ES322 Geomorphology Fall 2018
Final Exam Study Guide

NOTE: The final exam is scheduled to start 12:00 PM on Tuesday Dec. 4. Final Digital Lab Portfolio due Monday Dec. 3.

Study Tips

- complete all labs and worksheets before exam; complete and review the textbook questions, some of them will be on the exam verbatim.
- use study guide in combination with notes and online powerpoint slide shows
- go back through the in class / lab exercises, make sure you can work the math / units; review map skills
- spend a couple days studying, the exam will be short answer / 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.

Exam Procedures

(1) Final exam will be 125 points.
(2) Part 1 – Closed book, short answer/essay questions, focusing mainly on material since mid-term, but we have been building a cumulative vocabulary throughout the term. See key-word/review recommendations below.
(3) Part 2 Open Book- lab-style quantitative questions, map questions, air photo questions, identification of fluvial, glacial landforms, identification of basic climatic / tectonic / geomorphic features; association of landforms with processes, association of landform photos with processes and concepts. Bring a calculator.

LAB SKILLS / CONCEPTS

Topographic Maps; landform identification; stream gradient calculation; hillslope gradient calculation; elevation / relief; topographic profiles; scale / vertical exaggeration; Air Photo Interpretation; 3-D stereo view; landform identification; climate interpretation; scale determination; Fluvial Lab; work key equations: mannings, continuity, stream power, discharge unit conversions, determine stream gradient, channel profiles, river discharge measurements, calculate air photo metrics

-be able to identify fold and fold features from topographic maps

-understand the relationships from the “fluvial balance” model of aggradation and degradation

-be able to interpret relationships between tectonic uplift and global sea level change, can you identify which process is affecting a given sea level record

-how has global sea level changed during the late Quaternary, and why?

-make sure you can calculate slopes and gradients from topographic maps

-can you plot a ternary diagram using soil texture data?
-can you determine the recurrence interval of a given flood discharge?

- how about solving hydraulic flow problems using Manning's Equation and the Continuity Equation?

-what is the relationship between river load, type of sediment, and river morphology?
-can you identify landforms / geologic processes from air photos?
-how about identifying other landforms: e.g. point bar, cut bank, alluvial fans, deltas, lava flows, volcanoes?

- make sure you understand all of the concepts associated with the coastal geomorph. lab, as they apply to the pacific northwest.

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, caculate hillslope gradient (in degrees, in percent, in ratio form)

Draw a topographic profile from a topographic map.

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 WORDS FROM CLASS NOTES:

Oregon Coast Geomorphology / Neotectonics / Fieldtrip
http://www.wou.edu/las/physci/taylor/g322/Sunset_Bay_Field_Guide_F2017.pdf

coast
beach
tectonics / Cascadia Subduction
waves
tides
tsunami
storm surge
longshore drift
pocket beach
marine terrace
wave-cut notch
wave-cut terrace
emergent coasts
submergent coasts
erosional coasts
depositional coasts
headlands
sea cliff
sea stacks
sea arches
wave-cut platform
uplifted coasts
sea level change
global sea level rise /fall
global climate cycles
interglacial / glacial
PNW tectonic setting
convergent
subductions
neotectonic uplift
relative sea level change
uplift vs. SL change
subsidence vs. SL change
global warming
density currents
thermal expansion of water
re-leveling surveys
tide-gage surveys
tectonic vs. sea level changes
seasonal wave activity in OR
winter vs. summer beaches
rock headlands
pocket beaches
littoral cell
estuaries
Oregon Coast Range Uplift
Oregon rotation / tilt history

Fluvial / Rivers
http://www.wou.edu/las/physci/taylor/g322/fluvial2.pdf

Hydrologic Cycle / Water Budget
Discharge
precipitation
infiltration
channel area
wetted perimeter
hydraulic radius
gradient
runoff
rain splash
sheet erosion
rill erosion
gully erosion
channel flow
stream erosion
shear
abrasion (tools)
corrosion
Q=VA
V=L/T
A=wd
P=2d + w
velocity profiles
discharge calculations
~~manning equation~~
~~energy expenditure~~
~~roughness coefficient~~
velocity-depth relations
slope-discarge relations
stream power calculation
depth-velocity relations
width-velocity relations
sediment load
stream competence
stream capacity
vegetative effect on sed. load
dissolved load
suspended load
bed load
saltation
flotation load
bernoulli principle
"fluid lift force"
turbulent flow
laminar flow
channel morphology
straight
meandering
braided
width/depth ratio vs. channel bank grain size relations
gradient vs. stream type
sed. load vs. stream type
meanders
point bar
cut bank
levee
floodplain
terrace
oxbow lake
oxbow cutoff process
pool-riffle sequences
overbank sedimentation
bankfull discharge vs. flood discharge
meander scrolls
centrifugal force
braid gravel bars
river base level
local base level
regional base level
graded profile
Fluvial System Factors
- slope
- base level
- climate
- discharge
- velocity
- sed. supply
- sed. load

aggradation conditions
degradation conditions
river entrenchment
~~knickpoints~~
~~knickpoint retreat~~
terraces / incision rates
terrace tread
terrace scarp
~~paleohydrology~~

