Center (IPRC), Pelagic Fisheries Research Program (PFRP) and the Marine Bioproducts Engineering Center (MarBEC) are also part of SOEST.

Computing

Students have 24-hour access to more than 30 workstations in a dedicated computer room. The department owns several PC, Mac and Unix workstations. All have ample disk storage capacity, large monitors, accelerated graphics capability, and multimedia hardware/software. All are networked and have open access to the internet and a number of free-use peripherals such as postscript laser printers and digital scanners. Color printing and color slide-making are available to graduate students through their advisors. Overall, the student-to-computer ratio in our department stands between 3 and 4). Students also have unlimited internet access and generous limits on hard disk space for network file storage (e.g., for email and web documents). In addition to all of the above, SOEST researchers have another 100 or so work stations of various types in their laboratories, including a number of Silicon Graphics work stations. These are available to students through arrangement with the director(s) of the individual labs. Some of this equipment is described below.

General Equipment

20 Sun ULTRA workstations, some with multiprocessors
A department computer room with 10 networked PCs, Macintosh, and Ultra Sparc Sun workstations
Access to a CRAY YMP at the San Diego Supercomputer Center and an IBM SP2 massively parallel computer at the Maui High Performance Computing Center as well as S12-Linux cluster

Seismic Reflection Processing and Interpretation Facility:
Three Sun ULTRA 2 workstations, each with 512 MB of memory
Five 9 GB, three 4 GB and seven 2 GB disk drives
DLT, DAT, Exabyte and 9-track tape drives

Landmark’s ProMAX seismic processing software
Landmark’s OpenWorks/SeisWorks seismic interpretation software
GXTechnology’s GX2 seismic modeling software

Analytical and Experimental Laboratories

Radiogenic Isotope Facility, including:
VG54-WARP multi-collector high-abundance-sensitivity thermal ionization mass spectrometer (TIMS) for positive and negative ions analysis
VG Sector multi-collector thermal ionization mass spectrometer for positive ion analysis
Finnigan Element II icp-MS
Six high resolution detector Alpha Spectrometry system
Class 1000 clean laboratory
Radioactive-isotope tracer and dating facilities

Visible to mid-infrared spectrometers, including:
Nicolet 470 FTIR spectrometer equipped for hemispherical reflectance and emission analyses
ASD portable field spectrometer (visible to near IR)
D&P portable field spectrometer (thermal infrared)
Cameca SX-50 Electron Microprobe, 5 WDS spectrometers, Kevex EDS system
VG Plasmaquad II+ ICP-MS with laser
Siemens SRS-303 Automated X-ray Fluorescence Spectrometer (XRF)
JEOL LV-5900 SEM, Electron microscope with Link EDS system

Light Isotope Facility, including:
Three light stable isotope mass spectrometers (MAT 252, Delta-Plus and Delta-Plus XP) each linked to a variety of on-line sample introduction systems (e.g., GC-combustion, Elemental Analyzer, etc)

Sedimentology, sedimentary geochemistry, paleontology, and paleomagnetics (including a 3-axis cryogenic magnetometer) laboratories
Hydrogeology laboratory, fluid mechanics laboratory, soil and rock mechanics testing laboratory
Instruments for measuring electrical conductivity on rocks or rock melts, thermal conductivity and thermal expansion, porosity and gas permeability
Thin section and rock preparation labs
Crystal cutting and polishing facilities
1-atmosphere gas-mixing furnace and hydrothermal pressure vessels
PC-based image processing system

Seagoing Facilities Available to Faculty and Students within SOEST
The following research vessels and their supporting shipboard technical group are available to researchers for gathering geophysical, geochemical, and other open ocean and coastal data and samples.

R/V Kilo Moana
R/V Kila
R/V Ka‘imikai-o-Kanaloa (submersible and ROV mother ship)
Pisces V, research submersible with a depth capability of 2000m
RCV-150, a remotely-operated underwater vehicle

Seagoing instrumentation includes equipment for digital seismic reflection, gravity, magnetics, coring, dredging, and water column studies, the HAWAII MR1 side-scan sonar system, and fiber-optic-based deep-towed FOCUS camera system. In addition, software is available for multi-channel seismic processing and geophysical data analysis.

Other Facilities Available to Faculty and Students within SOEST

Engineering Support Facility including:
Electronic and mechanical engineering
Modern machine shop with CRC and HURCO mills
Electronics shops

Core and dredge collections
Geophysical data archives
Pacific Regional Planetary Data Center
SOEST research library
SOEST Publications Facility including:
Staff for professional editing, drafting, design, and layout
Computer facilities for desktop publishing, including color publication
Two deep research wells and a shallow test well field
   Geophysical well-logging system, evapotranspiration research station, and stream gauging station
High Pressure Facility, including:
   Ultrahigh pressure and high pressure-high temperature diamond anvil cells with ruby florescence
   pressure calibration system
   Computer-controlled energy-dispersive diffraction system
   Large-volume (DIA-type) high pressure-temperature apparatus
   Position sensitive detector for high-pressure x-ray diffraction

Ultrasonic and acoustic equipment
Laue camera, Buerger precession camera, and Debye-Scherer cameras
Multi-channel micro-Raman, infrared and Mossbauer spectrographs
Planetary environment simulators
Radioactive counting facility
X-ray diffraction, Scanning electron microprobe, Scanning and transmission electron microprobe, and
Inductively-coupled plasma spectrometer (optical).

WATER RESOURCES RESEARCH CENTER
The faculty and staff of this center plan and conduct research related to Hawaii’s water resources and provide
training opportunities for engineers and scientists. Research is interdisciplinary with a broad base of physical
sciences, ecology, technology, and social sciences. The center operates laboratories as well as field research facilities.
The laboratories are housed in Holmes Hall (the engineering building), adjacent to the Pacific Ocean Science and
Technology Building (POST).
At present the major efforts of the center are directed toward research in hydrology and hydraulic engineering;
the geology, geophysics, and geochemistry of water resources and waste disposal; sanitary engineering and public
health; climatology, soil physics, agricultural engineering, and forestry; and the social, economic, and legal aspects of
water resources.

OTHER RESEARCH FACILITIES
Cooperative research is also carried out with other units of the University and federal laboratories in Hawaii.
Some of these are the Institute for Astronomy, College of Tropical Agriculture and Human Resources, Pacific
Biomedical Research Center, Hawaiian Volcano Observatory (USGS), Marine Fisheries Laboratory (NOAA), Pacific
Tsunami Warning Center and Magnetic Observatory (NOAA). The International Pacific Research Center (IPRC), and
Marine Bioproducts Engineering Center (MarBEC). Students are encouraged to take advantage of opportunities for
cooperative, interdisciplinary research.
GRADUATE FACULTY MEMBERS

The graduate faculty of the university instruct graduate students and supervise their research. The degree committee of each graduate student is chosen from this body and an outside member. Current members of the graduate faculty in Geology and Geophysics and their research interests are listed below.

F. Scott Anderson, PhD, Arizona State, 1998. Planetary geology and geophysics
T. Bruce Appelgate, PhD, Hawaii, 1995. Marine geology and geophysics
Jeffrey F. Bell, PhD, Hawaii, 1984. Planetary geosciences
Janet Becker, PhD, UCSD (Scripps), 1989. Geophysical Fluid Dynamic
Benjamin A. Brooks, PhD, Cornell, 2000. Tectonic geodesy, structural geology
Patricia A. Cooper, PhD, Hawaii, 1985. Seismology
Keith Crook, PhD, New England (Australia), 1959. Marine geosciences, sedimentology, tectonics
Eric H. De Carlo, PhD, Hawaii, 1982. Marine geochemistry
Frederick K. Duenebier, PhD, Hawaii, 1972. Seismology; marine instrumentation
Robert Dunn, PhD, Oregon, 1999. Marine geophysics and seismology
Aly El-Kadi, PhD, Cornell, 1983. Hydrology
Pow-foong Fan, PhD, UCLA, 1965. Mineralogy of sediments; geology of Asia
Sarah A. Fagents, PhD, Lancaster (UK), 1994. Planetary volcanism, icy satellite geology
Charles H. Fletcher, PhD, Delaware, 1986. Near-shore processes; Quaternary geology
L. Neil Frazer, PhD, Princeton, 1978. Theoretical seismology
Gerard J. Fryer, PhD, Hawaii, 1980. Seismology; marine geophysics
Patricia B. Fryer, PhD, Hawaii, 1981. Marine geology; petrology; tectonics
Michael Fuller, PhD, Cambridge, 1961. Paleomagnetism; geomagnetism
Eric Gaidos, PhD, MIT, 1996. Geobiology
Milton A. Garces, PhD, UCSD (Scripps), 1995. Infrasound, seismology, fluid dynamics
Michael O. Garcia, PhD, UCLA, 1976. Igneous petrology; volcanology
Craig R. Glenn, PhD, Rhode Island, 1987. Sedimentary petrology and geochemistry; paleoceanography
Victoria E. Hamilton, PhD, Arizona State, 1998. Planetary geosciences IR spectroscopy, remote sensing
Julia E. Hammer, PhD, Oregon, 1996. Volcanology, experimental petrology
Andrew Harris, PhD, Open University (UK), 1996. Physical volcanology and remote sensing
B. Ray Hawke, PhD, Brown, 1978. Planetary geosciences
Emilio Herrero-Bervera, PhD, Hawaii, 1984. Paleomagnetism
Richard N. Hey, PhD, Princeton, 1975. Marine geophysics; plate tectonics
Bruce Houghton, PhD, Otago (New Zealand), 1977. Physical volcanology, volcanic hazards
Garrett M. Ito, PhD, MIT (Woods Hole), 1996. Marine geophysics and geodynamics
Kevin T.M. Johnson, PhD, MIT (Woods Hole), 1990. Mantle petrology and geochemistry, marine geology
Barbara H. Keating, PhD, Texas (Dallas), 1976. Paleomagnetism
Klaus Keil, PhD, Johannes-Gutenberg (Germany), 1961. Meteorites
Loren W. Kroenke, PhD, Hawaii, 1972. Marine geology and geophysics
Alexander N. Krot, PhD, Moscow State (Russia), 1989. Cosmochemistry and Meteorites
Barry R. Lienert, PhD, Texas (Dallas), 1976. Geophysics
Paul G. Lucey, PhD, Hawaii, 1986. Planetary geosciences
Fred T. Mackenzie, PhD, Lehigh, 1962. Marine geochemistry; geochemistry of sediments
John Mahoney, PhD, UCSD (Scripps), 1984. Geochemistry; radiogenic isotopes
Murli H. Manghnani, PhD, Montana State, 1962. Mineral physics
Fernando Martinez, PhD, Columbia, 1988. Extensional tectonics, marine geophysics
Stephen J. Martel, PhD, Stanford, 1987. Engineering geology; geomechanics
Floyd W. McCoy, PhD, Harvard, 1974. Marine geology, sedimentology, geochronology
Li-Chung Ming, PhD, Rochester, 1974. High-pressure mineralogy
Ralph Moberly, PhD, Princeton, 1956. Marine geology; sedimentology
Gregory F. Moore, PhD, Cornell, 1977. Seismic processing; tectonics
Peter J. Mouginis-Mark, PhD, Lancaster (UK), 1977. Planetary geosciences; remote sensing
Brian N. Popp, PhD, Illinois, 1986. Stable-isotope geochemistry
Douglas G. Pyle, PhD, Oregon State, 1994. Geochemistry, radioisotopes, marine geology
Greg Ravizza, PhD, Yale, 1991. Paleooceanography, Marine Chemistry and Environmental Geochemistry
C. Barry Raleigh, PhD, UCLA, 1963. Earthquake seismology; rock mechanics
Kent Ross, PhD, Houston, 1994. Igneous petrology, geochemistry
Scott Rowland, PhD, Hawaii, 1987. Volcanological remote sensing
Kenneth H. Rubin, PhD, UCSD (Scripps), 1991. Geochemistry and marine geology
Kathleen Ruttenberg, Yale, 1989. Sedimentary Geochemistry
Jane E. Schoonmaker, PhD, Northwestern, 1981. Marine geology and geochemistry
Edward R. Scott, PhD, Cambridge (UK), 1972. Meteorites
John M. Sinton, PhD, Otago (New Zealand), 1976. Igneous and metamorphic petrology
Brian Taylor, PhD, Columbia (LDEO), 1982. Geology of ocean-margin basins; tectonics
G. Jeffrey Taylor, PhD, Rice, 1970. Meteorites
Donald M. Thomas, PhD, Hawaii, 1977. Geochemistry of geothermal systems
Paul Wessel, PhD, Columbia, 1990. Marine geophysics
Roy H. Wilkens, PhD, U. of Washington, 1981. Physical properties
Lionel Wilson, PhD, London (UK), 1968. Theoretical volcanology
Cecily Wolfe, PhD, MIT (Woods Hole), 1994. Seismology, mid-ocean ridges,

