I. Detailed Assessment of CORE Knowledge Units

NGA/USGS Centers of Academic Excellence in Geospatial Sciences
RESULTS OF CAMPUS SURVEY
University of Maine

QUESTIONNAIRE TABLE OF CONTENTS

Summary: This document shows details on how all 9 CORE Knowledge Units are met through the content contained within geospatial graduate courses offered at the University of Maine. Reporting was accomplished through an online questionnaire completed by the instructors teaching the various listed courses.

Note: Focus Area knowledge units highlighted in red and green below meet the minimum criteria. Thus, as shown, the University of Maine fulfills all 9 of the CORE Knowledge Unit criteria.

Course Legend for the Knowledge Unit Tables

I. Geospatial Courses offered by Spatial Informatics Graduate Programs within the UMaine School of Computing and Information Science		
Course Abbreviation	**Course Title**	**Regular Instructor**
SIE 502	Research Methods	Egenhofer
SIE 503	Principles of Experimental Design	Giudice
SIE 505	Formal Foundations for Information Science	Hahmann
SIE 507	Information Systems Programming	Moratz
SIE 509	Principles of GIS	Beard
SIE 510	GIS Applications	Beard
SIE 512	Spatial Analysis	Beard
SIE 515	Human Computer Interaction	Giudice
SIE 516	Virtual Reality Research and Applications	Giudice
SIE 525	Information Systems Law	Onsrud
SIE 550	Design of Information Systems	Egenhofer
SIE 554	Spatial Reasoning	Egenhofer
SIE 555	Spatial Database Systems	Nittel
SIE 557	Database System Applications	Nittel
SIE 558	Data Stream Management Systems	Nittel
SIE 559	GeoSensor Networks	Nittel
SIE 565	Reasoning with Uncertainty in Spatial Information Systems	Hahmann
SIE 570	Spatial Cognition and Computing	Moratz
SIE 571	Pattern Recognition & Robotics	Moratz
SIE 598 fo	Formal Ontologies	Hahmann
SIE 598 sln	Spatial Learning and Navigation	Giudice

II. Geospatial Courses offered by Other Graduate Programs at UMaine		
Course Abbreviation	**Course Title**	**Regular Instructor**
Bio 597	Advanced Biometry for the Environmental Sciences	McGill
Ece 574	Cluster Computing	Yifeng
Int 527	Integration of GIS and Remote Sensing Data Analysis in Natural Resource Applications	Sader
Sfr 406	Remote Sensing, Image Interpretation, and Forest Mapping	Sader
Sms 540	Satellite Oceanography	Thomas
Svt 437	Practical GPS	Hintz
Svt 531	Advanced Digital Photogrammetry	Hintz
Svt 541	Geodesy	Hintz

QUESTIONNAIRE
for
UMaine Courses incorporating Geospatial Science Knowledge Units
Supporting the National Center of Excellence in Geospatial Sciences Application

Title of Survey: UMaine Courses with Geospatial Science Knowledge Units
Description: This survey documents the geospatial science knowledge units covered within graduate as well as 400 and 300 level courses at the University of Maine. Please complete this survey for each of your germane courses.
Welcome: Please complete this survey **on or before Monday February 9** for each and every one of your courses that addresses geospatial knowledge. The final application to USGS/NGA will be constructed from the data you supply.
Administrator: Harlan Onsrud
Start Date: current day
Expiration Date: Midnight on March 1.
End Message: Your responses have been recorded. Thank you for your contribution. You will have the opportunity to review the entire application prior to its submission to the federal government. For further questions or comments, contact Harlan Onsrud at harlan.onsrud@maine.edu

Exit Link (url to which survey goes after final step complete): http://www.umaine.edu/

Question Group A: Course Being Reported

A1. Course Designator and Number: _____
A2. Course Title: _____
A3. Last Taught (Please indicate Fall or Spring plus the Year):
A4. Frequency Offered: __ Every Semester, __ Annually, __ Bi-Annually, __ As Needed
A5. Most recent instructor: [small text box]
A6. Updates last made to course: __ current, __ within 1 year, __ within 2 years, __ other <list>
A7. Is this course regularly offered through distance technologies? __ Yes __ No

Question Group B: Core Geospatial Knowledge Units addressed within your UMaine Course

B0. Does this course partially or completely address the following Core Geospatial Knowledge Units?
Help: For each of your courses, please attempt to respond positively to as many items as possible under each of the 9 core areas.

