ES322 Geomorphology Fall 2015 Final Exam Study Guide

NOTE: The final exam is scheduled to start 12:00 PM on Tuesday Dec. 8.

Study Tips

- complete all labs and worksheets before exam
- 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

-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

air photo scale calculations, other air photo calculations as in lab

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)

Aerial photography calculations: photo scale, height-displacement calculations, photo distortion principles, 3-d viewing of landforms.

KEY WORDS FROM CLASS NOTES:

Mass Wasting / Hillslopes
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
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

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
R.I. / probability
energy expenditure
roughness coefficient
velocity-depth relations
viscosity
laminar flow
turbulent flow
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
drainage patterns
dendritic - flat rocks
trellis - folded rocks
rectangular - fractured rocks
radial - volcano
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 Geomorphology
http://www.wou.edu/las/physci/taylor/g322/tectonic.pdf

convergent boundary
divergent boundary
transform boundary
mountain front
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
active mountain front
inactive mountain front
mountain front sinuosity
soils-fault relations
Steens Mtn example
fault scarp
butte / mesa
cap rock
fault scarp degradation
zig-zag mountains
differential erosion

Glacier Key Word Worksheet
http://www.wou.edu/las/physci/taylor/g322/glacial_key_terms.pdf

glacier
alpine glacier
ice sheet
temperate glacier
polar glacier
snow-firn-ice
glacier ice budget – advance – retreat (explain)
brittle ice
visco-plastic deformation
basal sliding vs. internal deformation
zone of accumulation
zone of ablation
crevasse
abrasion and striation
quarrying or plucking
Cirque
Arête
horn
fjord
non-stratified drift
stratified drift
till
outwash
moraine
lateral moraine
end moraine
esker
drumlin
loess
kettle
bonus term: “pingo”
bonus term: “rock glacier”

River Key Word Worksheet
http://www.wou.edu/las/physci/taylor/g322/fluvial_key_terms.pdf

Drainage Basin
Drainage Divide
Runoff (provide sketch)
Infiltration
Overland flow
Base flow
Flood hydrograph
Recurrence interval
Strahler Stream Order .
Drainage density
Channel gradient
Hydraulic radius
Discharge
Suspended load
Bedload
Dissolved load
Sediment yield
Laminar flow
Turbulent flow
Mannings Equation
Stream power
Abrasion
Denudation
Aggradation
Meandering channel
Vertical accretion
Braided channel
Floodplain (provide photo)
Levee (provide photo)
River terrace (provide photo)
Strath terrace (provide sketch)
Fill terrace (provide sketch)
Alluvial fan (provide photo)
Pediment (provide photo)
Delta (provide photo)

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

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 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

Chapter 6 – 7 Channels / Drainage Basins

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

Chapter 9 Glacial Geomorphology

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

Chapter 12 Tectonic Geomporphology

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

Chapter 13 Climate Change

Global climate change
Carbon cycle
Carbon dioxide emission
Carbon sequestration
Greenhouse effect
LGM – last glacial maximum
Relict landform
Holocene/Pleistocene
Glacial / interglacial
Pluvial environment
Glacial advance /retreat
Lake / marine sediment
Varves
IRD ice rafted debris
Pollen
Macrofossils
Packrat middens
Foraminifera
Oxygen isotope ratio
O^{18}/O^{16} isotopes
H_2O^{16} vs. H_2O^{18}
Marine isotope stage
Paleothermometry
Ice cores
Gas / fluid inclusions
Loess
Paleosol
Climate cycle
Glacial cycle
Isotopic excursion
Terminations
Orbital forcing
Solar radiation
Celestial mechanics
Eccentricity

Obliquity
Precession
Milankovitch cycle
Thermohaline circulation
Gulf Stream
North Atlantic Conveyor
Younger Dryas
Heinrich Events
IRD
Altithermal / midHolocene
Little Ice Age
High Sea Level Stand
Low Sea Level Stand