University of Baghdad
جامعة بغداد

First Cycle – Bachelor's Degree (B.Sc.) – Remote Sensing & GIS

بكالوريوس – تحسس نائي ونظم معلومات جغرافية

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1. Overview

Remote Sensing and Geographic Information Systems (GIS) are two important fields in geospatial analysis and management. These fields are often studied together as they are complementary to each other. Undergraduate modules in Remote Sensing and GIS typically cover the following topics:

1. Introduction to Remote Sensing: This module provides an overview of remote sensing, its history, and basic principles. Students learn about platforms, sensors, and data types used in remote sensing.
2. Remote Sensing Data Acquisition: This module covers the acquisition of remote sensing data from various sources, including satellites, airborne platforms, and ground-based sensors.
4. Remote Sensing Image Analysis: This module focuses on the processing and analysis of remote sensing data. Students learn how to interpret and classify different types of remote sensing images.
5. GIS Fundamentals: This module provides an introduction to GIS and its components. Students learn about the types of data used in GIS, spatial analysis techniques, and GIS software.
6. GIS Data Acquisition: This module covers the acquisition of GIS data from various sources, including remote sensing data, field surveys, and existing databases.
7. GIS Data Management: This module focuses on the organization, storage, and retrieval of GIS data. Students learn about database design, data structures, and data quality assurance.
8. GIS Analysis and Modeling: This module covers the use of GIS for spatial analysis and modeling. Students learn about various analysis techniques, including spatial statistics, network analysis, and geostatistics.
9. GIS Applications: This module explores the applications of GIS in various fields, including urban planning, environmental management, and natural resource management.

Overall, undergraduate modules in Remote Sensing and GIS provide students with a solid foundation in geospatial analysis and management, which can prepare them for careers in various fields, including environmental science, geography, and urban planning .

١. نظرة عامة

الاستشعار عن بعد ونظم المعلومات الجغرافية (GIS) هما مجالان مهمان في التحليل والإدارة الجيومكانية. غالبًا ما تتم دراسة هذه المجالات معًا لأنها مكملة لبعضها البعض. عادةً ما تغطي وحدات البكالوريوس في الاستشعار عن بعد ونظم المعلومات الجغرافية الموضوعات التالية:

١. مقدمة في الاستشعار عن بعد: تقدم هذه الوحدة لمحة عامة عن الاستشعار عن بعد وتاريخه ومبادئه الأساسية. يتعرف الطلاب على المنصات وأجهزة الاستشعار وأنواع البيانات المستخدمة في الاستشعار عن بعد.
٢. الحصول على بيانات الاستشعار عن بعد: تغطي هذه الوحدة الحصول على بيانات الاستشعار عن بعد من مصادر مختلفة ، بما في ذلك الأقمار الصناعية ، والمنصات المحمولة جواً ، وأجهزة الاستشعار الأرضية.
٣. تحليل صور الاستشعار عن بعد: تركز هذه الوحدة على معالجة وتحليل بيانات الاستشعار عن بعد. يتعلم الطلاب كيفية تفسير وتصنيف الأنواع المختلفة من صور الاستشعار عن بعد.
٤. أساسيات نظم المعلومات الجغرافية: توفر هذه الوحدة مدخلاً إلى نظم المعلومات الجغرافية ومكوناتها. يتعرف الطلاب على أنواع البيانات المستخدمة في نظم المعلومات الجغرافية ، وتقنيات التحليل المكاني ، وبرامج نظم المعلومات الجغرافية.
٥. الحصول على بيانات نظم المعلومات الجغرافية: تغطي هذه الوحدة الحصول على بيانات نظم المعلومات الجغرافية من مصادر مختلفة ، بما في ذلك بيانات الاستشعار عن بعد ، والمسوحات الميدانية ، وقواعد البيانات الموجودة.
٦. إدارة بيانات نظم المعلومات الجغرافية: تركز هذه الوحدة على تنظيم وتخزين واسترجاع بيانات نظم المعلومات الجغرافية. يتعرف الطلاب على تصميم قواعد البيانات وهياكل البيانات وضمان جودة البيانات.
٧. تحليل ونمذجة نظم المعلومات الجغرافية: تغطي هذه الوحدة استخدام نظم المعلومات الجغرافية للتحليل المكاني والنمذجة. يتعرف الطلاب على تقنيات التحليل المختلفة ، بما في ذلك الإحصاء المكاني وتحليل الشبكة والإحصاء الجغرافي.
١٠. تطبيقات نظم المعلومات الجغرافية: تستكشف هذه الوحدة تطبيقات نظم المعلومات الجغرافية في مختلف المجالات ، بما في ذلك التخطيط الحضري ، والإدارة البيئية ، وإدارة الموارد الطبيعية.