B1. Core 1. Geo-referencing Systems __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge of datums, coordinate systems, map projections, coordinate transformation, registration, and rectification

B1a. Question: Please check any and all of the following TOPICS covered by your course.

ID	TOPICS	Courses Responding Yes									
		SIE 509	SIE 510	SIE 516	SIE 570	SIE 571	Int 527				
R	Geoid and ellipsoid, geometry, and WGS84	✓	✓				✓				
S	Geographic and planar coordinate systems, horizontal and vertical datums	✓	✓			✓					
T	Earth coordinate systems and associated transformations: Earth Centered Inertial (ECI), Earth Centered Frame (ECF), spherical, ellipsoidal, and 2D and 3D coordinate transformations		✓	✓							
U	Map projections	✓	✓	✓			✓				
V	Registration	✓	✓		✓	✓					
W	Rectification	✓	✓								

Help: This KU is satisfied when all six (6) Topics are met as drawn from among appropriate level courses offered on the campus.

B1b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course.

ID	LEARNING OBJECTIVES	Courses Responding Yes								
		SIE 509	SIE 510	SIE 516	SIE 570	SIE 571	Int 527			
X	1. Distinguish between a geoid, an ellipsoid, a sphere, and the terrain surface	✓	✓							
Y	2. Explain the angular measurements represented by latitude and longitude coordinates	✓	✓		✓					
Z	3. Explain why plane coordinates are sometimes preferable to geographic coordinates		✓		✓					
AA	4. Explain what Universal Transverse Mercator (UTM), State Place Coordinates (SPC) eastings and northings, and the Military Grid Reference System (MGRS) represent	✓	✓				✓			
AB	5. Describe an application in which a linear referencing system is particularly useful		✓	✓	✓	✓				
AC	6. Distinguish how the datum associated with a linear referencing system differs from a horizontal or vertical datum		✓							
AD	7. Define horizontal datum in terms of the relationship between a coordinate systems and an approximation of the Earth's surface	✓	✓		✓		✓			
AE	8. Illustrate the difference between a vertical datum and a geoid		✓							
AF	9. Define the four geometric properties of the globe that may be preserved or lost in projected coordinates	✓	✓							
AG	10. Explain the mathematical basis for how latitude/longitude coordinates are projected into X/Y coordinate space		✓							
AH	11. Discuss the methods used for coordinate transformations and map projection	✓	✓		✓		✓			
AI	12. Apply data transforms among datums coordinate systems, and map projections		✓				✓			
AJ	13. Explain the rectification processes for originally collected digital data and for scanned and digitized data layers	✓	✓							
AK	14. Explain the advantages and challenges of the Web Mercator projection									
AL	15. Recognize the distortions (shape, area, and distance) inherent to map projections	✓	✓		✓					
AM	16. Demonstrate the ability to determine proper map projections for different applications	✓	✓	✓	✓	✓	✓			
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria		✔							

Help: This KU is satisfied when any seven (7) Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B2. Core 2. Spatial Data Fundamentals __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge required to understand geospatial data and the techniques and methods needed for effective data management

B2a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS	Courses Responding Yes									
		SIE 505	SIE 509	SIE 510	SIE 550	SIE 554	SIE 555	SIE 570	SIE 571	SIE 598 fo	Int 527
AO	Challenges in vector-to-raster and raster-to-vector conversions		✓			✓		✓	✓		✓
AP	Conflation of data from different sources--or for different uses--as it relates to mapping		✓					✓	✓		
AQ	Data schemas and data models		✓	✓	✓		✓	✓	✓	✓	
AR	Data quality using Quality Assurance/Quality Control (QA/QC) methods		✓	✓				✓	✓		
AS	Concepts of geospatial data types (vector, raster, TIN, DEM, image, point cloud, object based, etc.) and their use		✓	✓			✓	✓	✓		✓
AT	Concepts of geospatial file structures on the web (XML, KML, GML, GeoJSON, RDF, and OWL) and their use				✓					✓	
AU	Data storage (e.g. RDBMS, NOSQL, etc.)		✓	✓	✓		✓				
AV	Extract, Transform and Load (ETL) operations for geospatial data: managing content								✓		
AW	Points, lines and polygons	✓	✓	✓		✓	✓	✓	✓		✓
AX	Topology		✓	✓		✓	✓	✓	✓		✓
AY	Networks	✓	✓	✓				✓	✓		✓
AZ	Linear referencing			✓							
BA	Grid cell, image, pyramid, quadtree, lidar (las), Logarithm of Odds (LoDs)		✓	✓			✓				
BB	Object-based feature models		✓	✓	✓		✓	✓	✓	✓	
BC	Scale and resolution (or "level of data")		✓	✓		✓	✓	✓	✓		