~~slackwater deposits~~

Glacial Processes and Landforms
http://www.wou.edu/las/physci/taylor/g322/glacial.pdf

Glacier
Snowfield
Snow-firn-ice
Ice stratification/accumulation
Ice deformation
    Plastic vs. brittle
Plastic = internal flow
Brittle = crevasses/fracture
Ice Flow Mechanisms
    Basal sliding
    Internal deformation
    Plastic deformation
    Crevassing
~~Glacial surging~~
Glacial meltwater
Ice-water mixture
Glaciers as aquifers
Temperate glaciers = wet
Polar glaciers = dry
Alpine vs. Continental glaciers
Glacial advance
Glacial retreat
Ablation/melting
Zone of accumulation
Zone of ablation
Glacial erosion
    Plucking
    Abrasion
    Subglacial water flow
Glacial Deposits
    Drift
    Till
    Outwash
    Erratics
    Diamicton
Alpine Erosional Landforms
    Cirque
    Tarn
    Arete
    Cols/Horn
    U-shape valley
    Hanging valley
    Fjords
    Roche Moutonee
    Striated pavement
Alpine Depositional Landforms
    Moraine
    End Moraine
    Lateral Moraine
    Medial moraine
    Terminal moraine
Continental Landforms
    Drumlin
    Esker
    Kame
    Kettle
    Outwash Plain

Quaternary Climate Change
http://www.wou.edu/las/physci/taylor/g322/quaternary_climate_change.pdf

Pleistocene Ice Ages
Glacial/Interglacial Climates
Solar-Geothermal Exchange
Global climate change
Greenhouse effect
Greenhouse gases
Carbon Cycle
Quaternary Sea Level Curve
Evidence of Past Glaciation
    Continental Landforms
    Continental Deposits
    Marine Record
    Oxygen Isotopes
    Fossil Evidence
    Paleoclimatology
Laurentide Ice Sheet
Cordilleran Ice Sheet
Sea-Level Fluctuation
Global Sea Level Change
Pluvial Lakes
Great Lakes
Missoula Floods
Ice Cores
Glacial maximum
Oxygen isotope stages
Ice-Ocean Isotope Exchange
Ocean cores
Ice cores
100,000-43,000-20,000
Stable Isotope Analysis
Oxygen18/Oxygen16
Global ice budget
Global ocean budget
~~isotopic fractionation~~
~~"heavy water"~~
~~"light water"~~
glacial climate
interglacial climate
ice sheet
evaporation
late Wisconsinan ice
global sea level
eustatic sea level
deep sea drilling
O18 stratigraphy
O18/O16 ratio
global correlation
radiometric dating
~~orbital forcing~~
~~general circulation model~~
~~Milankovitch Theory~~
    ~~obliquity~~
    ~~eccentricity~~
    ~~precession~~
~~angle of earth tilt~~
~~orbital path~~
~~plane of ecliptic~~
~~Global Warming~~

Tectonic / Structural Geomorphology
http://www.wou.edu/las/physci/taylor/g322/tectonic.pdf

convergent boundary
divergent boundary
transform boundary
mountain front
brittle vs. ductile deformation
anticline
syncline
mountain building
normal fault
reverse fault
strike slip fault
plunging fold
non-plunging fold
joints
dip
strike
dip slope
scarp slope
anti-dip slope
lithologic resistance to erosion
sandstone-shale example
differential erosion
hog back / cuesta
resistant bedrock
non-resistant bedrock
law of v-shape patterns
joint-fault erosion
lineaments
fault scarp
butte / mesa
cap rock
fault scarp degradation
zig-zag mountains
differential erosion

Textbook Review Questions Chapter 6 – Rivers
http://www.wou.edu/las/physci/taylor/g322/Bierman_Montgomery_Chap6_Rivers_Review_Questions.doc
Fluvial / river systems
Channel flow
Base flow
Emphemeral/perennial
Alluvial / riparian
Graded stream
Channel width
Channel depth
Flow velocity
Roughness
gradient
Cross-sectional area
Discharge = vol/time
Stage
Bankfull flow
Q=VA
Stream power
Alluvial sediment
Sediment supply
Alluvial channel
Bedrock channel
Bedload
Suspended load
Dissolved load
saltation
LWD
Abrasion
Plucking
Dissolution
Shear force
Point bar
Cut bank
Knickpoint
Thalweg
Meander
Braided
Straight
Oxbow lake
Mid-channel bar
Floodplain
Terrace
Aggradation
Degradation
Dendritic
Trellis
Rectangular
Radial
Sediment storage/routing
Stream order
Gradient
Drainage density
Longitudinal profile
Strath terrace
Fill terrace
Alluvial fan
Debris fan / Delta