بشكل عام ، توفر الوحدات الجامعية في الاستشعار عن بعد ونظم المعلومات الجغرافية للطلاب أساسًا متينًا في التحليل والإدارة الجغرافية المكانية ، والتي يمكن أن تعدهم لشغل وظائف في مختلف المجالات ، بما في ذلك العلوم البيئية والجغرافيا والتخطيط الحضري

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج التحسس النائي ونظم المعلومات الجغرافية للحصول على درجة بكالوريوس العلوم. يقدم البرنامج (٤٠) مادة دراسية، على سبيل المثال، مع (٦٠٠٠) إجمالي ساعات حمل الطالب و ٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
	Aerial and thermal photography	7	Six
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87
Description			

Aerial and thermal photography are important tools for capturing and analyzing data about the Earth's surface and atmosphere. Aerial photography involves taking photographs of the Earth's surface from an elevated position, typically from a plane or drone. Thermal photography, on the other hand, involves capturing images of the Earth's surface based on the heat energy emitted by objects.

A brief course on aerial and thermal photography might cover topics such as:

1. The principles of aerial and thermal photography, including the technology used to capture images and the properties of light and heat energy.
2. The equipment and techniques used to capture aerial photographs, including cameras, drones, and planes.
3. The types of data that can be extracted from aerial and thermal photographs, such as land cover, vegetation health, and building materials.
4. Image processing techniques, such as image enhancement, image mosaicking, and object-based image analysis.
5. The applications of aerial and thermal photography in various fields, such as agriculture, forestry, urban planning, and environmental monitoring.

Overall, a course on aerial and thermal photography would provide students with the technical skills and knowledge needed to capture, process, and analyze aerial and thermal imagery. Students would learn how to use these techniques to extract valuable information about the Earth's surface and atmosphere, and how to apply this information to solve real-world problems in a variety of fields. The course would be useful for professionals in environmental science, engineering, urban planning, and other fields that require a detailed understanding of the Earth's surface.

Module 2

Code	Course/Module Title	ECTS	Semester
	Analytical geometry and differential equations	6	Three
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect.	58	92
Description			

Analytical geometry is a branch of mathematics that deals with the study of geometric shapes using algebraic methods. In this course, students learn how to use coordinates and equations to describe geometric objects such as lines, circles, ellipses, parabolas, and hyperbolas. Topics covered in this course may include:

- The Cartesian coordinate system in two and three dimensions
- Equations of lines and planes in space
- Distance and midpoint formulas
- Conic sections (circles, ellipses, parabolas, and hyperbolas)
- Polar coordinates and graphs
- Vector operations and dot products
- Matrices and determinants

Differential equations are used to model many real-world phenomena in science, engineering, and economics. This course covers the study of differential equations and their applications. Topics covered in this course may include:

- First-order differential equations (separable, linear, exact)
- Second-order differential equations (homogeneous, nonhomogeneous, with constant coefficients)
- Laplace transforms and their applications to solving differential equations
- Systems of differential equations and their solutions
- Fourier series and their applications to solving differential equations
- Partial differential equations and their applications to physics and engineering

Throughout both courses, students will develop problem-solving skills and learn to apply mathematical concepts to real-world situations. They will also learn to use technology, such as graphing calculators and computer software, to aid in their problem-solving..

Module 3

Code	Course/Module Title	ECTS	Semester
	Arabic Language	2	one
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect.	30	20
Description			

Arabic is a widely spoken language that has important cultural and historical significance in the Middle East and North Africa. A course on Arabic language would provide students with the skills and knowledge needed to communicate effectively in Arabic and to understand the cultural context in which the language is used.

A brief course on Arabic language might cover topics such as:

1. The Arabic alphabet, including pronunciation and writing systems.
2. Basic Arabic grammar, including noun cases, verb conjugation, and sentence structure.
3. Basic vocabulary and phrases used in everyday conversation, including greetings, introductions, and common expressions.
4. Reading and writing in Arabic, including comprehension of written texts and basic writing skills.
5. Cultural aspects of Arabic language, including customs, traditions, and social etiquette.
6. Advanced topics in Arabic language, including regional dialects, classical Arabic, and media Arabic.

Overall, a course on Arabic language would provide students with the technical skills and cultural understanding needed to communicate effectively in Arabic and to engage with Arabic-speaking communities. The course would be useful for professionals in fields such as international relations, business, and journalism, where knowledge of Arabic language and culture is critical for effective communication and cultural understanding.

Module 4

Code	Course/Module Title	ECTS	Semester
	Calculus	8	one
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect	58	142
Description			

Calculus is a branch of mathematics that deals with the study of rates of change and accumulation. It has important applications in various fields, including physics, engineering, economics, and computer science.

A brief course on calculus might cover topics such as:

1. Differential calculus, including limits, derivatives, and applications of derivatives, such as optimization and related rates problems.
2. Integral calculus, including definite and indefinite integrals and applications of integrals, such as finding areas and volumes.
3. Multivariable calculus, including partial derivatives, double and triple integrals, and vector calculus.
4. Differential equations, including first-order equations, second-order linear equations, and systems of differential equations.
5. Applications of calculus in various fields, such as physics, engineering, economics, and computer science.

Overall, a course on calculus would provide students with the mathematical foundation and technical skills necessary to analyze and solve complex problems in various fields. Students would learn how to apply mathematical concepts to real-world problems, and how to use calculus to model and solve problems involving rates of change and accumulation. The course would be useful for professionals in fields such as physics, engineering, economics, and computer science, where calculus is commonly used to model and solve complex problems.

