Glendale Unified School District

High School

November 5, 2019

Department:	Career Technical Education
Course Title:	Honors GIS and Remote Sensing
Course Code:	7277V/7278V
Grade Level(s):	11-12
School(s) Course Offered:	Clark Magnet High School
UC/CSU Approved (Y/N, Subject):	Yes, "g" College-Preparatory Electives credits with honors designation
Course Credits:	10
Length of Course:	Full Year
Recommended Prerequisite:	Grade of "C" or better in Geology of Disasters or teacher approval; Integrated Math I and Physics, Biology, or Chemistry (can be concurrent)
Recommended Textbook:	Remote Sensing and Image Interpretation Supplemental Text: Principles of Remote Sensing (PDF)

Course Overview: Honors GIS and Remote Sensing is the concentrator course for the Environmental Engineering Industry Sector, Geographical Information Systems (GIS) pathway. This course introduces students to the basics of remote sensing, on land, in the ocean and out in space. Active versus passive sensors are investigated. Emphasis is placed on image acquisition and data collection through satellite sensors, aerial unmanned autonomous vehicles, underwater remotely operated vehicles and underwater sonar. This course is designed for geographic information systems (GIS) students interested in imagery analysis. Remote sensing is very much an interdisciplinary area of scientific investigation, and relies in large part on knowledge of physics, mathematics, chemistry, and geography. Students will develop a strong understanding of the tools and techniques used to

display, process, and analyze remotely sensed data. Proper cartographic techniques are taught iteratively throughout the course.

All Engineering and Architecture Anchor Standards are met through the Skills USA Career Essentials Experiences.

Course Content-First Semester

Unit 1: **Introduction to GIS & Remote Sensing** *(10 weeks)*

STANDARDS
CTE: D1.1, D3.6, D4.5, D4.6, D4.7, D7.1, D7.2, D8.1, D8.2, D8.3
Common Core State Standards: LS11-12.1, LS11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8

A. Students will learn the tools and techniques of remote sensing through hands-on learning. Esri tutorials and field exercises will be employed, along with selected reading and lecture materials from the GeoTech Center of Excellence. Students will get an overview of the electromagnetic spectrum using satellite and aerial data. They will learn to create electronic data collection files and perform mobile data collection in the field. The Crosscutting Concepts of "Scale, Proportion and Quantity," "Systems and System Models" will be emphasized in this unit. Students will demonstrate proficiency through a unit project developing a story map using remotely sensed data. Geographic information system instruction will focus on the ArcGIS Online program. Students complete the Get to Know GIS (For Secondary Students) learning pathway and earn an Esri certificate for completion.

B. *Key Assignments:* Get to Know GIS (For Secondary Students) learning pathway: Students complete five online tutorials for ArcGIS Online and earn an industry certificate for completion.

Maps and Computer Models: Students will map and analyze the path taken by ocean drifters, mini-boats from Educational Passages. Maps will include layers of data from The Living Atlas. Students will demonstrate knowledge of the Coriolis Effect, along with ocean and wind currents. They will make predictions of where the mini-boat will land using the Esri's Message in a Bottle modeling program.

Story Map: Students apply their knowledge of GIS and remote sensing to create a story map showcasing both the projected and actual path taken by Educational Passages mini-boats. Data collected on route will be processed and displayed along with original expository text. Students will incorporate the use of multimedia and communicate their research through the story map.

Unit 2: **Ocean GIS & Remote Sensing** *(10 weeks)*

STANDARDS
CTE: D1.1, D2.1, D3.2, D3.6, D4.3, D8.1, D8.2, D8.3, D10.1, D10.3, D14.2, D14.6
Common Core State Standards: LS11-12.1, LS11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8

A. Students will conduct field research using remotely operated vehicles and sonar for bathymetric mapping, documentation of marine life and seafloor features. The Crosscutting Concept of "Patterns" will be emphasized in this unit. Students will demonstrate proficiency through a unit project mapping field data gathered from ROV operations. Full Motion Video extension will be introduced and Geographic information system instruction will focus on ArcGIS Pro using Esri tutorials.