Textbook Review Questions – Chapter 9 Glaciers
http://www.wou.edu/las/physci/taylor/g322/Bierman_Montgomery_Chap9_Glacial_Review_Questions.doc
Glaciers
Permafrost
Alpine glacier
Cirque glacier
Piedmont glacier
Continental glacier
Ice sheets
Ice cap
Pleistocene
Last Glacial Maximum
Laurentide Ice Sheet
Cordilleran Ice Sheet
Glacial Mass Balance
Glacial advance
Glacial retreat
Ice accumulation
Ice Ablation
Meltwater
Firn-snow-ice
Equilibrium line altitude
Ice creep
Internal flow / deformation
Basal sliding
Viscoplastic solid
Brittle deformation
Ductile deformation
Glacial calving
Ice margin
Ice shelf
Marine ice
Plucking / quarrying
Warm vs. cold glaciers
Temperate vs. polar glaciers
Moulon
Jokulhlaups
Meltwater lake
Striation-polish-rock flour
Glacial buzzsaw
Diamicton
Till
Melt-out till
Ice-contact till
Kettle
Kame
Crevasse
Esker

Outwash plain
Varves
Dropstones
Rhythmites
Ice rafted debris
Moraine
Terminal moraine
End moraine
Lateral moraine
Recessional moraine
Arete-horn-cirque
Tarn – paternoster lake
Pro-glacial lake
Drumlin-esker
Nunataks
Periglacial
Paraglacial
Permafrost
Patterned ground

Textbook Review Questions – Chapter 12 Tectonic Geomorphology
http://www.wou.edu/las/physci/taylor/g322/Bierman_Montgomery_Chap12_Tectonic_Geomorphology_Review_Questions.doc

Active tectonics
Neotectonics
Active deformation
Plate tectonics
Convergence/subduction
Divergence/spreading
Transform
Crustal uplift / subsidence
Rifting
Rock uplift
Surface uplift
Exhumation
Isostatic rebound
Lithospheric flexure
Forebulge
Flexural upwarping
Flexural downwarping
Foreland basin
Forearc basin
Fault-bounded basin
Diaper
Brittle / ductile deform
Fault
Fault scarp
Reverse fault
Normal fault
Transverse fault
Rift zone
Pull-apart basin
Active margin
Passive margin
Horst/graben
Orogen
Thrust fault
Blind thrust
Transform margin
Transtensional margin
Transpressional margin
Restraining bend
Releasing bend
Offset stream
Shutter rudge
Sag pond
Craton
Shield
Plateau
Inselberg
Monadnock
Anticline / syncline
Anticlinal valley
Synclinal valley
monocline
Hog back
Cuesta
Flatiron
Triangular facet
Mesa / butte
Joints
Fractures
Lineaments
Coastal uplift
Marine terrace
Strath terrace

Journal Reading / Review Questions Roering et al., OCR Coast Range Landslides
http://www.wou.edu/las/physci/taylor/g322/Roering_etal_2005_deep_seated_landslides_OCR.pdf

Draw a sketch showing the differences between deep-seated rock-block landslides, and shallow-failure debris flow. Write a brief description of each.

List and discuss the causal long-term and short-term factors that influence the occurrence of deep-seated landslides.

Draw a sketch map showing the location of the Oregon Coast Range (OCR) and the occurrence of outcrop in the Eocene Tyee Formation that underlie the hillslopes.

What is the tectonic and deformational history of the OCR. Cite the evidence that supports your answer.

What effects do igneous intrusive rocks have on landscape resistance to erosion and relief in the OCR?

Describe how fold deformation of strata and dip angle influences the occurrence of deep-seated landslides in the OCR.

Using key figures provided in the article, draw a sketch from north to south in the OCR Tyee Formation outcrop belt, illustrating the effects of bedrock composition and lithofacies, on the style and occurrence of landslides in the Coast Range. Label your drawing and provide a brief explanation.

Journal Reading / Review Questions McInelly and Kelsey, 1990, Neotectonics of Western Oregon
http://www.wou.edu/las/physci/taylor/g322/mcin90.pdf

Draw a sketch and discuss how wave-cut platforms and marine terraces developed on the Oregon Coast during the Quaternary.

Describe the plate tectonic setting of western Oregon and how it influences the landforms at the Earth's surface we see today.