I. CATALOG INFORMATION

A. Discipline: GEOGRAPHIC INFORMATION SYSTEMS (GIS)

B. Subject Code and Number: GIS M23

C. Course Title: Remote Sensing

D. Credit Course units:

Units: 3

Lecture Hours per week: 3

Lab Hours per week : 0

Variable Units : No

E. Student Learning Hours:

Lecture Hours:

Classroom hours: 52.5 - 52.5

Laboratory/Activity Hours:

Laboratory/Activity Hours 0 - 0

Total Combined Hours in a 17.5 week term: 52.5 - 52.5

F. Non-Credit Course hours per week

G. May be taken a total of: [X] 1 [ ] 2 [ ] 3 [ ] 4 time(s) for credit

H. Is the course co-designated (same as) another course: No [X] Yes [ ]
If YES, designate course Subject Code & Number:

I. Course Description:

Uses ArcGIS software to analyze data collected by remote means such as satellite imagery, aerial photography and drone-acquired data. Introduces the basic concepts of remote sensing, characteristics of remote sensors, and remote sensing applications in academic disciplines and professional industries.

J. Entrance Skills

*Prerequisite: No [ ] Yes [X] Course(s)
GIS M01

*Corequisite: No [X] Yes [ ] Course(s)

Limitation on Enrollment: No [X] Yes [ ]

Recommended Preparation: No [X] Yes [ ] Course(s)

Other: No [X] Yes [ ]

K. Other Catalog Information:

II. COURSE OBJECTIVES

Upon successful completion of the course, a student will be able to:

		Methods of evaluation will be consistent with, but not limited by, the following types or examples.
1	define and describe basics of electromagnetic spectrum and interactions with various types of media.	In-class exercises Summative abstracts on in- class exercises Written and practical exams Capstone project
2	describe different types of remote-sensing data sets and select appropriate sets for remote sensing tasks based on spectral, temporal, radiometric and spatial resolution.	In-class exercises Summative abstracts on in-class exercises Written and practical exams Capstone project
3	apply basic digital image processing and interpretation techniques to obtain useful information from remote sensing images.	In-class exercises Summative abstracts on in-class exercises Written and practical exams Capstone project
4	perform basic remote sensing workflows to solve problems (such as acquiring data, feature extraction, change detection, pre- and post-processing, create composite images and image classification).	In-class exercises Summative abstracts on in-class exercises Written and practical exams Capstone project
5	differentiate among passive and active remote sensing systems based upon their characteristics.	In-class exercises Summative abstracts on in-class exercises Written and practical exams Capstone project
6	apply basic concepts, methods, and uses of accuracy assessment and ground truthing to the results of remote sensing workflows.	In-class exercises Summative abstracts on in-class exercises Written and practical exams

		Capstone project
7	interpret, analyze, summarize, and present the results of a remote sensing workflow.	In-class exercises Summative abstracts on in-class exercises Written and practical exams Capstone project
8	assemble remote sensing imagery from industry and government-specific sources.	In-class exercises Summative abstracts on in-class exercises Written and practical exams Capstone project

III. COURSE CONTENT

Estimated %	Topic	Learning Outcomes
Lecture (must total 100%)		
20.00%	Introduction to the Theory that Guides Remote Sensing: - Electromagnetic Radiation - Atmospheric Energy-Matter Interactions - Remote Sensing Data Collection	1, 2, 6, 8
10.00%	Active Sensors: - Radar - Lidar	1, 2, 5, 6, 8
10.00%	Aerial Imagery	1, 2, 5, 6, 8
15.00%	Image Processing: - Registration - Distortion Correction - Enhancement	2, 3, 4, 6, 7
15.00%	Supervised and Unsupervised Classification	3, 4, 6, 7
10.00%	Surface Generation from Point Data	4, 6, 7, 8
10.00%	Introduction to GIS software: - ArcGIS - Image Analyst Extension	4, 6, 7
10.00%	Satellite Sensors	1, 2, 3, 5, 8