Module 5

Code	Course/Module Title	ECTS	Semester
	Cartography	6	Two
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2+2	Lect+Lab.	60	90
Description			

A Cartography course typically covers the principles, techniques, and tools used in the creation and design of maps. The course covers a range of topics related to map design, including:

1. The history and evolution of cartography
2. Map scale, projection, and coordinate systems
3. Data acquisition and management, including remote sensing and GPS
4. Visual representation of data, including symbology, color, and typography
5. Map layout and design principles, including hierarchy, balance, and emphasis

6. Map production techniques, including digital and print publishing
7. Cartographic ethics and social responsibility

Students will also learn about the software tools and platforms used in cartography, such as ArcGIS, QGIS, and Adobe Illustrator. Through hands-on exercises and projects, students will gain practical skills in creating and designing maps for a variety of purposes, such as navigation, analysis, and communication.

The course may also cover advanced topics such as web mapping, interactive and dynamic maps, and 3D mapping. By the end of the course, students should have a solid understanding of the principles and techniques of cartography, as well as the ability to create effective and engaging maps that communicate spatial information clearly and accurately.

Module 6

Code	Course/Module Title	ECTS	Semester
	Computer I	3	Two
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lab.	58	17
Description			

Computer I is an introductory course that provides students with fundamental knowledge and skills related to computer hardware, software, and basic programming concepts. The course is designed to provide students with a foundation in computer literacy that will enable them to use computers effectively in their personal and professional lives.

A brief course on Computer I might cover topics such as:

1. Basic computer hardware and software components, including the central processing unit (CPU), memory, storage devices, and operating systems.
2. Basic computer programming concepts, including variables, data types, operators, and control structures.
3. Basic software applications, including word processing, spreadsheet, and presentation software.
4. Basic internet and email usage, including web browsing, search engines, and email communication.
5. Basic computer security principles, including password management, virus protection, and data backup.

Overall, a course on Computer I would provide students with the foundational knowledge and skills needed to use computers effectively in their personal and professional lives. The course would be useful for students in various fields, as computer literacy is increasingly important in today's digital world. The course would also provide a foundation for further study in computer science, information technology, and related fields.

Module 7

Code	Course/Module Title	ECTS	Semester
	Computer II	3	Three

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
4	Lab.	58	17

Description

Computer II is an intermediate-level course that builds upon the foundational knowledge and skills acquired in Computer I, and provides students with a deeper understanding of computer hardware, software, and programming concepts. The course is designed to provide students with the technical skills needed to use computers in a more advanced and specialized way.

A brief course on Computer II might cover topics such as:

1. Advanced computer hardware components, including graphics processing units (GPUs), sound cards, and networking devices.
2. Advanced computer programming concepts, including object-oriented programming, data structures, and algorithms.
3. Advanced software applications, including database management systems, computer-aided design (CAD) software, and video editing software.
4. Advanced internet and web development concepts, including web programming languages, server-side scripting, and web application development.
5. Advanced computer security concepts, including network security, encryption, and intrusion detection.

Overall, a course on Computer II would provide students with the technical skills and knowledge needed to use computers in a more advanced and specialized way. The course would be useful for students in fields such as computer science, information technology, and engineering, where advanced computer skills are essential for effective problem-solving and innovation. The course would also provide a foundation for further study in specialized areas of computer science, such as artificial intelligence, computer graphics, and computer networking.

Module 8

Code	Course/Module Title	ECTS	Semester
	Data structure and management	5	Five
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2+2	Lect. +Lab.	60	65

Description

Data structure and management is a field that focuses on the organization, storage, retrieval, and manipulation of data in computer systems. It is a fundamental area of computer science that has important applications in various fields, including business, healthcare, finance, and government.

A brief course on data structure and management might cover topics such as:

1. The principles of data organization, including arrays, linked lists, stacks, queues, trees, and graphs.
2. The design and implementation of databases, including data models, database normalization, and SQL.
3. The principles of data mining and machine learning, including association rules, clustering, and

decision trees.

4. The use of NoSQL databases, such as MongoDB and Cassandra, for big data management.
5. The management of data security and privacy, including encryption, access control, and compliance with regulations such as HIPAA and GDPR.
6. The use of data analytics and visualization tools, such as Tableau and Power BI, to extract insights from data.

Overall, a course on data structure and management would provide students with the technical skills and knowledge needed to design, develop, and manage databases and data-driven applications. Students would learn how to organize and analyze data, and how to apply data mining and machine learning techniques to solve real-world problems. The course would be useful for professionals in fields such as information technology, business, healthcare, and government, where data management and analysis are critical components of operations and decision-making processes.

Module 9

Code	Course/Module Title	ECTS	Semester
	Democracy and human rights	2	One
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect	30	20

Description

Democracy and human rights are important concepts that are closely intertwined. A course on democracy and human rights would explore the relationship between these two concepts and how they are applied in different contexts around the world.

