Final Exam: Thursday April 27, 2023; Final Exam, In-Person Lab Practicum: Wednesday June 14, 2023; 12-2 PM, NS218; comprehensive final exam covers all material and lessons learned from throughout the term including Quiz 1, Quiz 2 and Quiz 3 content activities.

RECOMMENDED STUDY TECHNIQUES

1) Review the class notes and learning resources, use the key words below as a glossary check list of terms and concepts.
2) Use the concepts below as a guide to help you focus on your study preparation
3) review the lab exercise answer keys
4) go back over the labs and make sure you can do the tricks / skills
5) review some of the important figures and equations in your text
6) Organize your unit conversion sheets, create handy reference equation sheets, organize your "open book" resources so that you can quickly refer to them in a timed quiz situation.

FINAL EXAM STUDY RESOURCES

Reference Resources:

Conversion Tables

https://people.wou.edu/~taylors/g302/convtab2.pdf

Reference List of Standard Algebraic, Geometric and Trigonometric Formulas

https://people.wou.edu/~taylors/g302/formulas.pdf

Units of Angular Measurement

https://people.wou.edu/~taylors/g302/angular_measurement_units.pdf

Class Notes and Readings:

AEG Jahn's Lecture Notes   https://people.wou.edu/~taylors/g302/Summary_Notes_AEG_Jahns_Lecture_April_2023.doc
Introductory Math and Algebra Review   https://people.wou.edu/~taylors/g302/mathrev.pdf
Intro to Unit Conversion   https://people.wou.edu/~taylors/g302/units_conversion_rules_schoenfeld.pdf
Introductory Math and Algebra Review   https://people.wou.edu/~taylors/g302/mathrev.pdf
Guidelines for Problem Solving   https://people.wou.edu/~taylors/g302/steps_in_problem_solving.pdf
Intro Dimensional Analysis   https://people.wou.edu/~taylors/g302/units_conversion_rules_schoenfeld.pdf
Waltham Chapter 1 Solving Geologic Problems   https://people.wou.edu/~taylors/g302/waltham1.pdf
Intro to Geologic Thinking   https://people.wou.edu/~taylors/g302/AGI_Lab_Manual_Intro_Methods.pdf
Notes: Review of Maps / Topographic Maps   https://people.wou.edu/~taylors/g302/maps.pdf
Reading: Topo Maps   https://people.wou.edu/~taylors/g302/9_AGI_lab_manual_lab9_Topo_Maps.pdf
Waltham Ch. 2 Geologic Variables   https://people.wou.edu/~taylors/g302/waltham2.pdf
Waltham Ch. 3 Equation Manipulation   https://people.wou.edu/~taylors/g302/waltham_chap3.pdf
Chapter 5 Application of Trigonometry to Geologic Problems

https://people.wou.edu/~taylors/g302/waltham_chap5_trig.pdf

Text Chapter 1 Solving Geologic Problems   https://people.wou.edu/~taylors/g302/waltham1.pdf
Introduction to Geologic Thinking   https://people.wou.edu/~taylors/g302/AGI_Lab_Manual_Intro_Methods.pdf
OSU/Water Abstracts   https://people.wou.edu/~taylors/g302/OSU_Water_Research_2023AbstractBookFinal.pdf
Class Notes: Application of Trigonometric Analysis to Geologic Problems

https://people.wou.edu/~taylors/g302/trig.pdf

Introduction to the Brunton Compass and Compass Surveys

https://people.wou.edu/~taylors/g302/compton_map.pdf

Text Reading: Twiss and Moore, Ch. 2, Structural Techniques - Introduction to Strike and Dip

https://people.wou.edu/~taylors/g302/TM_chap2_Techniques.pdf

PowerPoint Slide Shows:

AEG Jahns Lecture   https://people.wou.edu/~taylors/g302/Cronin_Jahns_Lecture_Geo_Careers_April6_2023.pptx

Video Resources:

How to Solve Quantitative Problems   https://www.youtube.com/watch?v=YocWuzi4JhY
Unit Conversions the Easy Way   https://www.youtube.com/watch?v=HRe1mire4Gc
Intro to Topo Maps   https://www.youtube.com/watch?v=zqPMYGDxCr0
Solving Physics Problems   https://www.youtube.com/watch?v=YocWuzi4JhY

Unit Conversions   https://www.youtube.com/watch?v=HRe1mire4Gc

Intro Topo Maps   https://www.youtube.com/watch?v=zqPMYGDxCr0

Topographic Profiles   https://www.youtube.com/watch?v=StDYPIuk25M

Map Scales   https://www.youtube.com/watch?v=co0CXao7IuY

Bearings and Azimuth   https://www.youtube.com/watch?v=lM6kWrgsGYw

Longitude and Latitude https://www.youtube.com/watch?v=swKBi6hHHMA

Universal Transverse Mercator https://www.youtube.com/watch?v=LcVlx4Gur7I

Re-Arranging Equations https://www.youtube.com/watch?v=eTSVTTg_QZ4

Solving for Unknowns   https://www.youtube.com/watch?v=BpLHHTY_umM

Rates and Slopes of Lines   https://www.youtube.com/watch?v=Iqws-qzyZwc

Sedimentation Rates   https://www.youtube.com/watch?v=9ch-6HiOAW4

Drawing Contour Lines https://www.youtube.com/watch?v=L6FbV0LiA_k

WOU Groundwater Lab https://www.youtube.com/watch?v=tUtVWPkio8s

Video: Determining the Slope of a Line (Youtube ~4 min)https://www.youtube.com/watch?v=R948Tsyq4vA

Video: Calculating Gradient of a Slope from a Topographic Map (Youtube ~3 min)

https://www.youtube.com/watch?v=3QFJ_uv2mGw

Video: Calculating Gradient of a Slope in Percent and Degrees (Youtube ~7 min)

https://www.youtube.com/watch?v=awKgHdOJefI

Video: Basics of the Unit Circle (Youtube ~9 min)   https://www.youtube.com/watch?v=1m9p9iubMLU

Video: Introduction to Right Triangles and Pythagorean Theorem (Youtube ~11 min)

https://www.youtube.com/watch?v=AA6RfgP-AHU

Video: Introduction to Trigonometric Identities (~9 min) https://www.youtube.com/watch?v=OLzXqIqZZz0

Video: Solving Right Triangle Problems (Youtube ~9 min)   https://www.youtube.com/watch?v=l5VbdqRjTXc

Video: Measuring Strike and Dip of Planar Features (Youtube ~14 min)

https://www.youtube.com/watch?v=MwBVztOz2No

Video: Measuring Height of Objects in Field Using Trigonometry (Youtube ~4 min)

https://www.youtube.com/watch?v=-2w7Mdq5C58

Video: Azimuth Bearings (Youtube ~3 min)   https://www.youtube.com/watch?v=lM6kWrgsGYw

Video: Converting Quadrant Bearings to Azimuth (Youtube ~6 min)

https://www.youtube.com/watch?v=ebPy_satu_0

Video: Determining Easting and Northing Coordinates from Point Bearings (Youtube ~11 min)
    https://www.youtube.com/watch?v=VCDC78wpuJc
Video: Anatomy of the Brunton Compass (Youtube ~4 min)
    https://www.youtube.com/watch?v=fo14Mm-dxjA
Video: Intro to Surveying with the Brunton Compass (Youtube ~4 min)
    https://www.youtube.com/watch?v=-geHuwt_0HY

