Course Specification

(Postgraduate Programs)

Course Title:	Satellite Images Processing and analysis
Course Code:	GIS5003
Program:	Higher Diploma in Geographic Information System
Department:	Geography
College:	College of Social Sciences
Institution:	Umm Al-Qura University
Version:	V1
Last Revision Date:	7 December 2024

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3 Credit hours)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: ((Level 2 / First year))				
4. Course General Description:				
The course focuses on processing and analyzing satellite images and the most important mathematical models used to correct and improve these satellite images. It also trains students on the methods and techniques of automated processing of satellite images, how to analyze images using statistical analytical methods and build mathematical models, machine learning models, and deep learning models using various remote sensing programs, and integrating them with geographic information systems and field data, to extract different information from satellite images about various natural and human environments.				
5. Pre-requirements for this course (if any)**:**				
Remote Sensing				
6. Pre-requirements for this course (if any)**:**				
N/A				
7. Course Main Objective(s):				
• Providing students with the principles and concepts of satellite images and mathematical and statistical models used in processing and analyzing satellite images. • Introducing students to the methods and techniques of automated processing of satellite images using various remote sensing programs. • Training students to analyze satellite images using remote sensing programs. • Providing students with the basic skills to deal with remote sensing software. • Obtaining experience in using computer and software systems for various digital image processing applications. • Developing students' experience in using mathematical models, machine learning models, and deep learning in extracting spatial information from satellite images.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify).....**	
	Total	75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	The student will learn about the principles of space images and the methods of obtaining them.	K1	• Lectures • Conducting discussions • Lab. Work	Eexams. Homework
1.2	The student will identify the methods of processing space images.	K1	• Lectures	Eexams. Homework
.13	The student will explain the methods of analyzing space images.	K2	• Lectures • Role Exchange • Lab. Work	Eexams. Homework
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	The student will distinguish between the methods of processing and analyzing satellite images.	S1	• Lectures • Lab. Work	Eexams. Homework
2.2	The student will apply mathematical and statistical models to satellite images.	S2	• Lectures • Lab. Work	Eexams. Homework
2.3	The student will employ machine learning and deep learning models to classify satellite images.	S2	• Lectures • Lab. Work	Eexams. Homework
3.0	**Values, autonomy, and responsibility**			
3.1	The student will build mathematical models in remote sensing programs with high efficiency.	V2	Seminar	Homework
3.2	The student will participate with his colleagues in making a project to extract geographical information from satellite images	V3	Directing students to paper and digital libraries and websites to obtain books, research, and articles that dealt with satellites.	Homework

C. Course Content:

No	List of Topics	Contact Hours
1.	Overview of digital satellite images (Digital image synthesis - digital settings - distinction accuracy).	9
2.	Preparing satellite image data in remote sensing programs	10
3	Correcting (restoring) satellite images in remote sensing programs (geometric correction - digital re-numbering of corrected image units - radiometric correction - noise removal)	10
4	Enhancing satellite images in remote sensing programs (linear contrast extension - nonlinear contrast extension - false color enhancement - density segmentation (digital image data)).	10
5	Filtering satellite images in remote sensing programs (digital image filters - high-transmission filters - low-transmission filters).	10

6	Converting satellite images in remote sensing programs (addition - subtraction - multiplication - division - complex ratio - principal components analysis).	10
7	Classifying satellite images in remote sensing programs (supervised classification - unsupervised classification - classification with machine learning and deep learning models - evaluation of classification accuracy).	16
Total		**75**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	During Lecture Exercises	weekly	5%
2.	Assignments	4/6	10%
3.	Mid-term exam	6/7	20%
4.	Final project	10	15%
5.	Final Exam	16 /17	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Ismat Mohammed Al-Hassan (2007) Digital Image Processing in Remote Sensing, King Saud University, Riyadh.
Supportive References	Ahmed Bahjat (2021), Processing, Analysis and Interpretation of Satellite Images Using ERDAS IMAGINE, University of Diyala, Iraq. Adel Bashta and Abdullah Sunbul (PhD) Digital Satellite Image Processing and Some Applications in Earth Sciences, King Abdulaziz University, Jeddah. "Remote Sensing and Visual Interpretation (1994). Authored by Lisando Kiefer (translated by Hassan Kharouf and Fouad Al-Ajl), published by the Arab Bureau for Arabization, Translation, Authorship and Publication, Syria. Abu Radhi, Fathi Abdul Aziz - 2003 - Remote Sensing: Foundations and Applications - Dar Al-Ma'rifah Al-Jami'ah - Alexandria - Egypt. Al-Daghestani, Nabil Sobhi: Remote Sensing. Fundamentals and Applications, Dar Al-Manahj for Publishing and Distribution, Amman, 1423 AH

	Al-Anqari, Khaled Muhammad - 1407 - Remote Sensing and its Applications in Spatial Studies - Riyadh. Al-Hiti, Imad Abdul Rahman - 2004 - Remote Sensing: Principles and Applications - Nasser International University Publications - Libya. Muawad, Muawad Badawi - 2009 - Principles of Remote Sensing and its Practical Training - Ain Shams University - Cairo - Egypt. Jensen, j. (2004). Introductory Digital Image Processing. Prentice Hall. Gonzalez, R., and R. Woods (2007) Digital Image Processing. Prentice Hall. Russ, J. (2006). The Image Processing Handbook. CRC Press
Electronic Materials	Saudi Digital Library King Abdullah Digital library Academia.com ResearchGate Google Scholars http://www.csun.edu/~hmc60533/CSUN_407_690D/S2008_exercises http://landsathandbook.gsfc.nasa.gov/handbook.html http://landsat.gsfc.nasa.gov/ http://www.fas.org/irp/imint/docs/rst/Intro/Part2_15.html http://geoinfo.amu.edu.pl/wpk/rst/rst/Front/tofc.html http://www.ccrs.nrcan.gc.ca/resource/tutor/fundam/index_e.php http://www.satimagingcorp.com/gallery.html http://eoedu.belspo.be/en/satellites/
Other Learning Materials	ISPRS Journal of Photogrammetry and Remote Sensing Photogrammetric Engineering and Remote Sensing Journal of Remote sensing

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms for lectures and exams for students during the scheduled class hours. Laboratories equipped with ERDAS remote sensing software
Technology equipment (Projector, smart board, software)	• Data show • Smart board

Items	Resources
Other equipment (Depending on the nature of the specialty)	Staff members are required to have printers and laptops with the required computer software programs. A lab dedicated to students to complete practical tasks.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty members who teach this course and the lab staff associated with the course.	Both written and verbal, through presentations. Analysis of students` marks Regular feedback of the students about the course and the teaching methods
Effectiveness of students' assessment	Faculty members who teach this course and those teaching other courses relevant to this course.	Regular revising and improving of the course contents and consulting the faculty member Teaching faculty and lab staff associated with the course are also available for personal consultation.
Quality of learning resources	Faculty members who teach this course	Frequent improvement for teaching and learning techniques. Frequent survey for latest references. Encouraging the students in team work cooperation and writing reports.
The extent to which CLOs have been achieved	Independent member(s) teaching staff	A sample of students answer sheets is revised by a specified committee of the department.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	

DATE	