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B2b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 505	SIE 509	SIE 510	SIE 550	SIE 554	SIE 555	SIE 570	SIE 571	SIE 598 fo	Int 527
BD	1. Describe methods for data storage related to database options to include pros/cons of each approach		✓	✓	✓		✓	✓	✓		
BE	2. Recognize the concepts of data modeling: (conceptual, logical, and physical) and the relationship of data models to data schemas		✓	✓	✓		✓	✓	✓	✓	
BF	3. Identify current tools for conflation of data and how data conflation operations are performed and the role of business rules and business logic in guiding conflation							✓			
BG	4. Explain methods of Quality Control and Quality Assurance and the differences between QA and QC.			✓				✓	✓		
BH	5. Describe the process for precision and accuracy assessment in QA/QC, tradeoffs in spatial representation, and the affects on analysis			✓			✓		✓		
BI	6. Discuss geospatial data types (vector, raster,		✓	✓				✓	✓		✓

	TIN, DEM, image, point cloud, object, etc.) and how each is used in cartographic production										
BJ	7. Describe geospatial file structures on the web (XML, KML, GML, GeoJSON, RDF, and OWL) and the use of each									✓	
BK	8. Explain and demonstrate the basic data and content management principles of extract, transform, and load operations.										
BL	9. Discuss how to access data from a database, exploit data using commercial GIS tools, and return data to a "gold data" repository										
BM	10. Identify basic spatial data models		✓	✓		✓	✓	✓	✓		✓
BN	11. Apply conversions among spatial data models		✓	✓		✓	✓	✓	✓		
BO	12. Recognize the basic elements and structures of each data model		✓	✓		✓	✓	✓	✓		
BP	13. Discuss the limitations imposed by the data model on data processing		✓	✓			✓	✓	✓		
BQ	14. Evaluate the assumptions that are made when representing the world as points, lines, or polygons		✓	✓			✓	✓	✓		✓
BR	15. Explain how uncertainty affects spatial representation.		✓	✓			✓	✓	✓		
BS	16. Define terms related to topology, and illustrate a topological relationship		✓	✓		✓	✓	✓	✓		✓
BT	17. Evaluate the positive and negative impact of the shift from integrated topological models			✓		✓			✓		
BU	18. Discuss the impact of early prototype data models (e.g. POLYVRT, GBF/DIME) on contemporary vector formats										
BV	19. List definitions of networks that apply to specific applications or industries	✓		✓							
BW	20. Demonstrate how attributes of networks can be used to represent cost, time, distance, or many other measures	✓	✓	✓							✓
BX	21. Construct a data structure to contain point or linear geometry for database record events that are referenced by their position along a linear feature		✓	✓							
BY	22. Describe the architectures of various object-relational spatial data models, including spatial extensions of DBMS, proprietary object-based data models from GIS vendors, and open source and standards-based efforts			✓			✓				
BZ	23. Recognize how scale affects the type of data that can be used and how this affects aggregated data sets (e.g. the generalization of aggregated data sources from multiple scales)		✓	✓		✓	✓				✓
CA	24. Describe multiple measurement techniques			✓				✓	✓		
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria		✔	✔			✔	✔	✔		

Help: This KU is satisfied when at least seven (7) Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B3. Core 3. Remote Sensing Fundamentals __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge required to broadly understand remote sensing systems and applications—an introduction to the theory of remote sensing, basic phenomenology, imaging systems, image analysis applications, and techniques.

