ES322 Geomorphology Mid-Term Study Guide
Fall 2014

Exam Format

Two-Part Exam, Tuesday November 4, 2014:

Part 1 - Closed Book, short answer essay – terms and definitions, draw sketches, long answer essay – “compare and contrast”, “discuss”, “explain”.

Part 2, Open Book, lab-style problem solving, you will be able to use all of your class resources to solve math-based, lab-style problems.

Study Tips

- go through the web site, look at the figures and slide shows, compare to notes
- use study guide in combination with notes
- go back through the in class / lab exercises, make sure you can work the math / units
- spend a couple days studying, the exam will be essay and there is much material.
- don't wait until the last minute!
- carefully go through the notes, some of the material we briefly discussed, but did not spend much time on in class... but the notes will give you the detail
- finish all your lab exercises before taking the exam!!! Lab questions will appear.
- Exam format: Part 1. Closed book short answer / essay. Part 2. Open-book lab-style problem solving.

Midterm Digital Lab Portfolio Moodle Upload Due Tuesday November 4, 2014

Recommendation:
Review Montgomery and Bierman "Key Concepts in Geomorphology" Text Chapters (posted on Moodle class site); focus on following key words and concepts:

Chapter 1 Introduction

Lithosphere-Biosphere-Atmosphere-Hydrosphere
Plate Tectonics
Isostacy
Convergent-Divergent-Transform Plate Boundaries
Continental / Oceanic Crust
Crustal Density
Asthenosphere
Landforms/Topography
Geomorphic Processes
Earth Materials
Age / Dating
Spatial vs. Temporal Scale
Force-Mass-Density-Velocity-Acceleration

Chapter 2 Techniques

Numerical vs. relative age dating
C-14 Dating
Radioactive decay
Mass spectrometer
Dates and rates
Law of uniformitarianism
Law of superposition
Law of cross-cutting relations
Chronosequence
Landform degradation
Fault scarp degradation
Rock weathering rind
Rock varnish
Lichenometry
Tree ring analysis
Dendrochronology
C-14 dating
K-Ar dating
Cosmogenic isotope dating
In Situ Cosmogenic Nuclides
Sediment flux
Erosion rate
Denudation rate
Uplift rate
Incision rate

Chapter 3 Weathering/Soils

Regolith
Saprolite
Soil Forming Factors = Cl O R P T
Pedogenesis
Exfoliation
Freeze-Thaw
Thermal Expansion
Grus
Fire Spallation
Honeycomb weathering (tafoni)
Ion Exchange
Hydrolysis
Solution
Oxidation
Reduction
Goldich Weathering Series vs. Bowen's Reaction Series (weathering index of minerals)
Mobile Cations (Ca, K, Na, Mg, Fe, Al)
Carbonation
hydration
Carbonic acid
Humic acid
Clay formation
Leaching
Soil Profiles /Development
Soil horizons
Leaching – eluviation
Accumulation – illuviation
O-A-B-C-R Horizons
B horizon (iron, clay, $CaCO_3$)
Soil texture: sand-silt-clay-loam
Differential weathering
Tafoni
Spheroidal weathering

Chapter 5 Hillslopes

Mass Wasting
Toe slope
Weathering limited
Transport limited
Colluvium
Alluvium
Saprolite
Till
Normal stress
Shear stress
Friction
Cohesion
Angle of repose
Creep
Flow
Falls-topples
Slides
Slumps
Debris flow
Earth flow
Shallow vs. deep slides
Factor of safety
Shear strength
Shear stress
Root strength

Key Words from Notes
(Web links provided below)
Introduction
http://www.wou.edu/las/physci/taylor/g322/intro.pdf

Intro to Landscape Analysis
- Landforms
- Materials
- Process
- Age

Active Channel
Floodplain
Valley Bottom
Hillslope
Sediment Transport
- Bedload
- Suspended load
- Dissolved load
- Flotsam

Force
Mass
Velocity
Acceleration
Energy
- Geothermal
- Solar
- gravity

Time
Temporal vs. Spatial Scaling
landscape construction
tectonics
landscape destruction
weathering
erosion
denudation
driving mechanisms
climate / solar energy
tectonics / internal
gravity
process rates
Earth Systems
process-response models
Systems
mass and energy flux
equilibrium concept
driving force vs. resisting framework
force
energy
kinetic energy
potential energy
work
climate controls
insolation
precipitation
temperature
gravity controls
tectonic controls
resisting framework
lithology
rock structure
resistant vs. non-resistant lithologies
geomorphic thresholds
extrinsic vs. intrinsic
critical angle
Constructional landforms
destructional landforms
exogenic processes
endogenic processes
isostacy
isostatic rebound
crustal uplift / isostacy
rates of crustal uplift
rates of crustal denudation
Quaternary (when is this time?)
Pleistocene (ages? When is this)
Holocene (ages? When is this)