AFFILIATE GRADUATE FACULTY

David Clague, PhD, UCSD (Scripps), 1979. Volcanic petrology; marine geology
Milton Garces, PhD, UCSD (Scripps), 1995. Volcanology
Charles Johnson, PhD, Penn State, 1972. Mineral resource economics
David Johnston, PhD, Massey (New Zealand), 1998. Volcanology
John P. Lockwood, PhD, Princeton, 1966. Modern volcanic processes
Julia Morgan, PhD, Cornell, 1993. Marine geology and geophysics
Paul G. Okubo, PhD, MIT, 1986. Geophysics, seismology
Stephen Self, PhD, Imperial College, London (UK), 1974. Volcanology
Donald Swanson, PhD, Johns Hopkins, 1964. Volcanology
Carl Thornber, PhD, Colorado, 1992. Geochemistry, volcanology
Gordon Tribble, PhD, Hawaii, 1990. Groundwater geochemistry
FINANCIAL ASSISTANCE
The department offers research and teaching assistantships, tuition waivers, and various scholarships and fellowships to qualified students. Each is described below.

Scholarships and Fellowships
The department offers various scholarships and fellowships, described in detail at www.soest.hawaii.edu/GG/gg_academics.html (under the “Financial Support” link). These include:

The National Weather Service Fellowship: This award is available annually as part of a cooperative agreement between the department and the National Weather Service. The award is offered to especially promising new graduate students.

The William T. Coulbourn Fellowship: These awards are endowed by the family and friends of former graduate student and professor William T. Coulbourn. They support marine geological research by graduate and undergraduate students. Application deadline is April 1.

The Harold T. Stearns Fellowship: These awards, endowed by a former geologist in Hawaii, support research on certain geological and geophysical problems in Hawaii and the Pacific Basin. Funds are awarded on the basis of research proposals submitted by undergraduate and graduate students. Application deadline is April 1.

The J. Watumull Merit Scholarship: This award is given each year to an outstanding Geology and Geophysics student by the Watumull Foundation. The recipient must have an excellent academic record and demonstrate outstanding service to the department or to fellow graduate students. Because the award is given in two parts, the recipient must have at least one more year of residence to complete.

Graduate Assistantship Positions (see also the UHM “Graduate Assistant Handbook”):
A graduate assistantship (GA) is a half-time temporary appointment as either a Teaching Assistant (TA) or a Research Assistantship (RA). The TA position is usually a nine-month appointment; the RA position is an eleven-month appointment yet regardless of appointment period, GAs are paid over the course of twelve months. The Department of Geology and Geophysics sometimes makes appointments for less than a full year (i.e., a semester). Salary for TAs is paid from 1 Aug to 31 January for the Fall semester and from 1 Jan to 30 June for the Spring semester.

Availability of Positions
The Department of Geology and Geophysics currently offers five TA positions each semester. The number of RA positions available each semester varies depending on the availability of funds by individual faculty members.

Duties
Teaching Assistants are required to teach undergraduate laboratories (normally two), under the direction of a faculty member in full charge of the course. Research assistants perform research duties that may or may not be related to their degree, working under the direction of a faculty member. Both TAs and RAs are expected to contribute an average of 20 hours per week to the assigned tasks that do not necessarily overlap with the time required to conduct your own graduate research. Graduate assistants with nine-month appointments (TAs) serve from one week prior to the start of fall semester through spring commencement and are entitled to three months off during the summer. Graduate assistants with eleven-month appointments (RAs) are entitled to one month of duty free time each year; this time should be scheduled at a time mutually agreeable to the student and faculty. More information on the duties of Graduate Assistants can be found on page 9-51 of the Board of Regents policies at: www.hawaii.edu/svpa/borp.html and in the Graduate Division Manual at: www.hawaii.edu/graduate/gdmanual.html.
**GA Eligibility**

Students are required to maintain a 3.0 grade point average and must carry nine credit hours of degree-related coursework (excluding audit hours) each semester while holding the assistantship. However, students who wish to enroll in more than nine credits may sometimes do so with department approval (requiring a memo to the Graduate Fellowships Office from the department chair). According to University policy, non-native English speakers with any instructional responsibility must demonstrate proficiency in English; the minimum score required for the Test of the English as a Foreign Language (TOEFL) is 600.

**Salaries**

GAs are paid according to a 9-step pay scale set by the Board of Regents, most recently increased July 1, 2003. All graduate assistants must be appointed to this pay scale. However, when a grant does not contain sufficient funds to meet a pay increase, a graduate assistant may be reappointed “below-scale” as a GA-0 (from the Grad Division Manual). The current salaries at each step are available on page 9-52 of the Board of Regents policies web site (www.hawaii.edu/svpa/borp.html).

According to University policy, initial placement on the pay scale will reflect the student’s experience, ability, and assigned responsibility; advancement from step to step, after at least one year of satisfactory service, may be recommended by a department chair or principal investigator of a student’s research project, with the approval of the pertinent academic dean (from the Board of Regents policies web site). TAs within the department receive a step 9 salary (the maximum on the teaching salary scale). The GG department suggests the faculty to follow a general guideline for RA salary levels starting at step 6 for incoming students (possibly 7 if the student already has an MS degree) and reaching a maximum of step 8 or 9, with increases following dates of significant progress towards degree completion (passing of departmental exams or otherwise). A research step 6 is equivalent in salary to a teaching step 9.

**Tuition Waivers**

Both types of graduate assistantships receive tuition waivers that are not exempt from University fees. University fees include Board of Publications fee, the Student Health Fee, the Graduate Student Organization fee, etc., and typically costs approximately $75 per semester. University fees are paid at the time the student registers for classes.

**Benefits**

Graduate assistants who are appointed at half-time for at least three months may enroll in the State Health Fund Plan and are eligible to join the University of Hawai’i Federal Credit Union. More information about health benefits is available from floor and department secretaries, or from the SOEST Personnel office. Graduate assistants are not eligible to accumulate vacation or sick leave.

**Pay Dates**

Graduate assistants receive their paychecks on the 5th and 20th of each month. When an RA or TA is hired, the first two weeks of pay is held by the University until the termination of that student’s term. Additionally, there may be some delay in the processing of the hiring paperwork. Therefore, new graduate assistants do not receive their first paycheck until a full month (or rarely two) after they begin work. A good way to avoid unwanted hardship is to check that your paperwork is in order with your unit secretary or the SOEST Personnel office as early as possible.

**Continuation of Funding**

Both types of assistantships may be renewed based on satisfactory performance, availability, and number of GA slots available at the time. Although every attempt is made to provide funding, assistantships are not guaranteed for the duration of your studies in the department. The department currently has a policy of giving incoming first-year graduate students priority for TA appointments. Ultimately, it is the responsibility of the graduate student to make sure their funding continues. Sometimes, graduate students who are supported by an RA appointment take a TA position to gain valuable teaching experience and/or to extend their RA funds.
Summer Overload Appointments

These are additional half-time positions that are sometimes available to graduate students. They carry a stipend in addition to a concurrent RA or TA stipend. Normally overload activity is permitted only during non-instructional periods (during the summer or between semesters). Stipends for summer overload appointments for RAs follow a 9-step pay scale similar to the stipends for the RA itself. Often, graduate students are placed at the same step for their summer overload appointment as they are for their regular RA appointment; however, this is subject to the availability of funds.

Paycheck Deductions for the PTS Deferred Compensation Plan

The State of Hawai‘i uses the PTS Deferred Compensation Retirement Plan for part-time, temporary, and seasonal/casual employees, since these employees are not eligible to participate in the State Employees’ Retirement System. Graduate assistants are exempt from this plan while they are full-time students, but are not exempt during non-instructional periods (over the summer). The employee’s contribution to the PTS Deferred Compensation Plan replaces his or her contribution to Social Security, although a Medicare contribution is still required. International students are exempt from this plan.