Lab Answer Keys:
- Task 2-1 Answer Key - Monmouth Quad Exercise, Introduction to Topographic Maps
- Task 2-2 Answer Key - Unit Algebra / Unit Conversion Exercise
- Task 2-5. Answer Key - Waltham Ch. 1 Intro to Geologic Problems
- Answer Key - Waltham Ch. 2 Geological Variables
- Homework 3 Answer Key - Waltham Ch. 3 Equation Manipulation
- Answer Key - Applied Hydrology Problems
- Answer Key - Map Scaling Problems 1
- Answer Key - Map / Photo Scaling Problem 2
- Answer Key - Longitude-Latitude Decimal Degree Conversion Worksheet
- Text Answer Key - Appendix B. Solutions to Problems
- Answer Key: Gradient and Slope Measurement from Topographic Map
- Answer Key - Measuring Compass Bearings Monmouth Quad
- Answer Key - Measuring Compass Bearings Monmouth Quad
- Answer Key - Waltham Ch. 5 Trigonometric Applications
- Key - Introduction to Brunton Compass
- Answer Key: Tape and Compass Exercise / Surveying Campus Locations

Key Words from Notes, Video Exercises and Readings

Introductory Math and Algebra Review

https://people.wou.edu/~taylors/g302/mathrev.pdf

decimal system
decimal fractions
scientific notation
powers of 10
metric vs. English system
metric prefixes
  Peta
  Tera
  Giga
  Mega
  Kilo
  Hecto
  Deka
  Deci
  Centi
  Milli
  Micro
  Nanno
  Pica
Length: Meters
Area: Acre, Hectare
Volume: m^3, cm^3 ft^3 gallons
Mass: gram, kg, tonne
Temerature: oF oC
Dimensional Analysis:
  Distance
  Mass
  Time
  Area
  Volume
  Velocity

Empirical equations
Significant figures
Unit algebra
Unit cancellation
Rules of exponents
Graphic visualization
Line Slope
Equation of Line
Y intersect

Guidelines for Problem Solving

https://people.wou.edu/~taylors/g302/steps_in_problem_solving.pdf

Six Steps:
1. Read
2. ID variables
3. Draw and sketch
4. Convert units
5. Rearrange, solve
6. Check your answer

Intro Dimensional Analysis

https://people.wou.edu/~taylors/g302/units_conversion_rules_schoenfeld.pdf

System International SI Units
Metric measure
Length, mass, time
Velocity, acceleration, area, density
Dimensional analysis: unit balancing and cancellation
Powers of 10
Orders of magnitude

Waltham Chapter 1 Solving Geologic Problems

https://people.wou.edu/~taylors/g302/waltham1.pdf

qualitative vs. quantitative problem solving
sedimentation rate
constants vs. variables
proportions and ratios
Geologic Age-Depth Relations
Greek symbology
Δ = "delta" change in variable over time
Superscripts, subscripts
Exponents
Scientific notation
Powers of 10
Orders of magnitude
Metric SI system of measurement
Decimal fractions
Unit conversion

Intro to Geologic Thinking

https://people.wou.edu/~taylors/g302/AGI_Lab_Manual_Intro_Methods.pdf

Geologic Record
Geologic Time
Scaling
Spatial Scales
Bar scale
Fractional scale
Ratio Scale
Graphical scale
Global-Regional-Local Scale
Microscopic Scale
Megascopic Scale
Macroscopic Scale
Geologic Time Scale
~~Hypothesis Testing~~
~~Scientific Method~~
~~Multiple Working Hypothesis~~
~~Geosphere~~
~~Hydrosphere~~
~~Biosphere~~
~~Atmosphere~~
~~Magnetosphere~~
~~Heat Energy~~
~~EM Energy~~
~~Potential Energy (gravity)~~
~~Kinetic Energy~~
~~Mechanical Energy~~
~~Chemical Energy~~
~~Electrical Energy~~
~~Energy vs. Force~~
~~Cycles of Time and Mass~~
~~Orders of magnitude~~
~~Scientific notation~~
SI Measurement System
Linear Measurement
Area-Volume
Mass
Time vs. Rates
Unit Conversion
Density
Graphs
  Line X-Y
  Bar Graph
  Scatter Graph

~~Gravity-Density-Isostasy~~
~~Topography~~
~~Hypsometric Curve~~

Review of Topographic Maps
https://people.wou.edu/~taylors/g302/maps.pdf
topographic maps
north arrow
magnetic declination
map scale
fractional scale
graphical scale
longitude, latitude
degrees-minutes-seconds
township-range-section
equator
prime meridian
parallels
angular measurement
7.5 min quadrangle
contour interval
index contour
law of V's / streams
~~air photos~~
~~stereovision~~
~~map projection~~
~~DEM, Grid~~