A brief course on democracy and human rights might cover topics such as:

1. The principles of democracy, including free and fair elections, rule of law, and civil liberties.
2. The principles of human rights, including the right to life, liberty, and security of person, freedom of expression and assembly, and the right to a fair trial.
3. The history of democracy and human rights, including the evolution of these concepts over time and across cultures.
4. The challenges and limitations of democracy and human rights, including issues of inequality, discrimination, and authoritarianism.
5. Case studies of democracy and human rights in practice, including examples of successful and unsuccessful democratic transitions and human rights movements.
6. The role of international organizations and civil society in promoting and protecting democracy and human rights.

Overall, a course on democracy and human rights would provide students with the knowledge and critical thinking skills needed to understand the complex relationship between these two concepts and their role in shaping global politics and society. The course would be useful for professionals in fields such as law, international relations, and human rights advocacy, where knowledge of democracy and human rights is essential for effective decision-making and social justice advocacy.

Module 10

Code	Course/Module Title	ECTS	Semester

	Differential equations and complex		
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
Description			
Differential equations and complex analysis are two fundamental areas of mathematics that have important applications in a wide range of fields, including physics, engineering, economics, and computer science. A brief course on differential equations and complex analysis might cover topics such as: 1. Ordinary differential equations, including first-order equations, second-order linear equations, and systems of differential equations. 2. Partial differential equations, including the heat equation, wave equation, and Laplace's equation. 3. Complex analysis, including complex functions, Cauchy-Riemann equations, contour integration, and Cauchy's theorem. 4. Applications of differential equations and complex analysis in various fields, such as fluid dynamics, electromagnetism, quantum mechanics, and finance. 5. Numerical methods for solving differential equations, such as finite difference methods and finite element methods. Overall, a course on differential equations and complex analysis would provide students with the mathematical foundation and technical skills necessary to analyze and solve complex problems in various fields. Students would learn how to apply mathematical concepts to real-world problems, and how to use numerical methods to solve differential equations. The course would be useful for professionals in fields such as physics, engineering, economics, and computer science, where differential equations and complex analysis are commonly used to model and solve complex problems.			

Module 11

Code	**Course/Module Title**	**ECTS**	**Semester**
	digital image processing	8	Four
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+Lab.	88	112
Description			
Digital image processing is a field that focuses on the manipulation of digital images using algorithms and mathematical models. It has important applications in various fields, including medical imaging, computer vision, remote sensing, and multimedia. A brief course on digital image processing might cover topics such as: 1. The principles of digital image acquisition and representation, including sampling, quantization, and color models. 2. Image enhancement techniques, including spatial domain enhancement, frequency domain enhancement, and histogram processing. 3. Image restoration techniques, including noise reduction, deblurring, and image denoising.			

4. Image segmentation and object recognition, including clustering, edge detection, and feature extraction.
5. Image compression techniques, including lossless and lossy compression, and image coding standards.
6. Applications of digital image processing in various fields, such as medical imaging, computer vision, remote sensing, and multimedia.

Overall, a course on digital image processing would provide students with the technical skills and knowledge needed to analyze and manipulate digital images using mathematical algorithms and models. Students would learn how to apply digital image processing techniques to solve real-world problems in various fields. The course would be useful for professionals in fields such as computer science, engineering, medical imaging, and multimedia, where knowledge of digital image processing is commonly used to develop new technologies and solve complex problems.

Module 12

Code	Course/Module Title	ECTS	Semester
	GIS for Disaster Management	4	Eight
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect.	30	70

Description

A GIS (Geographic Information System) for Disaster Management course would typically cover the use of GIS technology for managing and responding to natural disasters, such as floods, wildfires, hurricanes, earthquakes, and tsunamis. The course would explore the various ways in which GIS can be used to gather, analyze, and disseminate geospatial data during all phases of disaster management, including preparedness, response, recovery, and mitigation.

The course would cover a range of topics, including:

1. Introduction to GIS technology and disaster management
2. Spatial data acquisition and management
3. Spatial analysis and modeling
4. Risk assessment and vulnerability analysis
5. Emergency response planning and management
6. Damage assessment and recovery planning
7. Mitigation planning and implementation

Students would also learn about the various software tools and platforms used in GIS for disaster management, such as ArcGIS, QGIS, and Google Earth. Through hands-on exercises and real-world case studies, students would gain practical skills in using GIS technology for disaster management, as well as an understanding of the broader context of disaster management and the role that GIS plays in it.

Module 13

Code	Course/Module Title	ECTS	Semester
	Elective	3	Five

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	Lect	30	45

Description

An elective is a course that allows students to choose a topic or subject that is of interest to them and that may not be a required course in their program of study. Elective courses provide students with the opportunity to explore new areas of interest and to tailor their education to their specific career goals. A brief course on an elective topic might cover a wide range of subjects depending on the individual student's interests and program of study. Examples of elective courses might include:

1. Creative writing, including poetry, fiction, and non-fiction writing.
2. Film studies, including the history of cinema, film theory, and analysis of film genres.
3. Entrepreneurship, including business planning, marketing, and financial management.
4. Psychology, including abnormal psychology, social psychology, and cognitive psychology.
5. Music, including music theory, history of music, and instrument performance.
6. Art, including art history, drawing, painting, and sculpture.

Overall, an elective course would provide students with the opportunity to explore a subject in depth and to develop skills and knowledge in an area of interest. The course would be useful for students who want to broaden their education, develop new skills, and gain a deeper understanding of a subject that is not covered by their required courses.