Graduate assistants will be automatically enrolled in the PTS Deferred Compensation Plan for periods when they are not exempt. Each graduate assistant will be asked by the department to fill out an Enrollment Form. You will receive a copy of the booklet “PTS Deferred Compensation Retirement Plan Employee Information Booklet” from the department when you first enroll, which has answers to common questions you might have and contact information.

Tax Benefits Often Available to Graduate Students

Graduate students in Hawai‘i are often eligible for tax credits. See the instructions published by the U. S. Internal Revenue Service and the State of Hawai‘i Department of Taxes.
NORMAL UNDERGRADUATE PREPARATION

Students are accepted from undergraduate majors in the natural sciences, mathematics, and engineering who have normally completed at least one year each of college mathematics, geology, physics, and chemistry. Adequacy of each applicant’s additional preparation will depend on the particular branch of geology and geophysics being pursued. At the time of application, the student should state the area in which he or she intends to study. The areas listed in the following sections are active areas of research in the department. A brief description and the normal undergraduate preparation for each are listed below. Students with backgrounds in other fields may be accepted in an area, but advancement to candidacy may be delayed. A complete statement of courses and other work necessary for the MS or to prepare for the PhD comprehensive examination is in a subsequent part of this handbook.

HYDROGEOLOGY AND ENGINEERING GEOLOGY

Students combine principles of geology and civil engineering as a basis for solving practical problems in the utilization and conservation of natural resources, including water and urban land. A typical undergraduate background should have included basic courses in each of geology, chemistry, physics, and mathematics, and a major in geology, other physical sciences, or engineering. The student should be prepared for additional work in whatever combination of geology, geophysics, engineering, and geochemistry is appropriate.

MARINE GEOLOGY AND GEOPHYSICS

Combines geological and geophysical studies to focus on investigation of the ocean basins and margins. Typically, a strong undergraduate major in geology or one of the other natural sciences, along with basic courses in physics, chemistry, and mathematics, would be sufficient for entrance. The student should be prepared to commence or continue course work in (1) structural or tectonic geology, (2) exploration geophysics, and (3) any one or more of sedimentology, paleontology, geochemistry, chemical oceanography, paleoceanography, remote sensing, or petrology, as applied to marine research.

PLANETARY GEOSCIENCES

Is a broad field that uses geological techniques to learn about the origin and evolution of the planets and solar system. Students are drawn from a wide range of backgrounds in geology and from outside the geosciences (e.g. astronomy, engineering). They are expected to have, or to develop, a broad basic knowledge of geology, geophysics, geochemistry, mineralogy, instrumentation, computer programming, and data-analysis techniques. Specific course requirements depend on the area of the student’s interest and are established upon consultation between the student, advisor and planetary geosciences faculty, with the approval of the Graduate Studies Committee when needed. Upon graduation, the student will be able to function in one of the classical fields of geology as well as in chosen specialties of planetary geosciences and remote sensing.

GEOPHYSICS

Uses principles of physics to study the Earth. Areas of study include seismic wave propagation, earthquake source mechanisms, structure of the Earth, seismic exploration, heat flow, tectonic motion, lithospheric flexure, and mantle flow. Students may enter from majors in physics, geology, geophysics, mathematics, civil engineering, or geography. They should have an understanding of general physics and mechanics, and supporting mathematics. A background in geology (which can be acquired in graduate school) will be required before completion of graduate studies.

HIGH PRESSURE GEOPHYSICS AND GEOCHEMISTRY

Involves gaining an understanding of the nature of the Earth’s crust and its deep interior through measurements of physical, chemical, and mechanical properties of pertinent earth materials under high-pressure and high-temperature conditions. Entrance may be through chemistry, physics, engineering, or geology. A background in geology is necessary but can be obtained in graduate school, along with additional mathematics.

VOLCANOLOGY, GEOCHEMISTRY AND PETROLOGY

Combines geology with field and laboratory work in problems related to the origin, and evolution, and processes modifying of the Earth’s mantle and crust, and the origins of igneous and metamorphic rocks, including studies of volcanic processes and hazards. In addition to basic courses in chemistry, physics, and mathematics, the student should ideally have had training in mineralogy and optical mineralogy, petrology, structural geology, and geological field methods.
MASTER'S PROGRAM

For a complete listing of the requirements, PLEASE read the Graduate Division Manual (www.hawaii.edu/graduate/download/list.htm). The Geology and Geophysics department’s additions and modifications to the Graduate Division Manual are explained below.

Master’s Plan A (Thesis)

Course Requirements (Plan A)

Students must take at least 30 credits overall from coursework and research. A maximum of 12 credits from research (GG 699 and GG 700) and six credits must be for GG 700. Credits for GG 700 can only accrue after a thesis proposal is approved. Credits for GG 700 can be accrued by transferring credits from GG 699.

At least 18 credits in courses must be taken for a letter grade (A, B, C, etc.) at the 300-level or above. To find the actual number, subtract the number of research credits from 30. At least 12 of these credits must be in graduate courses (GG 600 – 798) outside of GG 699 and GG 700. All students must take GG 610, Graduate Seminar once each year for two years or until graduation.

Departmental course requirements vary depending on the area of concentration (see Area Requirements). Requirements for students entering from fields other than geological sciences will be determined on an individual basis by the GSC and the thesis committee. Directed Research (GG 699) may only be taken on a credit/no credit basis.

If a student is receiving a research assistantship, teaching assistantship, or tuition waiver, then he or she must be registered for nine program-related credit hours during the semester that he or she has the assistantship or waiver. Graduate Assistants registering for more than nine credits will require a memo of concurrence from the department chair.

Preliminary Conference (Plan A)

The purposes of the preliminary conference are to determine in which field the student will pursue a degree, to consider undergraduate deficiencies, to advise the student of a suitable selection of courses for the first semester, and to appoint an interim adviser in his or her field. Entering students will be advised by mail as to the time and place of the preliminary conference, which is normally conducted prior to registration for the first term.

The department chair, student’s interim advisor and a representative from the Graduate Admissions Committee (GAC) and Graduate Studies Committee (GSC) will also be present.

Undergraduate deficiencies will be assigned as follows. For all applicants, any of these courses not already completed: one year each of college mathematics, physics with labs, chemistry with labs, and geology-geophysics with labs. For applicants from majors that are equivalent to a BS (or BS in engineering) at the University of Hawaii, any deficiency in a course required for the same BS (or BS in Engineering) at UHM will be an undergraduate deficiency (e.g., a geologist entering without petrology, a physicist entering without electricity and magnetism). Normally, applicants from a field other than science, engineering, or mathematics would not be admitted. If circumstances suggest that such a student be admitted, all courses needed for a bachelor’s degree at UHM in the field he or she intends to enter will be listed as undergraduate deficiencies. Students shifting to a different field will not have the upper division courses (300-400) listed as undergraduate deficiencies (e.g., a geologist shifting to geophysics who has not had mechanics; a physicist shifting to geophysics who has not had structural geology).

Appointment of Committee (Plan A)

The student and his or her advisor will mutually agree on a thesis committee consisting of at least three members. The chair and a majority of the committee members must be of the graduate faculty of the Geology and Geophysics department. If a committee chairperson wishes to nominate someone not in the graduate faculty he or she may nominate that person as a fourth member.
**Approval of Thesis Topic (Plan A)**

A thesis proposal is required. The first purpose of the master's thesis is to demonstrate that the student can master a research effort of moderate scope, and write and defend the results of his or her work in a logical and clear manner. The student is encouraged to discuss potential topics with the faculty as early as possible. A thesis prospectus or proposal is required. An acceptable thesis prospectus should be submitted to the Thesis Committee near the end of the student’s second semester. The prospectus should contain at least three pages of text and should include the topics listed below. Approval of the thesis topic is official when Graduate Division Form II is filed.

Outline of Research Prospectus

1. **TITLE**
2. **INTRODUCTION** (Problem statement, rationale)
3. **OBJECTIVES/HYPOTHESIS** (Concisely written list)
4. **APPROACH** (Brief overview with references to established methods)

The student may not register for GG 700 (Thesis Research) until after the Graduate Division accepts the department chair’s recommendation of the thesis topic. Registration in GG 700 must total 6 credit hours, including at least 1 credit hour in the semester or summer session in which the degree is awarded. Copies of the completed thesis must be submitted to committee members at least two weeks prior to the date of the final examination.

This department encourages theses to be organized so that they are ready for submittal or have been submitted for publication. Details that require material extraneous for publication but deemed necessary for the thesis such as extensive reports of previous work and lengthy tables of data, should be set in chapters or appendices clearly independent of the principal work, discussion, and conclusions. The student should be aware of current Graduate Division rules on co-authorship of publications. The current instructions for the preparation of the thesis are available in the Graduate Division office.

The second purpose of the thesis is to allow a student to develop thoughtfully an original scientific project under the tutelage of a faculty mentor, so as to add to the knowledge of the discipline and to establish the student as a qualified scientist in his or her own right. The research program typically involves: a study of the literature to establish a broad base of knowledge; making new measurements, or finding an intriguing and previously undiscovered method of understanding existing data; explaining the results, defending the thesis; and publishing.

It is especially important for students to gain direct, first-hand experience in creating their own database when this is practical and feasible. But in any case, scientific integrity mandates that the student fully acknowledge in the thesis any and all collaboration, e.g., samples, sample preparation, measurements, analyses, data, or computer algorithms produced by others involved in the crafting of the thesis research.

**Application for Graduation (Plan A)**

You need to pick up the all-important forms at the Graduate Division Records Office, Spalding 352.

**Schedule Thesis Defense (Plan A)**

Graduate Division rules stipulate that copies of the completed thesis must be submitted to committee members at least two weeks prior to the date of the final examination. Keep in mind, however, that this should be considered a minimum: outside members, or members who are away from the campus must be sent the thesis long enough in advance to accommodate mailing transit times. The policy of the Department of Geology & Geophysics is that a student should not be permitted to defend until his or her committee has agreed that the written thesis is defendable, i.e., that the thesis is likely to require only modest revisions in consequence of the oral defense.
Thesis Defense (final examination for Plan A)

Of the two alternative styles described in the Graduate Division Manual for the MS final oral examination, the GG Department normally prefers the one in which results are presented at a departmental seminar. At the option of the thesis chairman, however, the final oral examination may be open only to members of the graduate faculty. In either case, reasonable notice must be given, and all members of the thesis committee must be present. If a committee member cannot be present at the defense, the student should consider re-scheduling the defense date, however, the student has the options of allowing a proxy member, or changing the committee entirely. At the defense the candidate will present his or her work and principal results within a period of time (usually 30 to 40 minutes) agreed upon in advance by the thesis committee chairman. Next, questioning by members of the audience is allowed. Then, the room may be cleared of persons not in the graduate faculty for additional questioning by the thesis committee, if members so wish.