IV. TYPICAL ASSIGNMENTS

A. Writing assignments

Writing assignments are required. Possible assignments may include, but are not limited to:	
1	summarize the results of in-class exercises that use remote sensing techniques in a professional abstract format.
	describe, in an essay, the uses and limitations of various types of remote sensing

2	imagery sources (drones, Landsat, Moderate Resolution Imaging Spectroradiometer (MODIS), and aerial imagery).
3	write a summary of the electromagnetic spectrum and the uses of the various parts of it.
4	write a research proposal for a remote sensing campaign that includes the subject of the project, why it is important, a research timetable, a materials list, and references to background material.
5	communicate the results of an applied research project that utilizes remote sensing in the technical writing style required by the industry.

B. Appropriate outside assignments

Appropriate outside assignments are required. Possible assignments may include, but are not limited to:	
1	divide a part of campus into a grid of pixels the size of drone pixels (0.5 m2 Landsat pixels (30 m2), and MODIS pixels (500m2). Walk the grid and define the contents of the pixel. Write a reflection on the resolution of various remote sensing data sources.
2	take reflectance spectra of common Earth materials and vegetation types. Present results to the class.
3	write a summary of the qualitative changes that have happened to campus since 1994 using satellite imagery in Google Earth.

C. Critical thinking assignments

Critical thinking assignments are required. Possible assignments may include, but are not limited to:	
1	perform an atmospheric correction on raw Landsat imagery.
2	evaluate the area of a recent forest fire using a Burned Area Reflectance Classification (BARC).
3	use supervised and unsupervised classification to create land cover maps of our community. Write an abstract contrasting the two methods.
4	design, as part of a capstone project, a GIS campaign that evaluates a problem using remote sensing. The project must include downloading and post-processing remotely sensed data, some kind of analysis of those data (classification, change detection, or feature extraction) and presentation of the results in a technical poster presentation.

V. METHODS OF INSTRUCTION

Methods of instruction may include, but are not limited to:

☐ Distance Education – When any portion of class contact hours is replaced by distance education delivery mode (Complete DE Addendum, Section XV)

☒ Lecture/Discussion

☐ Laboratory/Activity

☒ Other (Specify)
Lecture time will be interspersed with hands-on computer exercises demonstrating the topic
Class activities
Guest speakers
Collaborative group work will also be applied

[X] Optional Field Trips

[ ] Required Field Trips

VI. METHODS OF EVALUATION

Methods of evaluation may include, but are not limited to:

[X] Essay Exam	[X] Classroom Discussion	[X] Skill Demonstration
[X] Problem Solving Exam	[ ] Reports/Papers/ Journals	[X] Participation
[X] Objective Exams	[X] Projects	[X] Other (specify)

- Capstone project in which students evaluate a problem that can be solved with remote sensing techniques. They will access the appropriate data, post-process and analyze it, and present the results to the class.
- Quizzes
- Summative papers

VII. REPRESENTATIVE TEXTS AND OTHER COURSE MATERIALS

Jensen, John. Introductory Digital Image Processing: A Remote Sensing Perspective. 4th ed. Pearson, 2015.

Lillesand, Thomas, et al. Remote Sensing and Image Interpretation. 7th ed. Wiley, 2015.

He, Yuhong, and Qihao Weng. High Spatial Resolution Remote Sensing: Data, Analysis, and Applications (Imaging Science). CRC, 2018.

Hopkins, Max, ed. Introduction to Remote Sensing. Syrawood Publishing House, 2018.

VIII. STUDENT MATERIALS FEES

[X] No [ ] Yes

IX. PARALLEL COURSES

College	*Course Number*	*Course Title*	*Units*
San Diego Mesa College	GISG 130	Introduction to Remote Sensing	3
Humboldt State Univ.	GSP 216	Introduction to Remote Sensing	3
Columbia College	CCTIS 75	Introduction to Remote Sensing	3
Santa Monica College	GIS 26	Introduction to Remote Sensing	3

X. MINIMUM QUALIFICATIONS

Courses Requiring a Masters Degree:
Master's degree in geology, geophysics, earth sciences, meteorology, oceanography, or paleontology OR bachelor's degree in geology AND master's degree in geography, physics, or geochemistry OR the equivalent.