B3a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS	Courses Responding Yes									
		SIE 509	SIE 571	Int 527	Sfr 406						
CC	Electromagnetic radiation/material interaction basics (reflection, absorption, transmission, and scattering)	✓	✓		✓						
CD	Basics of atmospheric contributions to remotely sensed signals	✓			✓						
CE	Basic differences in spectral regimes (reflective vs. emissive remote sensing)	✓	✓	✓	✓						
CF	Passive imaging system fundamentals (EO, IR, MSI, HIS)		✓	✓	✓						
CG	Types of camera models and their parameters (frame, linear, whiskbroom)		✓		✓						
CH	Active imaging system fundamentals (radar and lidar)		✓		✓						
CI	Impacts of resolution dimensions (spatial, spectral, radiometric, temporal) and how they inform sensor design		✓	✓							
CJ	Impacts of resolution dimensions (spatial, spectral, radiometric, temporal) and how they inform data analysis			✓	✓						
CK	Characteristics of commercial/civil satellite, and airborne systems			✓	✓						
CL	Basics of atmospheric compensation (radiance vs. reflectance)			✓							
CM	Fundamentals of basic quantitative image analysis (classification, spectral analysis, thermal analysis)		✓	✓	✓						
CN	Basic concepts of remote sensing including spatial, spectral, radiometric and temporal resolution, spectral signatures, and creation and use of composite images	✓		✓	✓						

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B3b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course.

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 509	SIE 571	Int 527	Sfr 406						
CO	1. Explain light matter interactions and impacts on observable phenomenology		✓	✓	✓						
CP	2. Discuss how sensors are designed and how images are formed		✓	✓	✓						
CQ	3. Identify existing and planned remote sensing systems and their characteristics		✓	✓	✓						
CR	4. Express the basic premises behind the quantitative analysis of remotely sensed data	✓	✓	✓	✓						
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria		✔	✔	✔						

Help: This KU is satisfied when all Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B4. Core 4. Spatial Data Management __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge required to store, manage and maintain geospatial data, to include topological relationships.

B4a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS	Courses Responding Yes									
		SIE 505	SIE 509	SIE 510	SIE 550	SIE 554	SIE 555	SIE 558	SIE 570	SIE 571	Int 527
CT	Basic storage and retrieval structures	✓	✓		✓		✓		✓	✓	
CU	Basics of database management systems		✓	✓	✓		✓				
CV	Relational and object-oriented databases		✓	✓	✓		✓		✓		
CW	Feature-based DBMS, object oriented DBMS, non-SQL DBMS.			✓	✓		✓				
CX	Management of crowd-sourced, VGI, and other non-traditional data types			✓				✓			
CY	Managing topology, distance, adjacency, and connectivity in spatial data (points, lines, polygons, pixels, raster data)	✓	✓	✓			✓				
CZ	Database modeling		✓	✓	✓		✓	✓			
DA	Managing geometric relationships among features (distances and lengths; direction, shape, and area; proximity and distance decay; adjacency and connectivity)		✓	✓		✓	✓		✓	✓	✓

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B4b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 505	SIE 509	SIE 510	SIE 550	SIE 554	SIE 555	SIE 558	SIE 570	SIE 571	Int 527
DB	1. Define basic data structure terminology (e.g., records, field, parent/child, nodes, pointers, topology)	✓	✓	✓	✓		✓		✓		
DC	2. Differentiate among data models, data structures, and file structures	✓	✓	✓	✓		✓		✓		
DD	3. Discuss the advantages and disadvantages of different data structures (e.g., arrays, linked lists, binary trees) in storing geospatial data						✓			✓	
DE	4. Analyze the relative storage efficiency of each of the basic data structures						✓				
DF	5. Employ algorithms that store geospatial data to a range of data structures						✓		✓		
DG	6. Compare and contrast direct and indirect access search and retrieval methods						✓				
DH	7. Employ algorithms that retrieve geospatial data from a range of data structures						✓		✓		
DI	8. Describe the advantages and disadvantages of different compression techniques relative to geographic data representation		✓								
DJ	9. Demonstrate how DBMS are currently used in conjunction with GIS		✓	✓	✓		✓				
DK	10. Explain why some of the older DBMS are now of limited use within GIS		✓	✓	✓		✓				
DL	11. Diagram hierarchical DBMS architecture				✓						