After questioning is completed, the committee decides privately whether or not the final examination was passed. Students failing the examination may repeat it only once. The committee also records its opinion as to whether or not the thesis is satisfactory. Modest rewriting may be needed, in which case signatures on the approval page of the thesis may be delayed.

If the student wants to continue his or her graduate work in this department, a final duty of the thesis committee is to recommend to the Graduate Studies Committee whether or not the student may be admitted to the PhD program.

Submit Written Thesis (Plan A)

The approved thesis and necessary copies are to be submitted to the Graduate Records Office, Spalding Hall Room 352. Specific instructions included with the application for graduation.

Graduate Chair Approval (Plan A)

This is a routine step where Graduate Division sends the degree check form to the chairperson of your field of study- in our case the Geology and Geophysics chair.

Conferral of Degree (Plan A)

Semester Evaluation

Department policy requires that a graduate student meet with their thesis/dissertation committee every semester for the goal of reviewing progress and seeking guidance. Extenuating circumstances may prevent a timely and expeditious meeting. In this case, a student is expected to make every effort to communicate with committee members in lieu of a physical meeting such that the goal of this policy is fulfilled. Adherence to this policy will be considered annually by the G&G Graduate Student Committee.

Annual Evaluation

The academic record of all students and the length of time to earn that record will be evaluated annually in mid-spring. This evaluation of progress will include a written statement of progress and problems from the student and an interview of the student by members of the Graduate Studies Committee. The student's adviser or committee chairman, and his or her employer (if any) will not be present at the oral evaluation, although they will complete written evaluations. Members of the GSC will review and evaluate the student's plan of study and progress. All evaluators will report their opinions to the GSC of how deserving of financial aid and office space each student is for the following year. Suggestions from students for departmental improvements are strongly encouraged during the interview. The results of the spring evaluation become part of the student's file.

Exit Interviews

Effective Spring 2005, all graduate students in Geology and Geophysics will be required to participate in an exit interview prior to graduation. The Graduate Division's Student Progress Form III will be signed by the GG graduate chair only upon completion of the exit interview. Interviews will not be conducted by faculty members. These required interviews are being conducted as part of the University of Hawaii's accreditation with the Western Association of Schools and Colleges (WASC).
Summary of Procedures (Plan A)

1. Preliminary conference; appointment of interim advisor. Commence Student Progress Form I.

2. Appointment of thesis committee. Commence Student Progress Form II.

3. Approval of thesis topic. (Student Progress Form II)

4. Application for graduation, payment of graduation fees. Forms and thesis style guides are available at the Graduate Records Office (Spalding 352).

5. Schedule thesis defense.


7. Submit written thesis to the Graduate Records Office. (Student Progress Form III).

8. Exit interview.

9. Graduate Chair certifies that all degree requirements have been met.

10. Conferral of degree.

**Deadlines for submission of degree applications, final examination and thesis deposit vary between the fall, spring, and summer semesters. For specific dates see the Department’s Student Services bulletin board.**

**NOTE: The Geology and Geophysics department does not require a general examination as stated in the Graduate Division Manual.**
Master's Plan B (Non-Thesis)

Normally, students in Geology and Geophysics are admitted to Plan A in the MS program. If a demonstration of research ability is deemed unnecessary for the student's intended career, the student may be admitted to Plan B. The department's requirements for the Plan B master's degree are as follows.

Course Requirements (Plan B)

At least 30 credit hours must be completed. A minimum of 18 credit hours must be earned in courses numbered 600-798 (excluding Thesis 700).

Departmental course requirements vary depending on the area of concentration (see Area Requirements). Requirements for students entering from fields other than geological sciences will be determined on an individual basis by the GSC and the thesis committee. Directed Research (GG 699) may only be taken on a credit/no credit basis. If a student is receiving a research assistantship, teaching assistantship, or tuition waiver, then he or she must be registered for nine program-related credit hours during the semester that he or she has the assistantship or waiver. Graduate Assistants registering for more than nine credits will require a memo of concurrence from the department chair.

Preliminary Conference (Plan B)

The purposes of the preliminary conference are to determine in which field the student will pursue a degree, to consider undergraduate deficiencies, to advise the student of a suitable selection of courses for the first semester, and to appoint an interim adviser in his or her field. Entering students will be advised by mail as to the time and place of the preliminary conference, which is normally conducted prior to registration for the first term. The department chair, student's interim advisor and a representative from the Graduate Admissions Committee (GAC) and Graduate Studies Committee (GSC) will also be present.

Undergraduate deficiencies will be assigned as follows. For all applicants, any of these courses not already completed: one year each of college mathematics, physics with labs, chemistry with labs, and geology-geophysics with labs. For applicants from majors that are equivalent to a BS (or BS in engineering) at the University of Hawaii, any deficiency in a course required for the same BS (or BS in Engineering) at UHM will be an undergraduate deficiency (e.g., a geologist entering without petrology, a physicist entering without electricity and magnetism). Normally, applicants from a field other than science, engineering, or mathematics would not be admitted. If circumstances suggest that such a student be admitted, all courses needed for a bachelor's degree at UHM in the field he or she intends to enter will be listed as undergraduate deficiencies. Students shifting to a different field will not have the upper division courses (300-400) listed as undergraduate deficiencies (e.g., a geologist shifting to geophysics who has not had mechanics; a physicist shifting to geophysics who has not had structural geology).

Degree Committee (Plan B)

A committee must be formed, composed of an advisor and two other GG graduate faculty.

Research Proposal (Plan B)

In order to enter the Plan B program, a student must submit an acceptable proposal to his/her committee explaining the academic focus of the MS, outlining what courses he/she plans to take, and specifying the type of research activity that he/she will participate in. If the student is switching from Plan A to Plan B, the Graduate Studies Committee must approve the Plan B proposal.

Application for Graduation (Plan B)

You need to pick up the all-important forms at the Graduate Division Records Office, Spalding 352.

Research Defense (Plan B)

A written research report is required. The topic must be approved by the student's entire committee. The finished report must be delivered to their committee at least one week prior to the oral exam. An oral exam covering the student's research report and general geologic knowledge is required. The student's entire committee must attend. Other faculty may attend. Only the student's committee votes. The oral exam can be repeated only once.
**Graduate Chair Approval (Plan B)**

This is a routine step where Graduate Division sends the degree check form to the chairperson of your field of study – in our case the Geology and Geophysics chair.

**Conferral of Degree (Plan B)**

**Semester Evaluation**

Department policy requires that a graduate student meet with their thesis/dissertation committee every semester for the goal of reviewing progress and seeking guidance. Extenuating circumstances may prevent a timely and expeditious meeting. In this case, a student is expected to make every effort to communicate with committee members in lieu of a physical meeting such that the goal of this policy is fulfilled. Adherence to this policy will be considered annually by the G&G Graduate Student Committee.

**Annual Evaluation**

The academic record of all students and the length of time to earn that record will be evaluated annually in mid-spring. This evaluation of progress will include a written statement of progress and problems from the student and an interview of the student by members of the Graduate Studies Committee. The student's adviser or committee chairman, and his or her employer (if any) will not be present at the oral evaluation, although they will complete written evaluations. Members of the GSC will review and evaluate the student's plan of study and progress. All evaluators will report their opinions to the GSC of how deserving of financial aid and office space each student is for the following year. Suggestions from students for departmental improvements are strongly encouraged during the interview. The results of the spring evaluation become part of the student's file.

**Exit Interviews**

Effective Spring 2005, all graduate students in Geology and Geophysics will be required to participate in an exit interview prior to graduation. The Graduate Division's Student Progress Form III will be signed by the GG graduate chair only upon completion of the exit interview. Interviews will not be conducted by faculty members. These required interviews are being conducted as part of the University of Hawaii's accreditation with the Western Association of Schools and Colleges (WASC).

**Summary of Procedures (Plan B)**

1. Preliminary conference; appointment of interim adviser.

2. Appointment of program committee/adviser.


4. Application for degree (Student picks up form at Graduate Division Records Office, Rm. 352).

5. Defense (final examination); judgment of Plan B paper.

6. Exit interview.

7. Graduate chair certifies that all degree requirements have been met.

8. Conferral of the degree.
**MS PLAN A TIMETABLE* AND SEQUENCE OF PROGRESS REPORT FORMS**

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<thead>
<tr>
<th>FORM/TASK</th>
<th>EXPECTED PROGRESS</th>
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<tr>
<td>I. Preliminary Conference</td>
<td>1st semester (typically, before registration)</td>
</tr>
<tr>
<td>I. Admission to Candidacy</td>
<td>1st semester (at Preliminary Conference)</td>
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<tr>
<td>II. Thesis Committee Selection</td>
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<tr>
<td>II. Approval of Thesis Proposal</td>
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<tr>
<td>IIA. Final Exam (Thesis Defense)</td>
<td>Within two years</td>
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<tr>
<td>III. Thesis Approval</td>
<td>Within two years</td>
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**Time Allowed.** In general, the department expects that a student progressing normally will complete the MS degree within two years in residence or as soon thereafter as possible. Priority for office space is given to students within their first two years of graduate studies. If space is available and a student is making satisfactory progress, they may remain in residence for more than two years. Students are referred to the UH Manoa Graduate Division webpage for additional information (http://www2.hawaii.edu/graduate/sitemap.htm)

**Funding.** The initial offer letter details the Department’s commitment to funding. No funding is guaranteed beyond the initial offer. If additional funding is needed to complete the degree, this must be negotiated with the advisor and the Department Chair. Criteria for additional funding include the student’s progress towards completion of the degree, availability of support, and the nature of problem that prevented the student from completing the degree as planned. Priority for awarding Teaching Assistantships is given to students within their first two years in the Department.
DOCTORAL PROGRAM

The minimum requirement for the doctoral degree is three semesters of full-time work or its equivalent in credits at University of Hawaii at Manoa. Candidates must be registered in the 800 dissertation research course during the term in which the degree is awarded. Procedures for the doctoral program are laid out in the GRADUATE DIVISION MANUAL (pages 38-42). Their summary of procedures is summarized below.

