Course Approval Form

For instructions:
http://registrar.gmu.edu/facultystaff/catalog-revisions/course/

Action Requested: (definitions available at website above)
[X] Create NEW [ ] Inactivate
[ ] Modify (check all that apply below)

[ ] Title (must be 75% similar to original) [ ] Repeat Status [ ] Prereq/coreq [ ] Grade Mode
[ ] Credits [ ] Schedule Type [ ] Restrictions [ ] Other: _____

Course Level:
[ ] Undergraduate [X] Graduate

College/School: College of Science **Department:** Atmospheric, Oceanic, and Earth Sciences
Submitted by: Linda Hinnov **Ext:** 3-3082 **Email:** lhinnov@gmu.edu

Subject Code: GEOL **Number:** 535
(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [ ] Fall [X] Spring [ ] Summer *Year* 2017

Title:
Current
Banner (30 characters max w/ spaces)
New: Quantitative Stratigraphy

Fulfills Mason Core Req? (undergrad only)
[ ] Currently fulfills requirement
[ ] Submission in progress

Credits: (check one)
[X] Fixed → 3
[ ] Variable → to
[ ] Lec + Lab/Rct→ 0 or

Repeat Status: (check one)
[X] Not Repeatable (NR)
[ ] Repeatable within degree (RD) →
[ ] Repeatable within term (RT) →
Max credits allowed: 3 (required for RT/RD status only)

Grade Mode: (check one)
[X] Regular (A, B, C, etc.)
[ ] Satisfactory/No Credit
[ ] Special (A, B C, etc. +IP)

Schedule Type: (check one)
LEC can include LAB or RCT if linked sections will be offered
[X] Lecture (LEC)
[ ] Lab (LAB)
[ ] Recitation (RCT)
[ ] Internship (INT)
[ ] Independent Study (IND)
[ ] Seminar (SEM)
[ ] Studio (STU)

Prerequisite(s) (NOTE: hard-coding requires separate Prereq Checking form; see above website):
MATH 114 and STAT 250, or equivalent; or permission of instructor.

Corequisite(s):

Restrictions Enforced by System: Major, College, Degree, Program, etc. Include Code(s).

Equivalencies (check only as applicable):
[ ] YES, course is 100% equivalent to _____
[ ] YES, course renumbered to or replaces _____

Catalog Copy (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)	**Notes** (List additional information for the course)
Quantitative stratigraphy is a branch of geology that applies statistics to reconstruct the time sequence of geological events recorded in sedimentary strata. Course examines methods of interpolation and error analysis used for defining stratigraphic boundaries and events; time scale estimation using integrated chronostratigraphy, and intercalibration. Students receive training in graphic correlation, constrained optimization, ranking and scaling, and dynamic programming.	
Indicate number of contact hours: Hours of Lecture or Seminar per week: [ ] Hours of Lab or Studio: [ ]	
When Offered: (check all that apply) [ ] Fall [ ] Summer [ ] Spring	

Approval Signatures

Department Approval Date College/School Approval Date

If this course includes subject matter currently dealt with by any other units, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

Undergraduate or Graduate Council Approval

UGC or GC Council Member Provost's Office UGC or GC Approval Date

Form revised 9/2/2016

Course Proposal Submitted to the College of Science Curriculum Committee (COSCC)

The form above is processed by the Office of the University Registrar. This second page is for the COSCC's reference. Please complete the applicable portions of this page to clearly communicate what the form above is requesting.

FOR ALL COURSES (required)

Course Number and Title: **GEOL 535 – QUANTITATIVE STRATIGRAPHY**

Date of Departmental Approval:

FOR NEW COURSES (required if creating a new course)

- Reason for the New Course: Graduate students involved in paleoclimate and paleontologic research require training in quantitative methods that have been developed for stratigraphy.
  Relationship to Existing Programs: This proposed course also contributes to the Climate Dynamics PhD and Earth System Science Master's programs as an appropriate elective course.
- Relationship to Existing Courses: This course complements GEOL532-Paleoclimatology, GEOL565CLIM769-Paleoceanography and GEOL534-Vertebrate Paleontology with its focus on quantitative methods used in paleoclimatic and paleontological research.
- Semester of Initial Offering: Spring 2017
- Proposed Instructors: Linda Hinnov

SYLLABUS
GEOL 535 – QUANTITATIVE STRATIGRAPHY
LINDA HINNOV, PROFESSOR OF GEOLOGY

Catalog Description: Quantitative stratigraphy is a branch of geology that applies statistics to reconstruct the time sequence of geological events recorded in sedimentary strata. Methods of interpolation and error analysis used for defining stratigraphic boundaries and events, time scale estimation using integrated chronostratigraphy, and intercalibration are examined. Students receive advanced training in graphic correlation, constrained optimization, ranking and scaling, and dynamic programming. Prerequisites: MATH 114, STAT 250; or permission of instructor [3 credits].