DM	12. Diagram network DBMS architecture				✓						
DN	13. Differentiate among network, hierarchical and relational database structures, and their uses and limitations for geographic data storage and processing				✓						
DO	14. Describe the geo-relational model (or dual architecture) approach to GIS DBMS		✓	✓	✓		✓				
DP	15. Explain the use of non-traditional database management systems (e.g. non-SQL) for spatial data management			✓	✓		✓			✓	
DQ	16. Explain management approaches to non-traditional data types (e.g. crowd-sourced VGI, open GIS platforms/portals, web portal, cloud spatial data management							✓			
DR	17. Discuss spatial query and indexing to include metadata tagging						✓				
DS	18. Restate approaches to managing proximity, distance, adjacency, topology and connectivity in spatial data (e.g. points, lines, polygons, pixels, raster data) using data management systems						✓			✓	✓
DT	19. Describe several different measures of distance between two points (e.g. Euclidean, Manhattan, network, spherical, time, social, cost)		✓	✓		✓		✓		✓	
DU	20. Describe operations that can be performed on qualitative representations of direction					✓	✓			✓	
DV	21. Explain why an object's shape might be important in analysis					✓	✓		✓	✓	
DW	22. Explain how variations in the calculation of area may have real-world implications (e.g. when calculating density)		✓				✓				
DX	23. Explain the rationale behind the use of different forms of distance decay functions								✓		
DY	24. Demonstrate how adjacency and connectivity can be recorded into matrices	✓	✓			✓					
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria			✔			✔				

Help: This KU is satisfied when at least seven (7) Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B5. Core 5. Geospatial Data Standards __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge required to understand the processes and application of standards in geospatial science

B5a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS	Courses Responding Yes									
		SIE 509	SIE 510	SIE 555	SIE 570	SIE 598 fo					
EA	Standards bodies (national, international, commercial, non-profit)		✓	✓		✓					
EB	The importance of standards and how they are developed		✓	✓		✓					
EC	Open standards vs proprietary standards			✓		✓					
ED	Fundamentals of data standards	✓	✓	✓		✓					
EE	Fundamentals of metadata	✓	✓	✓	✓	✓					

EF	Fundamentals of Web Service Standards and how they are used		✓	✓							
EG	Service-enabling data			✓							
EH	Fundamentals of ontology			✓	✓	✓					

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B5b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 509	SIE 510	SIE 555	SIE 570	SIE 598 fo					
EI	1. Discuss the history and mission of critical standard bodies and coordination activities to include (e.g. ISO, IHO, DGIWG, OGC, ANSI, FGDC, WC3, Spatial Data Infrastructure (SDI), etc.)		✓	✓		✓					
EJ	2. Describe the role played by standards in cartographic activities		✓	✓							
EK	3. Examine the principles of open vs. proprietary standards and the pros and cons of each			✓	✓						
EL	4. Describe the fundamentals of data standards and how they are used in data/content management and the production of cartographic outputs	✓	✓			✓					
EM	5. Discuss basic metadata concepts. What metadata is; Primary uses; Importance in data discovery; Enabling of service catalog functions. Types of metadata (e.g. record level, feature/attribute level, service metadata, etc.)	✓	✓	✓	✓						
EN	6. Discuss the major dimensions of web service standards to include: WMS, WCS, WFS, WPS, REST, WSC; How these standards are developed; What they are used for; Differences between each; REST vs. OGC/SOAP			✓							
EO	7. Employ and employee concepts of standards to enable data for web services		✓	✓							
EP	8. Explain the role of ontology in spatial data standards			✓	✓	✓					
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria			✔							

Help: This KU is satisfied when at least seven (7) Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B6. Core 6. Effective Visual Communications of Spatio-temporal Information __ Yes __No (If response is yes, the following questions appear.)

Help: Skills and knowledge required to convey information and facilitate the presentation of knowledge in visual and multi-media form.