Preliminary Conference

Students admitted to the program attend a preliminary conference with the department chair and representatives from the GAC and GSC as discussed earlier for MS students. Any undergraduate deficiencies will be assessed. At the preliminary conference a list of courses, if any, will be determined and assigned to the student with the purpose of helping to prepare the student for his or her intended research and Comprehensive Examination.

Qualifying Examination

The purpose of the qualifying examination is to determine whether or not a student with a bachelor's degree meets the academic standards of the department for direct entry into the PhD program without completing an MS degree. For students entering with an MS degree and thesis in the sciences the qualifying examination is waived. This examination is designed to evaluate the student's ability to conduct research. The qualifying examination, normally held at the end of the student's first full year in the program (for students entering in the fall no later than the following September and for students entering in the spring no later than the following February), is required of all students entering with a bachelor's degree who wish to be considered for the PhD rather than the MS program.

The examination will be either the presentation of results of a research project or a research proposal, intended to demonstrate the student's ability to conduct PhD-level research. Two alternative types of presentation will be allowed: (1) an original research project (which may be an expansion of the student's undergraduate honor's thesis or other undergraduate research), or (2) a proposal for an original research project. Either (1) or (2) may lead on to the topic of the dissertation, but need not do so. The final product to be judged by the qualifying examination committee will consist of:

Option 1: a written description of the research methods, procedures, results, bibliography, etc. of approximately 10-12 pages (a published paper for which the student is first author may substitute for the written description), or

Option 2: a written research proposal of similar length, and similar in style to a student's proposal for GSA aid.

In either case there also will be an oral presentation of approximately one-half hour, to be followed by questions. A committee consisting of the student's advisor (or interim advisor) and at least two members of the GSC evaluates the qualifying examination. If the student's performance on the qualifying examination is judged by the committee to be acceptable for entry directly into the PhD program, the student will be admitted to PhD candidacy if the student so desires; if the performance is deemed not acceptable by the committee, the student will be required to complete the MS degree before receiving further consideration for entry into the PhD program.

Admission to Candidacy

Following selection of a field of specialization and successful completion of the Qualifying Examination (where applicable) the candidate advances to candidacy. Admission to candidacy requires the approval of the graduate chair and Graduate Division. Form I is complete once this is granted.
Comprehensive Examination

The comprehensive examination in the Department of Geology and Geophysics determines the depth of the candidate's knowledge in his or her special fields and the breadth of his or her knowledge in fields related to the dissertation and to the geological sciences. Results indicate to the department whether or not the candidate has a sufficiently firm and broad foundation on which to build a career of independent research, college-level instruction, or both.

The comprehensive examination is taken at or before the end of four semesters of residence in the PhD program. The examination covers "the major field of study and work fundamental thereto and minor fields as may be required" (GRADUATE DIVISION MANUAL page 39). A date for taking the comprehensive examination will be determined in consultation with your advisor.

Graduate Division states that the comprehensive examination will be conducted by "the graduate faculty or a subcommittee thereof". In the Department of Geology and Geophysics this subcommittee generally comprises those graduate faculty who will be appointed as your doctoral committee. Please discuss any possible variation on this with the G &G Chair and the chair of the Graduate Studies Committee and get their endorsement.

Scope: Examination topics include the PhD candidate's intended fields of specialization and allied subjects pertaining to the intended fields. The PhD candidate and advisor, in consultation with the rest of the committee, will decide upon the intended fields of specialization. These should be as broad in scope as possible while maintaining a focus on the candidate's PhD research topic.

It should be emphasized that specialized fields and allied subjects are not specific courses, but areas of expertise. Breadth and depth can be gained through coursework, using those courses listed in the Area Requirements as a guide, or by independent study, but usually are best gained by a combination of course work and additional reading.

Preparation: Candidates should meet with their committee well before the examination to decide mutually on the preparation required and level of guidance that the candidate should receive. The advisor will ensure breadth of coverage of questions by assigning amongst the committee various fields of expertise and allied subjects, as appropriate. A student should expect firm indications of the topics that will appear on the examination, especially the written part, and individual members of the committee must prepare a reading list for the candidate covering their topics.

The examination: The examination will have both written and oral sections. The format of comprehensive examinations is variable, but the committee must inform the student of the chosen format well in advance of the examination date. The oral part should follow the written part by a period of not more than one week. All members of the committee must be present for the oral examination, and all must participate in judging the written examination. By department rules, a judgment of pass or fail for the entire exam (written and oral) must be made at the end of the oral examination. At least one faculty member who is a member of the GSC must attend the oral portion of comprehensive exams. If the student's PhD committee does not include a member of the GSC, a non-voting and non-participating GSC faculty will be appointed by the GSC chair to observe all parts of the oral portion of the comprehensive exam.

For the examination itself, the rules of the Graduate Division prevail. All members of the committee must be present for the oral portion and all must participate in judging the result of the entire examination. By department rules, the judgment must be made at the end of the oral examination; an examination may not be "continued" at a later date.

Results: In order for the PhD candidate to pass the examination, a majority vote of pass is required from the committee. The committee chair is a voting member. A member voting in the minority may request a review by the Graduate Division Dean. Irrespective of a pass or fail result, the committee should use the results of the examination to indicate any outstanding deficiencies in the candidate's preparation for the intended doctoral research and to request or require courses or readings to satisfy that deficiency. Candidates who fail the
examination may repeat it once and the doctoral committee shall decide which topics will be re-examined. Those who fail the second examination will be irrevocably dropped from the program.

**Appointment of Doctoral Committee**

As a result of a successful comprehensive examination, the department chair, on the advice of the student and his or her advisor, recommends appointment of a doctoral committee to the dean of the Graduate Division. The doctoral committee guides the student, approves the dissertation topic, and conducts the comprehensive and final examinations. The rules* are as follows:

(i) The committee must have at least five members of the graduate faculty.

(ii) At least one will be a UH-Manoa faculty member NOT affiliated via the Department of Geology and Geophysics (for example a professor from geography or oceanography).

(iii) The chair and a majority of members must be from the student's field of study and affiliated via Geology & Geophysics.

* Deciding who is eligible to be a member of your committee is one of the most difficult tasks you will face. Graduate Faculty is a group of scholars who have been selected to work with and advise graduate students. It includes regular members, whose academic appointment is in the school housing the graduate field, cooperating members whose appointment is in another school, and affiliates from outside the University. All three classes may serve on a doctoral committee. Most HIGP graduate faculty are appointed via our department and therefore do NOT meet criteria (ii) above. Affiliate graduate faculty (people outside the UH system) do NOT fulfill the need for an 'outside member' either, as it must be a UH employee. You must, in consultation with your advisor, identify a willing regular member of the graduate faculty from another graduate field of study (e.g. geography, meteorology, oceanography, sociology) to serve as your outside member. At the discretion of the department chair, the committee MAY include a specialist from outside graduate faculty. Your advisor will need to submit a written request plus the individual's CV to achieve this.
Approval of Dissertation Topic

The department's guideline has been that approval of the dissertation topic will result from the successful oral defense of a written dissertation proposal before the doctoral committee. The proposal will normally include a clear statement of the problem or problems to be investigated, the relationship of the problems to the broader aspects of geological science as referenced by classic and current literature, and an outline of the proposed methods of approaching the problem, including a timetable, estimates of cost, computer time, and any equipment or facilities needed. In recent times, practice has varied from this guideline—some committees have stuck exactly to this protocol others have waived the oral defense. You MUST talk with your advisor concerning her/his expectations of you in this regard. The committee will record approval on Form II and once the form is accepted the candidate may then register for Dissertation Research 800 during their remaining semesters.

Although candidates should look to the chair of the doctoral committee for primary direction regarding research methods and the preparation of results, it is the joint responsibility of the candidate and his or her chair to keep all committee members informed of the scope, plan, and progress of research and writing. Each semester the committee should meet or the candidate should circulate a written report for comment.

Current instructions for the preparation of the dissertation are available at the Graduate Division office. The department urges that the dissertation be organized and written so that whole sections or chapters can be submitted for publication with a minimum of rewriting and editing.

The purpose of the dissertation is to allow a student to thoughtfully develop an original scientific project under the tutelage of a faculty mentor, so as to add to the knowledge of the discipline and to establish the student as a qualified scientist in his or her own right. The research program typically involves:

1. A survey of the literature to establish a broad base of knowledge
2. Making new measurements or finding an intriguing and previously undiscovered method of understanding existing data
3. Explaining the results, defending the thesis, and publishing

It is especially important for students to gain direct, first-hand experience in creating their own database when this is practical and feasible. But in any case, scientific integrity mandates that the student fully acknowledge in the thesis any and all collaboration, e.g., samples, sample preparation, measurements, analyses, data, or computer algorithms produced by others involved in the crafting of the thesis research.

In the range of endeavors that encompass modern research, from single-investigator to complex multi-investigator programs, the level and intricacy of collaboration will vary. It is important for the graduate student to identify and carve out a niche that will allow the student to make unique and valuable contributions, as well as to acknowledge the contributions made by others to his or her progress and professional development.

Application for Degree

You need to pick up the all-important forms at the Graduate Division Records Office, Room 352.

Schedule Dissertation Defense

Copies of the completed dissertation must be submitted to all committee members at least four weeks prior to the date of the final oral examination and the Graduate Division must be notified at least three weeks prior to the examination. The policy of the G&G department is that a student should not be permitted to defend until his or her committee has agreed that the written dissertation is defendable, i.e., that the dissertation is likely to require only modest revisions in consequence of the oral defense.

Dissertation Defense (final examination)

A public oral examination in defense of the dissertation is required of all candidates. It must be passed at least six weeks before the end of the semester or summer session in which the degree is granted. It must be of at least one hour's duration and be scheduled at least 4 weeks in advance. It must be advertised in Ku Lama and announcement made to Graduate Records Office 3 weeks prior to the date of examination. All members of the doctoral committee must be present.

The candidate presents the salient points in the background, methods, results, and conclusions of the research in a period of about 45 minutes. The chairman of the dissertation committee then will ask for questions from members of the graduate faculty and the public. Following the open question period, there will be a closed-
session question and answer period during which time the dissertation committee may examine the candidate further.

