ES473 Environmental Geology – Midterm Exam (50 Pts Total) – Spring 2020 NAME KEY

Part 1. Medium Answer Essay / Definition. (24 pts) Briefly define or discuss the following terms and concepts. Include a drawing as required. 5 to 6 well written sentences are appropriate for each answer; and should approximately fill the space provided.

1. Based on the introductory video exercise from Week 2; describe the two broad topical themes to the study of Environmental Geology that we are using in this class. Frame your answer in terms of human interaction with planet Earth, our home. Provide real world examples for each category of topical theme **(3 pts)**

NATURAL HAZARDS vs. ANTHROPOGENIC IMPACTS

Geologic Phenomena – WATER & SOIL CONTAMINATION

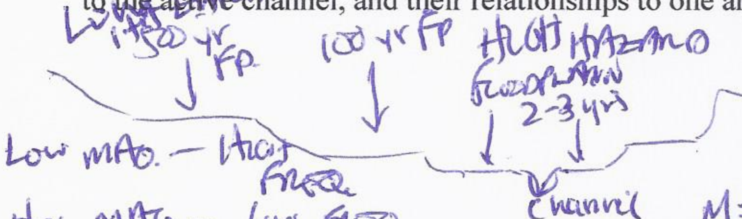
TECTONIC vs. CLIMATIC – LAND USE / RESOURCE EXTRACTION

EQ – FLOODS

ERUPTIONS – MASS WASTING

TSUNAMI – EROSION

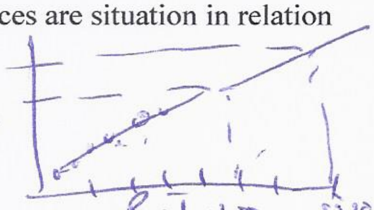
2. Based on your readings, discuss the difference between a 100-year floodplain and a 500-year floodplain. What techniques are used to identify them in terms of magnitude and frequency, and what are the statistical risk differences between the two. Draw a cross-sectional sketch to show how these surfaces are situation in relation to the active channel, and their relationships to one another. **(3 pts)**



$R.I. = \frac{N+1}{M}$ MAG. Q

$P = 1/R.I.$

M = STAGE OR DISCHARGE

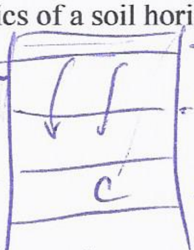


500 yr = 0.2% chance

100 yr = 1% chance

3. Based on the mass wasting lab map activity, sketch and label the primary topographic components indicative of landslide activity. What are the characteristic landforms and anatomy of a landslide on the Earth's surface? **(3 pts)**

4. Sketch an idealized soil profile showing the primary horizons associated with pedogenesis over time; what are they composed of and what are the processes that form them. Discuss how parent material and climate effect the characteristics of a soil horizon that forms at any given locality. **(3 pts)**



O – ORGANIC

A → ZONE OF LEACHING ELUVIATION

B → ZONE OF ACCUMULATION ILLUVIATION

C → WEATHERED BEDROCK

R BEDROCK

5. Based on your reading assignments, discuss the key elements and steps associated with the process of natural hazards risk assessment for human populations. Provide a real world example to support you answer. **(3 pts)**

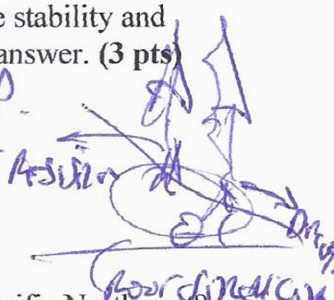
EARTHQUAKE OR TSUNAMI OR FLOOD

HAZARD MAPPING

1. IDENTIFY HAZARD – PROCESS, CLIMATIC vs. TECTONIC
2. MAP HAZARDS DISTRIBUTION
3. MAP HUMAN DISTRIBUTION
4. CONDUCT RISK ANALYSIS – MAG vs FREQUENCY
5. CREATE RISK POTENTIAL MAP
6. INFORM PUBLIC, POLICY & PLANNING

6. Based on your reading assignments, discuss how climate and vegetation influence hillslope stability and landslide occurrence. Provide examples and draw sketches / capture images to support your answer. **(3 pts)**

CLIMATE – SEASONAL PRECIPITATION & AIR TEMP.
VEGETATION → GROWTH RESPONSE TO CLIMATE RESULTING
VEGETATION → ROOT STRENGTH = STABILIZING FACTOR



7. Describe the concept of "River Restoration", how is it defined, what are the goals in the Pacific Northwest? In your answer, provide three examples of ways in which watersheds have historically become degraded over time with respect to anthropogenic process. **(3 pts)**

RESTORE NATURAL PROCESSES & FUNCTIONS OF RIVER SYSTEMS
PNW → SALMONID RECOVERY (SALMON, STEELHEAD)
ROAD IMPROVEMENTS
FISH PASSAGE – CULVERTS, DAMS   IN-CHANNEL STRUCTURES LWD

8. Based on your reading, list and discuss 4 methods used to mitigate flood hazards and reduce risk to life and property. Include sketches and/or images of each. **(3 Pts)**