Weathering and Soils
http://www.wou.edu/las/physci/taylor/g322/weather.pdf

mass transfer
weathering
sediment / grain size
"sediment" vs. rock
erosion
denudation
bedrock
regolith
residuum
colluvium
alluvium
diamicton
eolian
glacial
till
drift
lacustrine
deltal
pedogenesis – soil development
O,A,B,C, R
porosity
clay
clay size
clay minerals
joints
faults
permeability
physical weathering
frost wedging
unloading
sheeting
exfoliation
thermal expansion
organic activity
root wedging
salt wedging

water molecule
volume expansion
hydrolysis
clay expansion
thermal expansion
chemical weathering
pH
chelation
hydration
oxidation
ion exchange
solution
parent material
aspect
soil
horizonation
eluviation
illuviation
soil color / color index
soil profiles (A, B, C)
soil percolation
soil translocation
weathering rinds
relative dating
iron accumulation
phyllosilicates / clays
hydrous alumino silicates
bowen's reaction series
temp-pressure reactions

soil forming factors:
Cl,O,R,P,T
climate, parent,organic
time, slope/relief/aspect

Mass Wasting / Hillslope Process
http://www.wou.edu/las/physci/taylor/g322/masswast.pdf

potential energy
kinetic energy
force
stress
joules
newtons
shear force
normal force
shear stress
normal stress
shear strength
slope stability
internal friction
pore pressure
cohesion
safety factor
coulomb equation
mass wasting
angle of repose
slope angle
hillslope
rock
debris
earth
fall
topple
slide
slump
flow
slope gradient
angle: degrees vs. percent
head scar
creep
solifluction
avalanche
landslide classification

Geomorphic and Landscape Age Dating

Quaternary (when / how long ago?)
Pleistocene
Holocene
Relative age dating
Absolute or numerical age dating
Early-middle-late Pleistocene
Age of material vs. age of surface
coastal wave-cut terrace
soil correlation
law of superposition
law of geomorphic position

Topographic map Principles
http://www.wou.edu/las/physci/taylor/g322/topomaps.pdf

topographic maps
north arrow
magnetic declination
map scale
fractional scale
graphical scale
longitude latitude
township-range-section
equator
prime meridian
parallels
angular measurement
7.5 min quadrangle
contour interval
index contour
law of V's / streams

Geomorphic Mapping Criteria
*(**see new notes on web site)*
Landform-Material
Process -Age
hollow
side slope
channel
floodplain
dune
terrace
levee
sediment texture
diamicton
lacustrine
eolian
colluvial-alluvial
glacial

Introductory Helmick Park Field Trip Terms
http://www.wou.edu/las/physci/taylor/g322/luck_field_guide.pdf

W. Oregon Regional Geology
- Coast Range
- Willamette
- Cascades
- Western Cascades
- High Cascades
- Juan de Fuca Plate
- N. Am. Plate
- Subduction
- Accretion
- Tertiary
- Quaternary
- Eocene
- Oligocene
- Climate-Tectonics
- Coast Range Uplift
- Willamette Valley
- Missoula Floods
- Willamette Silts

Geomorphic and Landscape Age Dating
http://www.wou.edu/las/physci/taylor/g322/radiometric_dating.pdf
Quaternary -Pleistocene
Holocene
Relative age dating
Absolute / numerical age dating
Age of material vs. surface
soil correlation
weathering rinds
law of superposition
law of geomorphic position
Radiochronology
Carbon-14 dating
Rates vs. dates
Radioactive decay
Neutron/proton ration
Parent/Daughter
Mass spectrometer
Alpha-beta-gamma radiation
Half life
Decay rate
K-Ar dating
U-Pb dating
Cosmogenic Isotopes

Quantitative Skills

Process Rate Calculations

Basic map reading / landform identification from a topographic map.

Given a rate of weathering and "soil erosion", calculate the equivlalent rate of crustal denudation and rock erosion

From a topographic map, calculate hillslope gradient (in degrees, in percent, in ratio form)

Draw a topographic profile from a topographic map.

Plot soil texture data on a triangular diagram, determine soil classification, calculate soil texture parameters

calculate potential energy, kinetic energy, force, weight, stress

resolve weight, shear and normal stress from a basic slope problem

determine slope stability; calculate gradient and slope angle in degrees and percent

identification of basic landforms and geomorphic process by examining aerial imagery

calculating the slope of stream channel or hillslope from a topographic map (in degrees and percent)

Key Concepts

Give examples of resistant vs. non-resistant lithologies, and how they respond to erosion and landscape evolution.
List and discuss the driving mechanisms for geologic / geomorphic processes.
Give example rates of crustal uplift and crustal erosion
What are the necessary elements for the collection and analysis of air photos.
What is the significance of “clay” at the Earth's surface
What factors effect rates of weathering? What are the physical and chemical weathering processes?
What is the difference between soil and sediment? How are soils formed? How are they identified?
What are the soil forming factors, and how are they used as a dating tool in geomorphology?
What are the range of processes, landforms, and surficial materials found at the Earth's surface? in western Oregon? Can you make some general sketches showing these geomorphic elements?
How does the landscape evolve over time? How does this relate to systems theory? Thresholds theory?
What are the typical ranges of rates and processes of erosion and deposition found at the Earth’s surface?
List and discuss the mass wasting classification system?
What factors effect slope stability?
Discuss the controls of bedrock lithology on landslide style and susceptibility in the Oregon Coast Range
What are the primary controls on slope stability
Discuss the regional stratigraphy and bedrock geology of the central Oregon Coast Range