When questioning is completed, all members of the doctoral committee vote in private session on the candidate's performance. A majority of the members must vote "pass"; otherwise, the candidate fails. A member voting in the minority may request a review by the Dean of the Graduate Division. A candidate who fails may petition to repeat the final examination. Upon a second failure the student is dropped from candidacy. There are important differences to past practice contained in the Graduate Division manual and on Graduate Division Form III. In the past the committee recorded separate evaluations of the written thesis (old form VI) and the oral defense of the thesis (old form VII). If modifications were required to the written thesis these could then be approved by a minimum of three members of the doctoral committee. New Form III requires the ENTIRE committee to approve both thesis and defense simultaneously, either immediately following the defense or after revision of the dissertation. Approval of the dissertation defense is now noted by filing Departmental Form IIA.

**Revision of Written Thesis in Light of Committee's Evaluation**

Modest rewriting of the dissertation may be needed. The doctoral committee including the advisor is required to make their judgment of the thesis on Form III and a minimum of three committee members must sign the signature page of the final dissertation. Students are cautioned to acquaint themselves with the deadline for submission of the dissertation to the Graduate Division, as well as deadlines for fees, doctoral forms, and the dissertation abstract.

**Submit Form III and Thesis**

Two copies of the approved dissertation must be submitted to Graduate Division together with the completed UMI forms and payment of fees.

**Graduate Chair Certifies Degree Requirements**

The Graduate Chair submits the Certification of Degree Award, attesting that all degree requirements have been met.

**Conferral of Degree**

**MS Enroute**

The MS enroute plan is for PhD students who decide to complete both their master's and doctoral degrees within seven years at UHM. These students will be considered MS students until all requirements for the MS program are fulfilled. Switching between MS and PhD can take place at any time as long as these students are aware of their time constraints.

For example: If a MS enroute student completes the MS program in two years and goes on unofficial leave from the university for two years then decides to return to obtain a PhD, that student will have a total of three years to complete the program (7 years minus 2 years to complete the master's program minus 2 years of unofficial leave equals 3 years to complete the doctoral program).

**Time Allowed**

In general, the department expects that a student progressing normally will complete the PhD degree within six semesters of residence if he or she arrives with a MS in a geological field, and within eight semesters for other backgrounds. The department will strive to provide space and support for students for this period. The Graduate Division states that candidates for doctoral degrees are expected to complete all requirements within seven years after admission into the doctoral program. Candidates who fail to complete all requirements within this specified time are automatically dropped from the program. Reinstatement for a limited period of time is only possible upon favorable recommendation of the dissertation committee and the department chair and with concurrence of the Dean of the Graduate Division.
Requirements for Coursework and Residence

All PhD students are required to have completed a program of coursework equivalent to that required for the Geology and Geophysics MS degree in their field of study. In addition, all students are required to take **GG 610, Graduate Seminar**, once each year for a maximum of five years. Students who obtain a MS degree en route to a PhD may apply their existing GG 610 class credits to meet the minimum requirements for a PhD.

For those students entering with an MS degree the coursework requirement normally will be waived if during the period of their MS studies they had completed the required MS courses or acceptable equivalents. Beyond this MS equivalency, and the list prepared at the preliminary conference, courses may be added or substituted by the advisor and doctoral committee.

Directed Research (GG 699) courses may only be taken on a credit/no credit basis. **If a student is receiving a research assistantship, teaching assistantship, or tuition waiver, then he or she must be registered for nine program-related credit hours during the semester that he or she has the assistantship or waiver.** Graduate Assistants registering for more than nine credits will require a memo from the department chair.

The Graduate Division requires a minimum residence requirement of three semesters of full-time work while registered at the University of Hawaii at Manoa.

Semester Evaluation

Department policy requires that a graduate student meet with their thesis/dissertation committee every semester for the goal of reviewing progress and seeking guidance. Extenuating circumstances may prevent a timely and expeditious meeting. In this case, a student is expected to make every effort to communicate with committee members in lieu of a physical meeting such that the goal of this policy is fulfilled. Adherence to this policy will be considered annually by the G&G Graduate Student Committee.

Annual Evaluation

The academic record of all students and the length of time to earn that record will be evaluated annually in mid-spring. This evaluation of progress will include a written statement of progress/problems from the student, an interview of the student by members of the GSC. The student’s advisor or committee chairman, and his or her employer (if any) will not be present at the oral evaluation, although they will complete written evaluations. Members of the GSC will review and evaluate the student’s plan of study and progress. All evaluators will report their opinions to the GSC and the department chair, including how deserving of financial aid and office space each student is for the following year. Suggestions from students for departmental improvements are strongly encouraged during the interview. The results of the spring evaluation become part of the student’s file.

Deadlines for submission of degree applications, final examination and dissertation deposit vary between the fall, spring, and summer semesters. For specific dates see the Department’s Student Services bulletin board.

Exit Interviews

Effective Spring 2005, all graduate students in Geology and Geophysics will be required to participate in an exit interview prior to graduation. The Graduate Division's Student Progress Form III will be signed by the GG graduate chair only upon completion of the exit interview. Interviews will not be conducted by faculty members. These required interviews are being conducted as part of the University of Hawaii’s accreditation with the Western Association of Schools and Colleges (WASC).
SUMMARY OF PROCEDURES

1. Preliminary conference, appointment of preliminary advisor (Student Progress Form I).
2. Qualifying Examination, if applicable (Form I).
3. Admission to candidacy (Form I).
4. Comprehensive Examination (Departmental Form IA).
5. Appointment of doctoral committee (Form II).
6. Approval of dissertation proposal (Form II).
7. Application for degree and dissertation binding fees.
9. Final Examination (defense of dissertation). (Departmental Form IIA)
11. Exit interview.
12. Submit Form III. Submit 2 copies of thesis to Graduate Division. Complete University Microfilms Inc. forms, pay fees.
13. Graduate Chair certifies all degree requirements have been met.
14. Conferral of degree.
## PhD TIMETABLE AND SEQUENCE OF PROGRESS REPORT FORM

### Without MS or with non-geological MS

<table>
<thead>
<tr>
<th>FORM</th>
<th>TASK</th>
<th>NORMAL PROGRESS</th>
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<tbody>
<tr>
<td>I.</td>
<td>Preliminary Conference</td>
<td>1st semester</td>
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<tr>
<td>I.</td>
<td>Qualifying Examination</td>
<td>Beginning of 2nd semester</td>
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<td></td>
<td>Admission to Candidacy</td>
<td>3rd semester</td>
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<tr>
<td>IA.</td>
<td>Comprehensive Exam</td>
<td>4th semester</td>
</tr>
<tr>
<td>II.</td>
<td>Approval of Doctoral Committee</td>
<td>4th semester</td>
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<tr>
<td>II.</td>
<td>Approval of Dissertation Topic</td>
<td>5th semester</td>
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<tr>
<td>IIA.</td>
<td>Dissertation Defense (final exam)</td>
<td>8th - 10th semester</td>
</tr>
<tr>
<td>III.</td>
<td>Dissertation Approval</td>
<td>8th - 10th semester</td>
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### With MS in geological field

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<td>I.</td>
<td>Preliminary Conference</td>
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<tr>
<td>I.</td>
<td>Admission to Candidacy</td>
<td>2nd semester</td>
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<tr>
<td>IA.</td>
<td>Comprehensive Exam</td>
<td>2nd semester</td>
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<tr>
<td>II.</td>
<td>Approval of Doctoral Committee</td>
<td>2nd semester</td>
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<td>II.</td>
<td>Approval of Dissertation Topic</td>
<td>3rd semester</td>
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<td>IIA.</td>
<td>Dissertation Defense (final exam)</td>
<td>6th semester*</td>
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<td>III.</td>
<td>Dissertation Approval</td>
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*The GSC may under some circumstances consider the 8th semester to be normal progress.

### YOUR TIMETABLE

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<th>FORM</th>
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<th>YOUR PROGRESS</th>
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<td>Admission to Candidacy</td>
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<td>IIA.</td>
<td>Dissertation Defense (final exam)</td>
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III. Dissertation Approval

AREA REQUIREMENTS

HIGH-PRESSURE GEOPHYSICS AND GEOCHEMISTRY

MS Requirements

I. Courses: May be taken as an undergraduate or graduate student.

A. Basic:
   - GG 301    Mineralogy and lab
   - GG 302    Igneous & Metamorphic Petrology and lab
   - GG 401    Introduction to Mineral Physics
   - GG 450    Geophysical Methods
   - MATH 241-242 Calculus I, II
   - MATH 243-244 Calculus III, IV
   - PHYS 170-170L General Physics I and lab
   - PHYS 274    General Physics III
   - CHEM 351    Physical Chemistry I
   - CHEM 352    Physical Chemistry II

B. Additional for the area: At least four courses in category 1. ● = taught in last two years

1. Geology and Geophysics
   - ●GG 312    Geomathematics
   - ●GG 401    Introduction to Mineral Physics
   - ●GG 325    Fundamentals of Geochemistry
   - ●GG 600    Equations in Geophysics
   - ●GG 602    Theoretical Petrology
   - ●GG 603    Petrology of Ocean Lithosphere and lab
   - ●GG 608    Isotopes and Trace Elements
   - ●GG 653    Mantle Mineralogy
   - ●GG 701    Physics of the Earth's Interior

2. Optional Related Courses
   a. Geology and Geophysics
      - GG 642    Elemental Composition Changes
      - ●GG 681    Continuum Mechanics
   b. Physics
      - PHYS 400    Applications of Mathematics in Physical Science
      - PHYS 430    Thermodynamics and Statistical Mechanics
      - PHYS 440    Solid State Physics I
      - PHYS 785    Solid State Theory
   c. Chemistry
      - CHEM 422    Intermediate Inorganic Chemistry
      - CHEM 601    Theory of Chemical Bonding
      - CHEM 602    Chemical Applications of Spectroscopy
      - CHEM 651    Chemical Thermodynamics & Statistical Mechanics
      - CHEM 658    Crystallography
d. Mathematics
   MATH 402  Partial Differential Equations I
   MATH 407  Numerical Analysis
   MATH 442  Vector Analysis

e. Mechanical Engineering
   ME 371    Mechanics of Solids
   ME 435    Experimental Methods in Materials Research and lab
   ME 611    Classical Thermodynamics
   ME 474    Fundamental Acoustics
   ME 642    Mechanical Behavior of Engineering Materials
   ME 631    Advanced Materials Science
   ME 671    Continuum Mechanics

II. Writing of thesis (Plan A)

PhD Requirements

I. Courses: Coursework equivalent to MS degree requirements plus selected additional coursework as required by dissertation topic.