Resources: Agterberg, F. (2014), Geomathematics: Theoretical Foundations, Applications and Future Developments, Springer-Verlag, Cham; Guex, J., Galster, F., and Hammer, Ø (2016), Discrete Biochronological Time Scales, Springer-Verlag, Cham; Shaw, A.B. (1964), Graphic Correlation, J. Wiley and Sons; and other publications and software (see ACTIVITY list in the syllabus).

Requirements: 14 assignments (50%) (see ACTIVITY list in the syllabus); independent project (50%) (students design and complete a project that solves a geological problem by applying course methodologies on original stratigraphic data).

Ethics: Consult http://oai.gmu.edu/the-mason-honor-code-2/ for course policy.

Student learning objectives:

Knowledge and Understanding
• Gain detailed knowledge about the geologic time scale and underlying geological information
• Understand the principal quantitative methods that are available for correlating geologic sequences

Analytical Skills and Abilities
• Develop the ability to assess the best method(s) for specific stratigraphic data that require sequencing.
• Develop advanced skills in digital filtering, spectrum estimation and hypothesis testing.

Professional Development
• Paleontologists will be able to apply modern techniques to sequence fossils for global correlation
• Geologists will be able to integrate diverse stratigraphic data to develop statistically constrained time scales

Syllabus: half-time lecture, half-time hands-on student activity.

DATE	LECTURE	ACTIVITY
Week 1	Geochronology	Schmitz tutorial (U-Pb dating of zircons; age modeling)
Week 2	Geologic Time	TSCreator (design a geologic time scale and analyze events)
Week 3	Graphic Correlation	SINECOR (correlate two sections together based on fossils)
Week 4	Ranking and Scaling	RASC/CASC, QSCreator (use multiple sections to rank events)
Week 5	Unitary Associations	PAST (assess presence/absence of fossils for correlation)
Week 6	Constrained Optimization	CONOP, CONMAN (optimized seriation of stratigraphy)
Week 7	Horizon Annealing	HA (simulated annealing methods for fossil correlation)
Week 8	Ordination	prcomp (fossil ordination by principal components analysis)
Week 9	Automated Correlation	MATCH (stratigraphic data matching by linear programming)
Week 10	Signal Processing I	MATLAB (time series analysis of stratigraphic data)
Week 11	Signal Processing II	astrochron (advanced modeling of stratigraphic data)
Week 12	Radiocarbon	Bacon, Oxcal (Calendar dates and reservoir corrections)
Week 13	Bayesian Intercalibration	BCHRON (Uncertainty models for geologic time scales)
Week 14	Integrated geologic timescales	TSCreator redux (Time scales for critical geological intervals)

See next page for Mason Policies.

Some Important Mason Policies

Updated Spring 2016

Electronic Communications

Students must use their MasonLive email account to receive important University information, including communications related to this class.

Disability Accommodations

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with **Office of Disability Services** to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Office of Disability Services: http://ods.gmu.edu

Academic Integrity

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using MLA or APA format. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

Office of Academic Integrity: http://oai.gmu.edu/
Honor Code: http://oai.gmu.edu/the-mason-honor-code-2/

Mason Diversity Statement

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected.

The reflection of Mason's commitment to diversity and inclusion goes beyond policies and procedures to focus on behavior at the individual, group and organizational level. The implementation of this commitment to diversity and inclusion is found in all settings, including individual work units and groups, student organizations and groups, and classroom settings; it is also found with the delivery of services and activities, including, but not limited to, curriculum, teaching, events, advising, research, service, and community outreach.

Acknowledging that the attainment of diversity and inclusion are dynamic and continuous processes, and that the larger societal setting has an evolving socio-cultural understanding of diversity and inclusion, Mason seeks to continuously improve its environment. To this end, the University promotes continuous monitoring and self-assessment regarding diversity. The aim is to incorporate diversity and inclusion within the philosophies and actions of the individual, group and organization, and to make improvements as needed.