B6a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS	Courses Responding Yes									
		SIE 503	SIE 510	SIE 512	SIE 515	SIE 516	SIE 554	SIE 570	SIE 571		
ES	Graphic depiction precision and certainty		✓	✓		✓		✓	✓		
ET	Introduce, define, and display a variety of visualization methodologies		✓	✓	✓			✓			

EU	Graphic and visual depiction techniques for spatial data to support analytic or technical understanding, to include (traditional visual graphics and displays), virtual and immersive environments		✓	✓		✓	✓				
EV	Today's media and the use of infographic-type visualizations		✓	✓	✓						
EW	Multi-media style reporting		✓		✓						
EX	Advantages and disadvantages of virtual tools and technology with on data and imagery applications emphasis					✓					
EY	Appropriate use of scale in visual presentations		✓	✓	✓			✓			
EZ	Appropriate use of graphic vs. image-based representation of information	✓	✓					✓			
FA	Cartographic representation of data		✓	✓			✓				
FB	Geospatial representation of non-spatial data							✓			

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B6b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 503	SIE 510	SIE 512	SIE 515	SIE 516	SIE 554	SIE 570	SIE 571		
FC	1. Demonstrate the ability to organize, prepare and display visual images and graphics	✓	✓	✓				✓	✓		
FD	2. Demonstrate the ability to tell a story through static, motion, and multi-dimensional images and graphics	✓	✓				✓				
FE	3. Organize a persuasive argument using visual images and graphics	✓	✓	✓			✓				
FF	4. List virtual and immersive environments appropriate to the applications of geospatial data and imagery		✓			✓					
FG	5. List data required to create imagery-based graphics, and the advantages and disadvantages of creating a variety of imagery-based products		✓								
FH	6. Explain the use of multi-media used in graphic depictions		✓		✓	✓		✓			
FI	7. Discuss the need for graphic spatial depictions to communicate information effectively, and discuss the impact of timeliness, data sets, and how the information will be disseminated		✓	✓							
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria		✔								

Help: This KU is satisfied when all Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B7. Core 7. Professional Ethics in Geospatial Information Science and Technology __ Yes __No (If response is yes, the following questions appear.)

Help: Skills and knowledge—including but not limited to codes of ethics—that govern work with geospatial technologies used to track people and things (e.g., Global Positioning Systems [GPS], satellite remote sensing, GIS).

B7a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 525									

FK	Components of professionalism including care, attention and discipline, fiduciary responsibility, and mentoring	✓									
FL	Keeping current as a professional (familiarity, tools, skills, legal and professional framework as well as the ability to self-assess and computer fluency)	✓									
FM	Professional certifications and codes of ethics, conduct, and practice, (e.g. ASPRS, GISCI, USGIF and international societies)	✓									
FN	Accountability, responsibility and liability (e.g. data and software correctness, reliability and safety, as well as ethical confidentiality of geospatial professionals)	✓									
FO	Maintaining awareness of consequences	✓									
FP	Ethical dissent and whistle-blowing	✓									
FQ	Potential misuse of geospatial technologies (e.g. geoslavery, infringement of privacy, proper conducts and etiquette when working with indigenous communities, etc.), examples of misuses and consequences	✓									
FR	Acceptable use policies for workplace computing	✓									

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B7b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 525									
FS	1. Identify ethical issues that arise in software development and determine how to address them technically and ethically.	✓									
FT	2. Recognize the ethical responsibility of ensuring software and data correctness, reliability and safety.	✓									
FU	3. Describe the mechanisms that typically exist for a professional to keep up-to-date.	✓									
FV	4. Describe the strengths and weaknesses of relevant professional codes as expressions of professionalism and guides to decision-making.	✓									
FW	5. Analyze a global geospatial issue, observing the role of professionals and government officials in managing this problem.	✓									
FX	6. Evaluate the professional codes of ethics from the ASPRS, GISCI, and other organizations.	✓									
FY	7. Describe the consequences of inappropriate professional behavior.	✓									
FZ	8. Identify the progressive stages of a whistle-blowing incident.	✓									
GA	9. Investigate forms of harassment and discrimination and avenues of assistance	✓									
GB	10. Examine various forms of professional credentialing	✓									
GC	11. Develop a computer usage/acceptable use										

	policy that include enforcement measures.										
GD	12. Describe issues associated with industries' push to focus on time to market vs. enforcing quality professional standards	✓									
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria	✔									

Help: This KU is satisfied when at least seven (7) Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B8. Core 8. Geospatial Analysis __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge required to conduct basic geospatial analysis; this KU can be applied to a broad range of spatial problems.