① HAZARDS MAPPING & ZONING
② ELEVATE STRUCTURES
③ ALTER HYDROLOGY / FLOOD CONTROL
④ FLOOD INSURANCE

Part 2. Lightening Round: True/False (circle one) and Short Answer Definition / Explanation (15 Pts)

9. Anadromous vs. Resident **(2 pts)**

ANADROMOUS – FISH migrate FRESH → OCEAN H2O
RESIDENT – FISH IN SITU IN FRESH H2O

10. Large Woody Debris **(2 pts)**

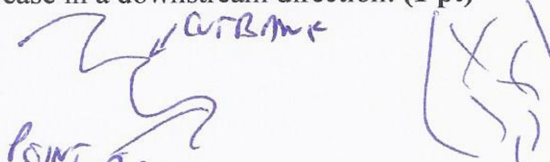
LWD = WOOD DEBRIS IN RIVER CHANNEL SYSTEMS, INCREASED GRAVEL RETENTION, INCREASED HYDRAULIC COMPLEXITY

11. Culvert Assessment **(2 pts)**

↳ FISH PASSAGE FOR SALMON SPAWNING; LWD & GRAVEL CONVEYANCE

12. True or False: reduction of riparian vegetation buffer promotes enhanced salmonid spawning. **(1 pt)**
13. True or False: straight, fast flowing channels, free of sediment are beneficial for salmonid spawning. **(1 pt)**
14. True or False: channel width, gradient and discharge increase in a downstream direction. **(1 pt)**

15. meandering vs. braided **(2 pts)**



MEANDERING
LOW GRADIENT
SUSPENDED LOAD

BRAIDED
> GRADIENT
GRAVEL
DOMINATED
MID channel bars

16. Annual Peak Discharge **(2 pts)**

Q → VOL/t (CFS) → Highest VALUE RECORDED AT A GAGING STATION ON A GIVEN YEAR

17. debris flow vs. slump **(2 pts)**

VISCOUS SED-H2O SLURRY MIXTURE, MIXING
– SLUMP – ROTATIONAL SLIDE, CONCAVE UP FAILURE SURFACE

Part 3. Lab Style Problem Solving (11 Pts total)

18. The table below shows peak annual discharge data for a USGS gaging station that was installed seven years ago. Although the data are sparse, determine the recurrence interval and probability of recurrence for each discharge. Fill out the table accordingly. **(5 pts)**

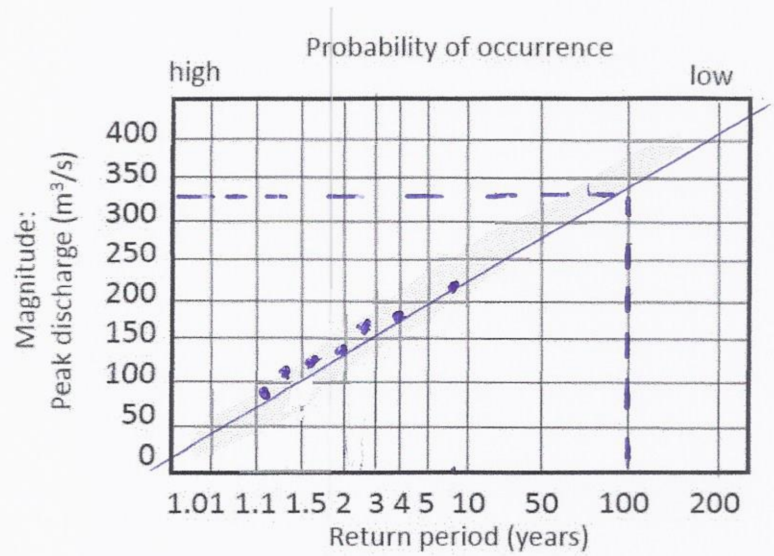
Year	M	Qp m^3/sec		R.I. (yrs)		Prob.
1995	1	211	8/1 =	8	1/8 =	0.125
1996	6	112	8/6 =	1.33	1/1.33 =	0.75
1997	7	90	8/7 =	1.14	1/1.14 =	0.88
1998	4	143	8/4 =	2	1/2 =	0.5
1999	5	120	8/5 =	1.6	1/1.6 =	0.625
2000	2	180	8/2 =	4.	1/4 =	0.25
2001	3	173	8/3 =	2.67	1/2.67 =	0.37

$R.I. = n+1/m$

$P = \frac{1}{R.I.}$

Plot your magnitude-frequency data on the graph below, and estimate the discharge that would characterize the 100 year flood event for this stretch of river. Extend the graph axes and scale by hand as needed. **(3 pts)**

$Q_{100} \sim 325 \frac{m^3}{sec}$



$Q = 211\ m^3/sec$

Given the highest peak discharge recorded above, and a maximum flow velocity during that time period of 4.9 ft/sec, calculate the cross-sectional area of the river discharge during the flood event. Show all of your math work. (answer in sq. meters). **(3 pts)**

$V_{el} = 4.9 \frac{ft}{sec}\left(\frac{1 m}{3.28 ft}\right) =$

$V_{el} = 1.49\ m/sec$

$Q = (V_{el})\ Area_x$

$\left(211 \frac{m^3}{sec}\right) = \left(1.49 \frac{m}{sec}\right)(A) = \frac{211\ m^3/sec}{1.49\ m/sec} = (141.6\ m^2) = A$