II. Comprehensive Examination

III. Dissertation
HYDROGEOLOGY AND ENGINEERING GEOLOGY

MS Requirements

I. Courses: May be taken as an undergraduate or graduate student.

A. Basic:
   ● GG 200 Geological Inquiry
   ● GG 305 Geological Field Methods
   MATH 241-242 Calculus I, II
   PHYS 170-272 General Physics I, II and labs
   CHEM 161-162L General Chemistry and lab

B. Requirements for the area. For hydrogeology students: all courses from category 1, one or more courses from category 2, and one or more courses from categories 3, 4, and 5 combined. For engineering geology students: three or more courses from category 3, one or more courses from category 1, and two or more courses from categories 2, 4, and 5 combined. Especially desirable courses are underlined.

1. Hydrogeology Core:
   ● GG 455 Hydrogeology and lab
   GG 605 Groundwater/Engineering Geology
   GG 654 Groundwater Contamination
   ● GG 655 Groundwater Modeling
   NREM 660 Hydrologic Processes in Soil and lab
   CEE 424 Applied Hydrology OR
   GEOG 405 Water in the Environment

2. Water Quality:
   ● GG 325 Fundamentals of Geochemistry
   ● GG 425 Environmental Geochemistry
   ● CEE 330 Environmental Engineering
   CEE 635 Environmental Chemistry
   CEE 636 Water Quality Biology
   CEE 644 Water Quality Modeling

3. Engineering Geology and Soils:
   ● GG 300 Volcanology
   ● GG 303 Structural Geology
   ● GG 312 Geomathematics
   ● GG 313 Geological Data Analysis I
   ● GG 420 Sea Levels, Ice Ages and Global Change
   ● GG 450 Geophysical Methods
   GG 451 Earthquakes
   ● GG 454 Engineering Geology
   ● GG 455 Hydrogeology and lab
   ● GG 600 Equations of Geophysics
   GG 605 Groundwater/Engineering Geology
   GG 632 Numerical Modeling in Geology
   ● GG 685 Geophysical Inverse Theory
   CEE 355 Geotechnical Engineering and lab
   GEOG 403 Fluvial Geomorphology
   GEOG 412 Environmental Impact Assessment
4. Advanced Hydrology and Water Resources:
   - GG 656 Transport Modeling
   - CEE 422 Environmental Fluid Mechanics
   - CEE 627 Groundwater Hydrology
   - CEE 630 Water Resources Systems Planning and Management
   - ME 625 Numerical Method in Fluid Mechanics and Heat Transfer

5. Other related courses:
   - GG 691 Geological Data Analysis II
   - CEE 320 Fluid Mechanics Fundamentals
   - CEE 469 Photogrammetric Engineering and lab
   - ME 311 Thermodynamics
   - GG 681 Continuum Mechanics
   - ME 672 Finite Element Analysis
   - NREM 461 Soil, Erosion, and Conservation
   - GEOG 470 Remote Sensing
   - MATH 243-244 Calculus III, IV
   - MATH 311 Introduction to Linear Algebra
   - Certain other math, physics, soils, and engineering courses.

II. Writing of a thesis (Plan A).

PhD Requirements

I. Courses: Coursework equivalent to MS degree requirements plus selected additional coursework as required by dissertation topic.

II. Comprehensive Examination

III. Dissertation
MARINE GEOLOGY AND GEOPHYSICS

MS Requirements

I. Courses: May be taken as an undergraduate or graduate student.

A. Basic:  
- MATH 241-242  Calculus I, II  
- PHYS 170-272L  General Physics I, II and labs  
- CHEM 161-162  General Chemistry and lab  
- GG 200  Geological Inquiry  
- GG 303  Structural Geology  
- GG 305  Geological Field Methods  

Either group depending on the track that the student is interested in pursuing

1. General Geology  
   - GG 301  Mineralogy  
   - GG 302  Igneous and Metamorphic Petrology  
   - GG 309  Sedimentology and Stratigraphy and lab  
   - GG 313  Geological Data Analysis I  

2. Earth Dynamics & Mechanics  
   - GG 312  Geomathematics  
   - GG 313  Geological Data Analysis I  

B. Additional for the area: Normally six courses, at least one from each of three of the four categories below, are required.

1. General marine geology, including tectonics:  
   - GG 423  Marine Geology  
   - GG 625  Seminar in Marine Geology and Geophysics  
   - GG 672  Seminar in Tectonics  

2. Sedimentology, paleontology, geochemistry, and petrology:  
   - GG 300  Volcanology  
   - GG 301  Mineralogy and lab  
   - GG 302  Igneous and Metamorphic Petrology and lab  
   - GG 325  Fundamentals of Geochemistry  
   - GG 420  Sea Levels, Ice Ages and Global Change  
   - GG 421  Geologic Record of Climate Change  
   - GG 425  Environmental Geochemistry  
   - GG 603  Petrology of Ocean Lithosphere and lab  
   - GG 615  Micropaleontology and lab  
   - GG 641  Origin of Sedimentary Rocks and lab  
   - GG 644  Sedimentary Geochemistry  
   - GG 674  Paleooceanography  
   - GG 735  Seminar in Geochemistry  
   - OCN 623  Chemical Oceanography  
   - OCN 643  Topics in Marine Geochemistry
3. Exploration and general geophysics:

- GG 450 Geophysical Methods
- GG 600 Equations of Geophysics
- GG 650 Seismology
- GG 651 Geomagnetism and Cosmic Magnetism
- GG 652 Gravity, Magnetics, and Heat Flow
- GG 681 Continuum Mechanics
- GG 685 Geophysical Inverse Theory
- GG 691 Geological Data Analysis II
- GG 701 Physics of the Earth’s Interior
- OCN 620 Physical Oceanography

4. Other related courses:

- GG 312 Geomathematics
- MATH 243 Calculus III
- MATH 244 Calculus IV
- MATH 311 Introduction to Linear Algebra
- MATH 371 Elementary Probability Theory
- MATH 402 Partial Differential Equations
- MATH 407 Numerical Analysis
- PHYS 310 Theoretical Mechanics I
- PHYS 350 Electricity and Magnetism
- PHYS 400 Applications of Mathematics in Physical Sciences
- PHYS 600 Methods of Theoretical Physics

Certain chemistry, zoology, oceanography, and ocean engineering courses.

II. Participation in field work at sea or nearshore; credit may be obtained through GG 614 or 699.

III. Writing of a thesis (Plan A).

PhD Requirements

I. Courses: Coursework equivalent to MS degree requirements plus selected additional coursework as required by dissertation topic.

II. Comprehensive Examination

III. Dissertation
PLANETARY GEOSCIENCES

The graduate program in Planetary Geosciences within the Department of Geology and Geophysics is designed to provide a broad understanding of the multidisciplinary field of planetary science and terrestrial remote sensing as well as to develop competency in an area of specialization. This philosophy implies that after completion of this program a student will be able to understand and contribute research in fields that are related to the study of the Solar System. These fields include, but are not limited to, astronomy, chemistry, geology, geophysics, mathematics, meteorology, oceanography, and physics.

Note: Because of the very wide range of disciplines that are spanned by this area, a large amount of flexibility in specific course programs is necessary. It is recognized that in a significant number of cases the student program will be tailored for that individual by the student, advisor, and committee.

MS Requirements

I. Courses

A. Basic: Demonstration of proficiency in the following courses or equivalents is expected:

- GG 301  Mineralogy and lab
- GG 302  Igneous and Metamorphic Petrology and lab
- GG 303  Structural Geology
- GG 305  Geological Field Methods
- GG 325  Fundamentals of Geochemistry
- GG 466  Planetary Geology
- CHEM 351-352  Physical Chemistry I - II

Math through calculus and differential equations, physics, and computer programming.

B. Required Courses: Because planetary sciences involve a wide range of disciplines, students are strongly encouraged to take a broad range of planetary courses in addition to those courses that are required for a particular field of study. At least 9 credits (3 courses) must be taken from the following:

- GG 666  Planetary Surfaces
- GG 667  Planetary Atmospheres: Origin and Evolution
- GG 669  Formation of the Solar System
- GG 670B  Geology of Planetary Bodies: The Moon
- GG 670C  Geology of Planetary Bodies: Mars
- GG 671B  Remote Sensing: Planets
- GG 671C  Remote Sensing: Volcanoes
- GG 673B  Extraterrestrial Materials: Meteorites
- GG 673C  Extraterrestrial Materials: Petrological Evolution of the Moon
- GG 681  Continuum Mechanics

In addition, students must receive 1 credit for each of two semesters for GG 665 (Current Readings in Planetary Science). Not more than 6 of the total 30 credits required for an MS degree can normally be for courses at the 300-500 level.
Courses that can contribute towards the fulfillment of course requirements:

1. Other planetary science courses:
   GG 711   Special Topics in Geology and Geophysics

2. All other GG courses

3. Physics and Astronomy
   ASTR 630   The Solar System
   ASTR 633   Astrophysical Techniques
   Upper-level physics courses

4. Chemistry
   CHEM 351-352   Physical Chemistry I and II

5. Oceanography
   OCN 638   Earth System Science and Global Change
   OCN 640   Advanced Physical Oceanography

6. Meteorology
   MET 600   Atmospheric Dynamics I
   MET 601   Atmospheric Dynamics II
   MET 620   Physical Meteorology
   MET 621   Cloud Physics

7. Additional courses (e.g., numerical methods, statistics, computer science, remote sensing, and engineering) from other departments that the student's MS or PhD committee and the Department of Geology and Geophysics deem necessary for the fulfillment of course requirements. A course plan should be developed with the advisor to reflect the specific interest and needs of the student. The plan should be flexible, and updated subject to the learning needs of the student, as well as recommendations of the advisor and committee on recognizing areas of weakness and/or new areas of desired skill development.

II. Writing of a thesis (Plan A)

PhD Requirements

I. Courses: Students must take coursework equivalent to MS degree requirements, including at least four 600-level planetary geosciences courses, unless they have taken these or their equivalents during their MS program.

II. Comprehensive Examination

III. Dissertation
GEOPHYSICS

Advances in these disciplines depend largely on a basic knowledge of physics, mathematics, and chemistry, and on the ability to apply these collateral sciences to geological problems. For this reason the best preparation for graduate work combines an adequate background in related sciences and mathematics with a basic introduction to the geological sciences.