B8a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS										
		SIE 509	SIE 510	SIE 512	SIE 554	SIE 571	Sfr 406	Int 527			
GF	Buffers and overlays	✓	✓		✓			✓			
GG	Neighborhoods	✓	✓		✓	✓					
GH	Raster/map algebra	✓	✓		✓			✓			
GI	Least-cost analysis	✓	✓					✓			
GJ	Error analysis/matrices	✓	✓	✓			✓				
GK	Point pattern analysis and density estimation			✓							
GL	Cluster analysis			✓							
GM	Multi-criteria evaluation										
GN	Spatial process models			✓		✓					

Help: This KU is satisfied when at least seven (7) Topics are met as drawn from among appropriate level courses offered on the campus.

B8b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 509	SIE 510	SIE 512	SIE 554	SIE 571	SFr 406	INt 527			
GO	1. Outline circumstances where buffering around an object is useful in analysis	✓	✓		✓			✓			
GP	2. Demonstrate how the geometric operations of intersection and overlay can be implemented in a GIS	✓	✓		✓			✓			
GQ	3. Demonstrate methods that can be used to establish non-overlapping neighborhoods of similarity in raster datasets	✓									
GR	4. Explain the categories of map algebra operations (e.g. focal, local, zonal, and global functions)		✓					✓			
GS	5. Perform basic error analysis, understanding errors of commission/omission		✓			✓	✓	✓			
GT	6. Create density maps from point datasets using kernels and density estimation techniques using standard software			✓							
GU	7. Discuss the characteristics of the various cluster detection techniques			✓		✓					
GV	8. Perform a cluster detection analysis to detect hot spots in a point pattern			✓							
GW	9. Compare and contrast the terms multi-criteria evaluation, weighted linear combination, and site	✓									

	suitability analysis										
GX	10. Differentiate between contributing factors and constraints in a multi-criteria application										
GY	11. Discuss the relationship between spatial processes and spatial patterns			✓	✓						
GZ	12. Differentiate between deterministic and stochastic spatial process models			✓							
	Two courses together meet minimum TOPIC and LEARNING OBJECTIVE criteria: SIE 512 and (509 or 510)	*	*	*							

Help: This KU is satisfied when at least seven (7) Learning Objectives are met as drawn from among appropriate level courses offered on the campus.

B9. Core 9. Errors in Geospatial Information __ Yes __No (If response is yes, the following questions appear.)
Help: Skills and knowledge required to identify and correct various forms of inaccurate or corrupted geospatial data

B9a. Question: Please check any and all of the following TOPICS covered by your course:

ID	TOPICS	Courses Responding Yes									
		SIE 509	SIE 510	SIE 512	SIE 554	SIE 570	SIE 571	Int 527			
HB	Common ways that error is introduced into geospatial analysis and information	✓	✓	✓		✓		✓			
HC	Methods to detect corrupted data/information		✓			✓	✓				
HD	Methods for correcting inaccurate or incorrect geospatial information		✓								
HE	Using quality management systems in geospatial information production		✓		✓						
HF	Error inherent in scale	✓	✓	✓				✓			

Help: This KU is satisfied when all Topics are met as drawn from among appropriate level courses offered on the campus.

B9b. Question: Please check any and all of the following LEARNING OBJECTIVES covered by your course:

ID	LEARNING OBJECTIVES	Courses Responding Yes									
		SIE 509	SIE 510	SIE 512	SIE 554	SIE 570	SIE 571	Int 527			
HG	1. Describe common ways in which geospatial data and information is corrupted primarily through data collection, human communication, and error propagation through analysis processes	✓	✓	✓	✓	✓	✓	✓			
HH	2. Identify corrupted geospatial information in various forms.		✓	✓							
HI	3. Recognize the criticality of providing precise, accurate and valid/correct geospatial information to various end consumers (e.g. the military, scientists, disaster responders)		✓	✓							
HJ	4. Explain the value and utility of employing a rigorous, industry-accepted (e.g. ISO) Quality Management System in geospatial information production		✓								
HK	5. Describe the effect of scale in precision and accuracy of map data	✓	✓	✓		✓		✓			
	Course by itself meets minimum TOPIC and LEARNING OBJECTIVE criteria		✔								

Help: This KU is satisfied when all Learning Objectives are met as drawn from among appropriate level courses offered on the campus.