Overview of Topo Maps
https://people.wou.edu/~taylors/g302/9_AGI_lab_manual_lab9_Topo_Maps.pdf
Map
Topographic map
Quandrangle map
7.5-minute quadrangles
Latitude-longitude
Degrees-minutes-seconds
Map scale
Ratio vs. graphical scales
Verbal scale
Compass bearings
Magnetic declination
Azimuth vs. Quadrant Bearing
UTM Location System
Township-Range System
Map symbols
North arrow
Map title

GPS, Global Positioning
~~Triangulation~~
~~Public Land Survey System~~
Aerial Photographs
Stereograms
~~Orthoimages~~
Contour lines
Index Contour
Contour Interval
Elevation
Depressions
Ridges and valleys
Spot elevations
Benchmarks (BM)
Rules for Contouring
Relief and Gradient
Topographic profile

Waltham Ch. 2 Geologic Variables
https://people.wou.edu/~taylors/g302/waltham2.pdf

geologic rates and functions
linear relationships
equation of a line
$Y = mX + B$
Y-intercept
Slope of line (rise / run)
Equation variables
ΔX and ΔY
Quadratic Equation
Polynomial Functions
Exponents and powers
Positive vs. negative powers
Fractional powers
Square root
Exponential functions
~~Logarithmic functions~~
~~Logarithms~~
~~Uses of Log Functions~~
~~1. Rearrange exponential equations~~
~~2. Reduce exponential functions to straight lines~~
~~3. Compress and transform large data set~~
~~Log base 10~~
~~Log base 2~~

Waltham Ch. 3 Equation Manipulation
https://people.wou.edu/~taylors/g302/waltham_chap3.pdf
equation manipulation
solving for unknown variables
combining and simplifying equations
cancelling variables
variable substitutions
order of operations: brackets and braces
factorial vs. distributive property
rearranging equations

~~Contouring Techniques~~
~~https://people.wou.edu/~taylors/g302/Contouring_Techniques.pdf~~
~~contour lines~~
~~isopach lines~~
~~isochre lines~~
~~isobar lines~~
~~isotherm lines~~
~~isolith lines~~
~~structure contour lines~~
~~3-D visualization~~
~~Subsurface mapping~~
~~Dipping surfaces~~
~~Rules of contour lines~~
~~1. Cannot cross~~
~~2. Can merge~~
~~3. Cannot split~~
~~4. Can close~~
~~5. Can end at edge of map~~
~~Elevation Datum = sea level~~
~~Contour interval~~
~~Index contour~~
~~Map scale~~
~~Hachured lines~~
~~Control Points~~
~~Parallel contour patterns~~
~~Mechanical vs. digital contouring~~
~~Interpretive contouring~~
~~Computer modeling~~
~~Gridding~~
~~Triangulation~~

~~Delaunay triangles~~
~~Nearest neighbor analysis~~
~~Grid nodes~~
~~Estimated fit~~
~~Triangulation~~
~~Surface stacking~~

~~Digital Elevation Models~~
~~https://people.wou.edu/~taylors/g302/Intro_DEM.pdf~~
~~Terrain Modeling~~
~~Digital Elevation Model DEM~~
~~Digital Terrain Model DTM~~
~~Grid pattnerns~~
~~Data capture~~
~~Visualization~~
~~Grid resolution~~
~~Elevation point data~~
~~Contour maps~~
~~Remote Sensing~~
~~DEM Interpolation~~
~~Triangulation TIN~~
~~Data filtering, processing~~
~~Sinks and Pits~~
~~Shaded relief map~~
~~Slope map~~
~~Aspect map~~
~~Profile curvature~~
~~Elevation and vertical precision~~