B. *Key Assignments:* Full Motion Video: Students will produce a Full Motion Video documenting the path flown by the ROV during field operations. Maps will include a point to line conversion to show the underwater path taken by the ROV, a buffer of the line set to document water visibility, and points of interest where still photographs were taken. Pop-ups will be configured to include coordinates, description of target and a photo. Students learn operations and applications of marine science tools and local marine ecology.

ArcGIS Pro tutorials: Students will have the choice of completing two Esri tutorials from the list below:

- Explore NOAA's Deep Sea Coral Database
- Find Fish in the Bering Sea
- Interpolate 3D Oxygen Measurements in Monterey Bay
- Predict Seagrass Habitat With Machine Learning

Conference Presentation: Students will write and submit abstracts of their project and then present their research at the Ocean and Atmospheric GIS Forum.

Course Content-Second Semester

Unit 3: **Land GIS & Remote Sensing** *(10 weeks)*

STANDARDS
CTE: D1.1, D2.1, D3.4, D3.6, D6..2, D6.3, D6.4, D6.5, D8.1, D8.2, D8.3, D10.1, D10.2, D10.3, D10.4, D10.5, D10.6, D10.7, D10.8
Common Core State Standards: LS11-12.1, LS11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8

A. Students will choose a learning path based on their interest in one of the three categories: Agriculture, Urban Planning or Wildlife Conservation. Each learning pathway will consist of a collection of Esri tutorials compiled as a theme to guide students through applying remote sensing and GIS to solve a problem or illustrate a spatial phenomenon. Pathways will include ArcGIS Online and ArcGIS Pro tutorials. Students will learn the application of UAVs for imagery acquisition and data collection. Land use, land cover and image classification topics are covered. The Crosscutting Concepts of "Stability and Change," "Patterns," and "Cause and Effect" will be emphasized in this unit. Thermal imagery, lidar data and processing will be introduced.

B. *Key Assignments:* Story Map or Full Motion Video Presentation: After completing a learning pathway of their choice, students will choose a project theme, then collect data to map, analyze and share as a story map and/or FMV presentation.

Mapping Competition: Students will choose one of their finished projects to enter into the California High School Mapping Competition, and/or the Southern California Association of Governors Story Map Competition.

Unit 4: **Mars Student Imaging Program** *(10 weeks)*

STANDARDS
CTE: D1.1, D2.1, D2.2, D2.3, D2.4, D2.5, D3.1, D3.3, D3.6, D8.1, D8.2, D8.3
Common Core State Standards: LS11-12.1, LS11-12 RLST 11-12.2, 11-12.4, 11-12.7, 11-12.10 WS 11-12.1, 11-12.2, 11-12.4, 11-12.5, 11-12.6, 11-12.7, 11-12.8 WHSST 11-12.2, 11-12.5, 11-12.6, 11-12.7, 11-12.8

A. Students will participate in the Arizona State University/NASA Mars Student Imaging Program. Students work as a team to investigate geologic features on Mars. They develop a big picture question, research question, and hypothesis as they analyze a geologic feature of interest. Students will research and compare similar features on Earth to have a starting point for their study. Students learn to use the GIS program from NASA, JMARS, to perform various analyses to answer their research question. Students will write a final report to communicate their findings. Hyperspectral remote sensing, radiance and reflectance is covered in this unit.

B. *Key Assignments:* False Color Composite Poster: Students will download Mars Exploration Rover imagery files and insert the appropriate wavelengths into the red, blue, green color bands in Photoshop to create false color composites of the surface of Mars. They will create posters in the scientific format with text using a large scale printer to showcase their work.

Question Mars: Using Mars imagery, students work together to compose and refine a big picture question relating to the geologic features present on Mars. Next they move to proposing hypotheses to address their inquiry, then refine a final research question that they will investigate using NASA's GIS tool, JMARS.

Comprehensive Final Project: Students will map imagery of their study area in ArcGIS Pro using the Image Analyst extension. They will perform the appropriate geoprocessing using the Image Analyst toolbox to help find an answer to their research question. After obtaining their results from ArcGIS Pro and JMARS, they will write a Final Report that follows the scientific method, and summarize their report in an abstract. Each report will include components of content covered in this course. Outstanding reports and abstracts will be submitted Arizona State University, Mars Student Imaging Program for publication.

Additional Recommended Materials - Must be approved by Board of Education.