XI. ARTICULATION INFORMATION

A. Title V Course Classification:

1. This course is designed to be taken either:

   ☐ Pass/No Pass only (no letter grade possible); or
   ☒ Letter grade (P/NP possible at student option)

2. Degree status:
   Either ☒ Associate Degree Applicable; or ☐ Non-associate Degree Applicable

B. Moorpark College General Education:

1. Do you recommend this course for inclusion on the Associate Degree General Education list?
   Yes: ☐ No: ☒ If YES, what section(s)?

   ☐ A1 - Natural Sciences - Biological Science
   ☐ A2 - Natural Sciences - Physical Science
   ☐ B1 - Social and Behavioral Sciences - American History/Institutions
   ☐ B2 - Social and Behavioral Sciences - Other Social Behavioral Science
   ☐ C1 - Humanities - Fine or Performing Arts
   ☐ C2 - Humanities - Other Humanities
   ☐ D1 - Language and Rationality - English Composition
   ☐ D2 - Language and Rationality - Communication and Analytical Thinking
   ☐ E1 - Health/Physical Education
   ☐ E2 - PE or Dance
   ☐ F - Ethnic/Gender Studies

C. California State University(CSU) Articulation:

1. Do you recommend this course for transfer credit to CSU? Yes: ☒ No: ☐

2. If YES do you recommend this course for inclusion on the CSU General Education list?
   Yes: ☐ No: ☒ If YES, which area(s)?

   A1 ☐ A2 ☐ A3 ☐ B1 ☐ B2 ☐ B3 ☐ B4 ☐

   C1 ☐ C2 ☐ D1 ☐ D2 ☐ D3 ☐ D4 ☐ D5 ☐

   D6 ☐ D7 ☐ D8 ☐ D9 ☐ D10 ☐ E ☐

D. University of California (UC) Articulation:

1. Do you recommend this course for transfer to the UC? Yes: ☐ No: ☒

2. If YES do you recommend this course for the Intersegmental General Education Transfer Curriculum (IGETC)? Yes: ☐ No: ☒

   IGETC Area 1: English Communication

- [ ] English Composition
- [ ] Critical Thinking-English Composition
- [ ] Oral Communication

IGETC Area 2: Mathematical Concepts and Quantitative Reasoning

- [ ] Mathematical Concepts

IGETC Area 3: Arts and Humanities

- [ ] Arts
- [ ] Humanities

IGETC Area 4: Social and Behavioral Sciences

- [ ] Anthropology and Archaeology
- [ ] Economics
- [ ] Ethnic Studies
- [ ] Gender Studies
- [ ] Geography
- [ ] History
- [ ] Interdisciplinary, Social & Behavioral Sciences
- [ ] Political Science, Government & Legal Institutions
- [ ] Psychology
- [ ] Sociology & Criminology

IGETC Area 5: Physical and Biological Sciences (mark all that apply)

- [ ] Physical Science Lab or Physical Science Lab only (none-sequence)
- [ ] Physical Science Lecture only (non-sequence)
- [ ] Biological Science
- [ ] Physical Science Courses
- [ ] Physical Science Lab or Biological Science Lab Only (non-sequence)
- [ ] Biological Science Courses
- [ ] Biological Science Lab course
- [ ] First Science course in a Special sequence
- [ ] Second Science course in a Special Sequence
- [ ] Laboratory Activity
- [ ] Physical Sciences

IGETC Area 6: Language other than English

- [ ] Languages other than English (UC Requirement Only)
- [ ] U.S. History, Constitution, and American Ideals (CSU Requirement ONLY)
- [ ] U.S. History, Constitution, and American Ideals (CSU

Requirement ONLY)

XII. REVIEW OF LIBRARY RESOURCES

A. What planned assignment(s) will require library resources and use?

The following assignments require library resources: None

B. Are the currently held library resources sufficient to support the course assignment?

YES: [X] NO: [ ]

If NO, please list additional library resources needed to support this course.