MS Requirements

The background required of master's students is usually obtained during undergraduate studies but may be completed during graduate school. This background should include:

- Math - through differential equations
- Physics - 2 years
- Chemistry - 1 year
- Elementary geophysics and geophysical prospecting
- Introductory geology - mineralogy, petrology, and structural geology
- One computer programming course of proficiency in programming (preferably in C, C++, MATLAB, or PERL)

Students in geophysics must take five of the following core courses

1. GG 600 Equations of Geophysics
2. GG 681 Continuum Mechanics
3. GG 652 Gravity, Mechanics, and Heat Flow
4. GG 650 Seismology
5. GG 691 Geological Data Analysis II, or GG 685 Geophysical Inverse Theory
6. GG 701 Physics of the Earth’s Interior

Students are expected to write a thesis (Plan A); students are admitted to the non-thesis (Plan B) program only in unusual circumstances.

PhD Requirements

I. Courses: Coursework equivalent to MS degree requirements plus selected additional coursework as required by dissertation topic.

II. Comprehensive Examination

III. Dissertation
VOLCANOLOGY, GEOCHEMISTRY, AND PETROLOGY

The graduate program in Volcanology, Geochemistry, and Petrology is designed to provide a broad understanding in these fields. In terms of physical volcanology areas of coverage include hazards, physical processes, field methods and data processing/application. In terms of geochemistry and petrology, coverage includes elements of igneous, sedimentary and metamorphic geochemistry and petrology theory, as well as analysis skills. Upon completion of the program the student will be able to understand and contribute to these fields. Given the demands of the subject area, an adequate background in mathematics and the sciences are required.

MS Requirements

I. **Courses:** May be taken as an undergraduate or graduate student. Equivalent coursework from other institutions can be substituted upon approval of the student's committee.

   A. **Basic:** (student should already have taken these, or equivalent, courses as an undergraduate)

      - GG 200   Geological Inquiry
      - GG 305   Geological Field Methods
      - GG 325   Fundamentals of Geochemistry
      - GG 425   Environmental Geochemistry
      - MATH 241-242 Calculus I, II, note: 242 now includes a credit of computer lab.
      - PHYS 151-152L College Physics and labs (or PHYS 170-272L: General Physics and labs)
      - CHEM 161-162L General Chemistry I, II and lab (or 171, 171L: Principles of Chemistry and lab)

   B. **Normally,** a total of at least six courses from the first four categories below. Especially useful courses are underlined.

      1. **Volcanology:**
         - GG 300   Volcanology
         - ●GG 601  Explosive Volcanism
         - GG 711-002 Explosive Volcanism in the 21st Century
         - GG 711-005 Lava Flow Rheology and Morphology

      2. **Petrology:**
         - GG 302   Igneous and Metamorphic Petrology
         - ●GG 602  Theoretical Petrology
         - ●GG 603  Petrology of Ocean Lithosphere
         - ●GG 733  Seminar in Igneous Petrology
         - GG 734   Seminar in Metamorphic Petrology

      3. **Geochemistry:**
         - GG 325   Fundamentals of Geochemistry
         - GG 425   Environmental Geochemistry
         - ●GG 608  Isotopes and Trace Elements
         - GG 735   Seminar in Geochemistry I

      4. **Allied Geology and Geophysics courses:**
         - GG 303   Structural Geology
         - GG 312   Geomathematics
         - GG 313   Geological Data Analysis I
         - GG 401   Introduction to Mineral Physics
         - ●GG 407  Energy and Mineral Resources
         - ●GG 423  Marine Geology
         - GG 430   Geology and Mineral Resources of Asia
5. Other fields:
- CHEM 274-274L Principles of Analytical Chemistry
- CHEM 351 and 352 Physical Chemistry I, II
- CHEM 658 Crystallography
- PHYS 274 General Physics III
- PHYS 350 Electricity and Magnetism
- PHYS 430 Thermodynamics and Statistical Mechanics
- MATH 243-244 Calculus III, IV
- MATH 311 Introduction to Linear Algebra
- MATH 371 Elementary Probability Theory
- OCN 631 Ocean Minerals
- OCN 635 Isotopic Marine Geochemistry
- CE 320 Fluid Mechanics Fundamentals and lab

The graduate program in Volcanology, Geochemistry, and Petrology is designed to provide a broad understanding in these fields. In terms of physical volcanology areas of coverage include hazards, physical processes, field methods and data processing/application. In terms of geochemistry and petrology, coverage includes elements of igneous, sedimentary and metamorphic geochemistry and petrology theory, as well as analysis skills. Upon completion of the program the student will be able to understand and contribute to these fields. Given the demands of the subject area, an adequate background in mathematics and the sciences are required.

II. Writing of a thesis (Plan A)

PhD Requirements

I. Courses: Coursework equivalent to MS degree requirements plus selected additional coursework as required by dissertation topic.

II. Comprehensive Examination

III. Dissertation
APPENDIX

WHO'S WHO

Department Chair ..............................................................................................................Chip Fletcher
Associate Chair ................................................................................................................ ..Greg Moore

Student Services Specialist ...............................................................................................Leona Anthony
GG Office Manager............................................................................................................Susan Van Gorder

GG POST 6th Floor Secretary...........................................................................................Deanna Kikuchi
GG POST 7th Floor Secretary...........................................................................................Arlene Sullivan
GG POST 8th Floor Secretary...........................................................................................Evelyn Norris

Hawaii Institute of Geophysics and Planetology Director (Acting).........................Peter J. Mouginis-Mark
Secretary to the Director ..................................................................................................Violenda Nakahara
Hawaii Institute of Geophysics and Planetology Secretary.................................Grace Furuya
Planetary Geosciences Secretary.......................................................................................Karen Ogino
TIME ALLOWED
All work towards a master’s degree must be completed within seven years preceding the date upon which the degree is conferred. Credits earned prior to the seven-year period are not valid for the application toward the degree.

Candidates for doctoral degrees must complete all requirements within seven years after admission into the doctoral program. Candidates who fail to complete all requirements in the specified time are automatically dropped from the program. Reinstatement for a limited period of time is only possible upon favorable recommendation of the field of study and concurrence of the Dean of the Graduate Division.

CREDIT HOURS & COURSES
Here are some guidelines to follow when registering for classes.

MS students can only convert 6 credits of GG 699 to GG 700.

Students who have defended their thesis/dissertation topics may enroll in GG 700 (MS) or GG 800 (PhD).

For MS students, only courses taken for a grade will count toward your degree program (excluding GG 699 and GG 700). Courses taken only for credit will not count.

Both GG 699 and GG 700/800 can be taken during the same semester.

All TAs, RAs, and tuition waiver recipients are required to take 9 degree-related credits. Any number of credits over 9 will require a memo from the department chair. Please see Leona if you require such a memo.

Each English Language Institute (ELI) course is equal to 3 credits.

Students who have applied for graduation may register for 1 credit of GG 700 or 800 and be considered full-time (this excludes TAs, RAs, and tuition waiver recipients). PhD students taking 1 credit of GG 800 have a special tuition and fee rate. MS students taking 1 credit of GG 700 do not have a special tuition and fee rate.
RESERVING ROOMS
When you wish to reserve a room, make sure that you have the following information: date, time, room desired, alternates. If you are reserving room for an exam or defense, make sure that the dates and times are mutually agreed upon by all parties on your committee. See Susan Van Gorder (POST 701) regarding room requests.

SETTING UP THESIS/DISSERTATION PROPOSALS
See appropriate personnel to reserve room. Ask Leona for Student Progress Form II.

SETTING UP COMPREHENSIVE EXAMS
For the oral portion of the exam, see appropriate personnel to reserve a room. For the written portion, seek out a place in one of the libraries on campus. Rooms may not be reserved to accommodate such a long exam for one person. See Leona for Student Progress Form II.

SETTING UP DEFENSES
See Susan or your Floor Secretary to assist you with the logistics. Make sure that you have the date, time, room desired and alternates decided before seeing her. Make sure that the date(s) and time(s) you selected have been mutually agreed upon by all members of your committee.

FORMS, FORMS, AND MORE FORMS
Just about everything has a form. If you did something and didn't get a form, make sure you ask for one. You never know!
CALENDAR OF EVENTS
The following are a few important monthly events to keep in mind when planning your semesters. Please consult the University of Hawaii General and Graduate Information Catalog and posted announcements for specific dates.

JANUARY
Fall semester grades are posted on-line
Preliminary conferences for incoming graduate students
Registration for new and unclassified students
Deadline to receive graduate applications from students for the fall semester
Deadline to apply for spring graduation

FEBRUARY
Annual graduate student evaluation by Graduate Studies Committee

MARCH
Deadline to defend for spring graduation
Deadline for restricted withdrawals
Spring Break

APRIL
Deadline to submit Commitment of Graduate Assistantship forms for fall TAs and RAs
Deadline to submit renewal for Tuition Waiver
Fall registration for continuing classified students
Last day to remove I's from previous semester's work (April 1)
Submission of thesis/dissertation for spring graduation
Deadline to apply for the William T. Coulbourn Fellowship in Marine Geology
Deadline to apply for the Harold T. Stearns Fellowship

MAY
Annual GG awards presentation
Final Exams
Spring Graduation
Summer Session begins

JUNE
Spring semester grades are sent out
Deadline to defend for summer graduation
Deadline to apply for summer graduation
Summer Session I grades are sent out
JULY
Deadline to submit thesis/dissertation for summer graduation

AUGUST
Summer graduation
Summer Session II grades are sent out
Preliminary conferences for incoming graduate students
Fall semester begins
Registration for new and unclassified students
Deadline to receive graduate applications from students for the spring semester
Deadline to apply to fall graduation
Deadline to receive graduate applications from international students for spring

SEPTEMBER
Deadline to receive graduate applications from U.S. students for spring
Deadline to apply for fall graduation

OCTOBER
Deadline to defend for fall graduation

NOVEMBER
Deadline to submit Commitment of Graduate Assistantship forms for spring TAs and RAs
Deadline to submit renewal for Tuition Waiver recipient
Spring registration for continuing classified students
Last day to remove I's from previous semester's work (November 1)
Submission of thesis/dissertation for fall graduation

DECEMBER
Final exams
Fall graduation
EXAMPLES OF STUDENT PROGRESS FORMS

Master’s and Doctoral

http://www.hawaii.edu/graduate/download/list.htm