Module 14

Code	Course/Module Title	ECTS	Semester
	English language I	2	One
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect	30	20

Description

English Language I is typically an introductory course in English language for non-native speakers. The course aims to develop students' proficiency in the four language skills: listening, speaking, reading, and writing.

The course may cover a range of topics, including:

1. Basic grammar rules and structures
2. Vocabulary building and word usage
3. Pronunciation and intonation
4. Comprehension skills for listening and reading
5. Basic writing skills such as sentence structure and paragraph development
6. Conversation skills for basic social interactions

The focus of the course is on developing practical language skills that can be used in everyday situations, such as introducing oneself, ordering food and drinks, asking for directions and expressing opinions.

The course may also introduce students to cultural aspects of English-speaking countries, such as customs, traditions, and etiquette. Through a combination of lectures, discussions, group activities, and language practice exercises, students will develop a foundation in the English language that will enable them to communicate effectively in a variety of contexts.

Module 15

Code	Course/Module Title	ECTS	Semester
	English language II	20	Four
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect	30	20
Description			

English Language II is typically a continuation of the introductory English Language I course for non-native speakers. The course builds upon the foundation established in English Language I and further develops students' language skills in listening, speaking, reading, and writing.
The course may cover a range of topics, including:

1. More advanced grammar rules and structures
2. Idiomatic and colloquial language usage
3. Advanced vocabulary building and word usage
4. Advanced comprehension skills for listening and reading
5. Advanced writing skills such as essay writing and formal correspondence
6. Conversation skills for more complex social interactions and discussions

The focus of the course is on developing more advanced language skills that can be used in academic, professional, and social contexts. The course may also explore cultural and social issues related to English-speaking countries, such as current events, social norms, and cultural diversity.
Through a combination of lectures, discussions, group activities, and language practice exercises, students will further develop their language proficiency and become more confident in their ability to communicate effectively in English. By the end of the course, students should have a solid understanding of the English language and be able to express themselves fluently and accurately in a range of settings.

Module 16

Code	Course/Module Title	ECTS	Semester
	English language III	2	Five
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect	30	20
Description			

English Language III is typically an advanced level course in English language for non-native speakers who have already acquired a strong foundation in the language. The course aims to further develop students' proficiency in the four language skills: listening, speaking, reading, and writing.
The course may cover a range of topics, including:

1. Complex grammar rules and structures
2. Advanced vocabulary building and word usage, including academic and specialized language
3. Critical reading and listening skills for analyzing and interpreting complex texts and speeches
4. Advanced writing skills such as research papers, reports, and proposals
5. Advanced conversation skills for participating in academic and professional discussions and

debates

The course may also explore cultural and social issues related to English-speaking countries, such as literature, history, politics, and economics.

Through a combination of lectures, discussions, group activities, and language practice exercises, students will further develop their language proficiency and become more fluent and accurate in their use of the English language. By the end of the course, students should be able to communicate effectively in a variety of academic and professional settings, and have the language skills necessary to pursue further studies or career opportunities in English-speaking countries.

Module 17

Code	Course/Module Title	ECTS	Semester
	English language IV	2	Eight
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect	30	20

Description

English Language IV is typically an advanced level course in English language for non-native speakers who have already acquired a high level of proficiency in the language. The course aims to refine and perfect students' language skills in the four areas of listening, speaking, reading, and writing, with a focus on advanced academic and professional contexts.

The course may cover a range of topics, including:

1. Advanced grammar and syntax
2. Advanced vocabulary development, including academic and specialized terminology
3. Advanced reading and listening comprehension, including critical analysis of complex texts and speeches
4. Advanced writing skills such as academic research papers, professional reports, and proposals
5. Advanced conversation skills for participating in academic and professional discussions and debates, including formal presentations

The course may also explore cultural and social issues related to English-speaking countries, such as contemporary literature, film, art, and popular culture.

Through a combination of lectures, discussions, group activities, and language practice exercises, students will refine their language skills and become more confident and proficient in their use of the English language. By the end of the course, students should have achieved a level of fluency and accuracy that would enable them to communicate effectively in any academic or professional setting, and to pursue further studies or career opportunities in English-speaking countries.

Module 18

Code	Course/Module Title	ECTS	Semester
	Environmental pollution	5	Seven
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect	58	67

Description
Environmental pollution is a field that focuses on the study of the harmful effects of human activities on the environment and human health. It has important implications in various fields, including environmental science, public health, and policy. A brief course on environmental pollution might cover topics such as: 1. The sources and types of environmental pollution, including air pollution, water pollution, soil pollution, and noise pollution. 2. The effects of environmental pollution on human health, including respiratory diseases, cancer, and neurological disorders. 3. The principles of environmental risk assessment and management, including hazard identification, exposure assessment, and risk characterization. 4. The technologies and strategies used to control environmental pollution, including pollution prevention, waste management, and pollution control devices. 5. The policies and regulations related to environmental pollution, including the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act. 6. Case studies of environmental pollution incidents and their impact on human health and the environment. Overall, a course on environmental pollution would provide students with the technical skills and knowledge needed to understand the causes and effects of environmental pollution, and to develop and implement strategies to mitigate pollution and protect human health and the environment. The course would be useful for professionals in fields such as environmental science, public health, and policy, where knowledge of environmental pollution is critical for decision-making processes.