XIII. PREREQUISITE AND/OR COREQUISITE JUSTIFICATION

Requisite Justification for GIS M01

[ ] A. Sequential course within a discipline.

[X] B. Standard Prerequisite or Corequisite required by universities.

Humboldt State

[ ] C. Corequisite is linked to companion lecture course.

[ ] D. Prerequisite or Corequisite is authorized by legal statute or regulation.
Code Section: _____

[ ] E. Prerequisite or Corequisite is necessary to protect the students' health and safety.

[ ] F. Computation or communication skill is needed.

[ ] G. Performance courses: Audition, portfolio, tryouts, etc. needed.

XIV. WORKPLACE PREPARATION

Required for career technical courses only. A career technical course/program is one with the primary goal to prepare students for employment immediately upon course/program completion, and/or upgrading employment skills.

Detail how the course meets the Secretary of Labors Commission on the Achievement of Necessary Skills (SCANS) areas. (For a description of the competencies and skills with a listing of what students should be able to do, go to: http://www.ncrel.org/sdrs/areas/issues/methods/assment/as7scans.htm)

The course will address the SCANS competency areas:

1. Resources: the students will retrieve geospatial data from governmental or academic sources, organize those data using proper data management

techniques, and analyze their data according to a time schedule articulated at the start of the semester.

2. Interpersonal: the students will work in groups of 2-3 students to create and execute a workflow that will answer a geospatial question in a manner that simulates a real workplace environment. Students will communicate the results of this work to the class and will, in part, be evaluated by peer-review.

3. Information: the students will use the Internet to acquire geospatial data sets and GIS software to analyze those data. Students will communicate the results of their analyses in written abstracts and in verbal and posterpresentations.

4. Systems: the students will understand their roles as Geographic Information Systems technicians by setting up and executing data analysis workflows, troubleshooting and modifying these workflows when problems arise.

5. Technology: the students will apply GIS software every day in class and on every out-of-class assignment.

The course also addresses the SCANS skills and personal qualities:

1. Basic Skills: the students will use reading, writing and mathematics to access geospatial data, analyze those data, and present their results to the class in a professional conference-style poster presentation. Emphasis is placed upon the technical writing and speaking style demanded by the industry.

2. Thinking Skills: the students will apply creative and critical thinking to answer geospatial questions using the tools of a GIS technician, solving problems when they arise.

3. Personal Qualities: the students will conduct themselves in a responsible, professional manner when completing an industry-level capstone project applying remote sensing tools. Projects will be completed in a timely fashion, so students must set realistic goals and manage time appropriately to meet them. During the peer-review process, students will behave in a critical, yet polite, fashion when giving feedback.

XV. DISTANCE LEARNING COURSE OUTLINE ADDENDUM

GIS M23: Not Applicable

XVI. GENERAL EDUCATION COURSE OUTLINE ADDENDUM

GIS M23: Not Applicable

XVII. STUDENT MATERIALS FEE ADDENDUM

GIS M23: Not Applicable

XVIII. REPEATABILITY JUSTIFICATION TITLE 5, SECTION 55041

GIS M23: Not Applicable

XIX. CURRICULUM APPROVAL

Course Information:

Discipline: GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Discipline Code and Number: GIS M23

Course Revision Category: New Course

Course Proposed By:

Originating Faculty Roger Putnam 09/14/2018

Faculty Peer: _____

Curriculum Rep: _____

Department Chair: Robert Keil 10/24/2018

Division Dean: Mary Rees 09/16/2018

Approved By:

Curriculum Chair: Jerry Mansfield 12/07/2018

Executive Vice President: _____

Articulation Officer: Letrisha Mai 11/01/2018

Librarian: Mary LaBarge 10/31/2018

Implementation Term and Year: Fall 2019

Approval Dates:

Approved by Moorpark College Curriculum Committee: 11/06/2018

Approved by Board of Trustees (if applicable): 12/11/2018

Approved by State (if applicable): 12/14/2018