WOU Groundwater Lab Fieldtrip
Topographic map
Location map
Lidar Hillshade Model
Soil Survey
Geologic Map
Well Log
Groundwater
Groundwater Contour lines
Groundwater flow
Monitoring Well
Soil Sample
Drilling Log
SPT Penetration Test
Blow Counts
Mud Rotary Drilling
Riser Pipe
Well Screen

Well Assembly

Trigonometric Problem Solving
https://people.wou.edu/~taylors/g302/trig.pdf
https://people.wou.edu/~taylors/g302/waltham_chap5_trig.pdf
points-lines-polygons
georeferenced
Line networks
Triangulation surveys
Coordinate point positions
Angular measurement
Degrees-minutes-seconds
Radians
Unit circle
Circular geometry
Radius-diameter-circumference
Angles
    Acute vs. obtuse
    right
Triangles
    Right triangle
Law of interior angles
Sin-Cos-Tan
Pythagorean Theorem
Hypotenuse
Adjacent vs. opposite side
Complex polygons
arcSin arcCos arcTan
Sine rule
Cosine rule
Compass bearings
    Azimuth
    Quadrant
Cartesian Coordinates
True Dip vs. Apparent Dip
Vector
Magnitude vs. direction

Strike and Dip
https://people.wou.edu/~taylors/g302/TM_chap2_Techniques.pdf
Planar Orientation
Bedding Planes
Fault Planes
Fracture Planes
Folded Beds
Tilted Beds

Anticline vs. Syncline
Structural attitude
Strike and dip
Strike azimuth
Dip angle

Guidelines for Problem Solving
https://people.wou.edu/~taylors/g302/steps_in_problem_solving.pdf
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1. Read
2. ID variables
3. Draw and sketch
4. Convert units
5. Rearrange, solve
6. Check your answer

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

Possible short answer essay questions and problem solving concepts
- • What is the difference between a dimensionally balanced analytical equation and an empirical equation?
- • What is the difference between the SI system of measurement and English system
- • What is unit algebra, and how is it used to solving equations?
- • What are the basic concepts of physical measurement in nature: length, mass, time, temperature, area, volume, density, velocity, acceleration, force, energy
- • ~~What is a DEM, how is it created.~~

Map reading, photo observation.
Can you conduct basic calculations of map scale, and unit conversions?
Can you draw a profile and make basic map observations? Can you read a topographic map?
Can you solve basic hydrology / watershed problems?   Calculate slope and gradient.
Determine the equation for a line
Determine elevations from a map
Measure locations in Lat-Long and UTM
Measure bearings in the azimuth and quadrant systems
Can you draw contour lines from point data?
How do powers of 10 work in the metric system?
Can you draw a topographic profile?
Can you re-arrange an equation and solve for the unknown?
Can you read a problem and draw a sketch showing a visual representation?
Can you determine the scale of a map? Use a map scale to make measurements?
Possible short answer essay questions and problem solving concepts

Measure locations in Lat-Long and UTM
Measure bearings in the azimuth and quadrant systems
Can you read a problem and draw a sketch showing a visual representation?
Can you determine the scale of a map? Use a map scale to make measurements?
Solve triangle problems using Sine, Cosine, Tangent functions.
Calculate slope and gradient of a line on a topographic map
Determine the equation for a line
Determine elevations from a map
Measure locations in Lat-Long and UTM
Measure bearings in the azimuth and quadrant systems
Draw map view-cross-section view – block diagram views of the Earth
Sketch and visualize word problems
Can you draw a topographic profile?
Can you re-arrange an equation and solve for the unknown?
Can you read a problem and draw a sketch showing a visual representation?
Can you determine the scale of a map? Use a map scale to make measurements?
Can you determine strike and dip of a planar feature?
Solve Trig functions COS-SIN-TAN
Work problems around Pythagorean Theorem
Determine heights of objects using trigonometric solutions
Determine gradients in degrees and percent.

The quiz will include an open-book problem solving portion related to the lab exercises; review lab answer keys posted on class web site: https://people.wou.edu/~taylors/g302/ES302_home.html