Module 19

Code	Course/Module Title	ECTS	Semester
	Environmental sciences	6	Tow
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect	58	92
Description			
Environmental Science is a course that focuses on the scientific study of the environment and the impact of human activities on natural systems. The course covers the following topics: 1. Introduction to Environmental Science: Understanding the basic concepts of environmental science, including ecosystems, biodiversity, and sustainability. 2. Environmental Chemistry: Learning about the chemical processes that occur in the environment, including the cycling of nutrients, pollutants, and greenhouse gases. 3. Environmental Biology: Understanding the principles of ecology, including the interactions between organisms and their environment, and learning about the impacts of human activities on biodiversity. 4. Environmental Policy and Law: Learning about the policies and laws that govern environmental protection, including the Clean Air Act, the Clean Water Act, and the Endangered Species Act. 5. Environmental Health: Understanding the impacts of environmental factors on human health, including air and water pollution, toxicology, and risk assessment. 6. Environmental Management: Learning about the principles of environmental management, including sustainability, life cycle assessment, and environmental impact assessment. 7. Environmental Challenges: Examining the major environmental challenges facing the world			

today, including climate change, biodiversity loss, and resource depletion.

Overall, a course in Environmental Science will provide students with a broad understanding of the environment and the impact of human activities on natural systems, enabling them to identify and address environmental problems and contribute to the development of sustainable solutions. The course will enable students to apply their knowledge to real-world problems, such as environmental management, policy development, and conservation.

Module 20

Code	Course/Module Title	ECTS	Semester
	Geodesy	5	Three
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2+2	Lect.+Lab.	60	65

Description

Geodesy is a course that focuses on the scientific study of the Earth's shape, gravity, and rotation, and its applications in geolocation and navigation. The course covers the following topics:

1. Introduction to Geodesy: Understanding the basic concepts of geodesy, including the Earth's shape, gravity, and rotation, and its relationship to geolocation and navigation.
2. Geodetic Datums and Coordinate Systems: Learning about the different types of geodetic datums and coordinate systems, including the World Geodetic System (WGS84), and understanding how they are used to model the Earth's surface.
3. Geodetic Measurements: Understanding the different methods of geodetic measurements, including terrestrial surveying, satellite geodesy, and airborne geodesy, and learning how to use geodetic instruments, such as GPS and InSAR.
4. Geodetic Networks: Learning about the principles of geodetic networks, including the establishment of control points and the computation of geodetic coordinates.
5. Geoid and Gravity: Understanding the principles of the geoid, the equipotential surface of the Earth's gravity field, and learning how to compute the geoid using geodetic measurements.
6. Geodetic Applications: Understanding the diverse applications of geodesy, including geolocation, navigation, mapping, and geophysical studies.
7. Geodetic Modeling: Learning how to use geodetic measurements to model the Earth's surface and its changes over time, including the study of plate tectonics and sea level rise.

Overall, a course in Geodesy will provide students with a strong foundation in the principles and applications of geodetic measurements, enabling them to contribute to the development of geodetic models and their applications. The course will enable students to apply their knowledge to real-world problems, such as disaster management, infrastructure planning, and environmental monitoring.

Module 21

Code	Course/Module Title	ECTS	Semester
	Geographic Information Systems I	8	Three
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

4+2	Lect. +Lab.	88	112
Description			
Geographic Information Systems (GIS) is a field that focuses on the collection, analysis, and visualization of geographic data. It has important applications in various fields, including environmental science, urban planning, disaster management, and public health. A brief course on Geographic Information Systems I might cover topics such as: 1. The principles of GIS, including spatial data models, coordinate systems, and map projections. 2. The components of GIS, including hardware, software, data, and people. 3. The collection and management of spatial data, including remote sensing, global positioning systems (GPS), and data formats. 4. Spatial analysis techniques, including spatial queries, geoprocessing, and spatial statistics. 5. Cartographic design principles, including symbolization, classification, and generalization. 6. Applications of GIS in various fields, such as environmental science, urban planning, disaster management, and public health. Overall, a course on Geographic Information Systems I would provide students with the technical skills and knowledge needed to design, develop, and manage spatial databases and data-driven applications. Students would learn how to analyze spatial data, and how to apply GIS techniques to solve real-world problems. The course would be useful for professionals in fields such as information technology, environmental science, urban planning, and public health, where spatial data management and analysis are critical components of operations and decision-making processes.			

Module 22

Code	Course/Module Title	ECTS	Semester
	Geographic Information Systems II	7	Five
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87
Description			
Geographic Information Systems II is a continuation of Geographic Information Systems I and focuses on more advanced techniques and applications of GIS. It builds upon the foundational concepts and skills covered in GIS I and delves deeper into the analysis and interpretation of spatial data. A brief course on Geographic Information Systems II might cover topics such as: 1. Advanced spatial analysis techniques, including spatial statistics, network analysis, and 3D modeling. 2. Geodatabase design and management, including topology and data integrity. 3. Programming and automation in GIS, using languages such as Python and ArcGIS ModelBuilder. 4. Advanced cartographic design principles, including data visualization and web mapping. 5. Advanced applications of GIS in various fields, such as transportation planning, natural resource management, and emergency management. Overall, a course on Geographic Information Systems II would provide students with the technical skills and knowledge needed to apply advanced GIS techniques to solve real-world problems in various fields. Students would learn how to design and manage complex spatial databases, automate GIS tasks using programming languages, and create advanced cartographic products. The course would be useful for professionals in fields such as information technology, environmental science, urban planning, and			

emergency management, where advanced GIS analysis and interpretation are critical components of operations and decision-making processes.

Module 23

Code	Course/Module Title	ECTS	Semester
	Geology	8	Tow
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	112
Description			
Geology is a course that focuses on the scientific study of the Earth, its structure, composition, and processes that shape it. The course covers the following topics: 1. Introduction to Geology: Understanding the basic concepts of geology, including the rock cycle, plate tectonics, and the Earth's history. 2. Mineralogy: Learning about the physical and chemical properties of minerals, including crystal structure, cleavage, hardness, and color. 3. Petrology: Understanding the principles of petrology, including the classification, origin, and distribution of rocks. 4. Geomorphology: Learning about the processes that shape the Earth's surface, including weathering, erosion, and deposition, and understanding the landforms that result from these processes. 5. Structural Geology: Understanding the principles of structural geology, including the deformation of rocks and the formation of geological structures, such as faults and folds. 6. Stratigraphy: Learning about the principles of stratigraphy, including the study of the Earth's layers and their relationships to one another. 7. Geologic Time: Understanding the methods used to determine the age of rocks and the Earth's history, including radiometric dating and the geological timescale. Overall, a course in Geology will provide students with a broad understanding of the Earth's structure, composition, and processes, enabling them to interpret geological features and understand the geological history of the Earth. The course will enable students to apply their knowledge to real-world problems, such as natural resource exploration and environmental management.			

Module 24

Code	Course/Module Title	ECTS	Semester
	Geophysics	6	Five
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2+2	Lect.+ Lab.	60	90
Description			

Geophysics is a field of study that explores the physical properties and behavior of the Earth and other planets. It uses principles of physics, geology, and mathematics to investigate the structure, composition, and processes of the Earth's interior, as well as its surface features and the atmosphere.
A brief course on geophysics might cover topics such as:

1. The principles of geophysics, including the use of seismic waves, gravity, magnetism, and electromagnetic radiation to study the Earth's interior and surface.
2. Plate tectonics and the movement of the Earth's crust, including the formation of mountains, earthquakes, and volcanoes.
3. The Earth's magnetic field and its variations, including the causes and effects of magnetic anomalies.
4. The Earth's atmosphere and its interaction with the Sun, including the formation of auroras and the effects of space weather on the Earth.
5. Geophysical techniques for exploration and resource management, including the use of seismic surveys, magnetic and gravity surveys, and remote sensing.
6. Applications of geophysics in environmental science, such as studying climate change, groundwater resources, and natural hazards.

Overall, a course on geophysics would provide students with the technical skills and knowledge needed to analyze and interpret data about the Earth's physical properties and processes. The course would be useful for professionals in fields such as geology, environmental science, and resource management, where knowledge of geophysics is essential for effective decision-making and problem-solving. The course would also provide a foundation for further study in specialized areas of geophysics, such as seismology, geomagnetism, and planetary science.

Module 25

Code	Course/Module Title	ECTS	Semester
	Geospatial intelligence	6	Eight
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect.+ Lab.	58	92
Description			

Geospatial Intelligence is a course that focuses on the principles and applications of geospatial technology for intelligence analysis. The course covers the following topics:

1. Introduction to Geospatial Intelligence: Understanding the basic concepts of geospatial intelligence, its importance, and its potential for supporting national security and defense.
2. Remote Sensing and GIS: Learning about the different types of remote sensing technologies, including satellite imagery and aerial photography, and understanding the principles of GIS and their applications for intelligence analysis.
3. Spatial Analysis Techniques: Understanding the different techniques of spatial analysis for intelligence analysis, including terrain analysis, pattern analysis, and geospatial modeling.
4. Intelligence Collection: Learning about the different methods of intelligence collection, including human intelligence, signals intelligence, and imagery intelligence.
5. Intelligence Analysis: Understanding the principles of intelligence analysis, including the intelligence cycle, the analytic process, and the intelligence product.
6. Geospatial Intelligence Applications: Understanding the diverse applications of geospatial intelligence, including military intelligence, law enforcement, border security, and disaster response.
7. Geospatial Intelligence Policy and Ethics: Understanding the policies and regulations that

govern the use of geospatial intelligence, including privacy and civil liberties considerations, and learning how to ensure that geospatial intelligence is used ethically.

Overall, a course in Geospatial Intelligence will provide students with a strong foundation in the principles and applications of geospatial technology for intelligence analysis, enabling them to contribute to the development of geospatial intelligence products that support national security and defense.

Module 26

Code	Course/Module Title	ECTS	Semester
	GIS programming	7	Six
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2+4	Lect.+ Lab.	88	87
Description			

GIS programming refers to the use of programming languages and tools to create geospatial applications, analyze spatial data, and automate GIS workflows.

In a GIS programming course, you can expect to learn the following concepts:

1. Introduction to GIS programming: Understanding the basics of GIS and how programming can be used to enhance GIS capabilities.
2. Programming languages: An overview of programming languages used in GIS programming, such as Python, Java, and JavaScript.
3. Geospatial libraries and APIs: Understanding how to use geospatial libraries and APIs to perform spatial analysis, create maps, and work with spatial data.
4. Data visualization: Learning how to create interactive maps and visualizations using libraries like Leaflet, D3.js, and Mapbox.
5. Workflow automation: Understanding how to automate GIS workflows using scripting and programming techniques.
6. Web mapping: Learning how to create web applications using geospatial libraries and APIs.
7. GIS database management: Understanding how to manage and manipulate geospatial data using databases like PostGIS and SQLite.

Overall, a GIS programming course will equip you with the skills needed to develop applications, automate workflows, and analyze geospatial data using programming languages and tools.

Module 27

Code	Course/Module Title	ECTS	Semester
	Graduation Project	3	Eight
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect.	30	45
Description			

A Graduation Project is an independent research project that students undertake during their final year of study as a culminating experience in their academic program. The course covers the following topics:

1. Project Proposal: Learning how to develop a project proposal that includes a clear research question, a literature review, methodology, and expected outcomes.
2. Project Planning: Understanding the principles of project planning, including project scope, timeline, budget, and resources.
3. Data Collection and Analysis: Learning about the different methods of data collection and analysis, including surveys, interviews, focus groups, and statistical analysis.
4. Literature Review: Conducting a comprehensive review of relevant literature in the field, including identifying gaps in the literature and developing research questions based on the literature review.
5. Research Ethics: Understanding the ethical considerations involved in research, including informed consent, confidentiality, and privacy, and learning how to ensure that research is conducted in an ethical manner.
6. Project Implementation: Conducting the project according to the plan, including data collection, analysis, and interpretation.
7. Project Presentation: Learning how to present the project in a clear and concise manner, including developing a research report, a poster presentation, and an oral presentation.

Overall, a course in Graduation Project will provide students with the opportunity to conduct independent research in their field of study, develop critical thinking and problem-solving skills, and showcase their research skills and knowledge in a culminating project. The course will enable students to apply the knowledge and skills acquired throughout their academic program to a real-world problem, and to communicate their findings effectively to a broader audience.

Module 28

Code	Course/Module Title	ECTS	Semester
	Hydrology	3	Four
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect.	30	45
Description			

Hydrology is the study of water in the Earth's system, including its distribution, movement, and quality. A course in hydrology will typically cover the following topics:

1. Introduction to hydrology: Understanding the basic concepts of hydrology, including the hydrologic cycle, precipitation, evapotranspiration, and runoff.
2. Water resources: Understanding the availability and distribution of water resources, including surface water, groundwater, and water in the atmosphere.
3. Hydrologic measurements: Learning how to measure and analyze hydrologic data, including streamflow, precipitation, and water quality.
4. Hydrologic modeling: Understanding how to use computer models to simulate and predict hydrologic processes, including rainfall-runoff modeling, flood forecasting, and water quality modeling.
5. Watershed management: Understanding the principles of watershed management, including the assessment of water resources, the identification of potential water quality issues, and the development of management strategies.
6. Climate change and hydrology: Understanding the potential impacts of climate change on the hydrologic cycle, including changes in precipitation patterns, temperature, and

evapotranspiration rates.

7. Water law and policy: Understanding the legal and policy frameworks that govern water resources management, including water rights, water allocation, and environmental regulations.

Overall, a course in hydrology will provide students with a strong foundation in the principles and applications of hydrology, enabling them to understand and manage water resources in a variety of settings.

Module 29

Code	Course/Module Title	ECTS	Semester
	Image Analysis and interpretation	7	Five
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87
Description			

Image analysis and interpretation is an interdisciplinary field that focuses on the use of advanced imaging techniques to extract meaningful information from images. A course on image analysis and interpretation would provide students with the technical skills and knowledge needed to analyze and interpret images from a variety of sources and applications.

A brief course on image analysis and interpretation might cover topics such as:

1. The principles of image analysis and interpretation, including image acquisition, processing, and analysis techniques.
2. The tools and techniques used in image analysis, including image enhancement, segmentation, and classification.
3. The use of image analysis in various fields, including medicine, engineering, environmental science, and remote sensing.
4. The use of machine learning and artificial intelligence in image analysis, including deep learning and convolutional neural networks.
5. The challenges and limitations of image analysis, including issues related to image quality, feature extraction, and data interpretation.
6. Case studies of image analysis and interpretation in various fields, including examples of successful and unsuccessful applications of image analysis.

Overall, a course on image analysis and interpretation would provide students with the technical skills and knowledge needed to analyze and interpret images from a variety of sources and applications. The course would be useful for professionals in fields such as medical imaging, engineering, environmental science, and remote sensing, where knowledge of image analysis is essential for effective decision-making and problem-solving. The course would also provide a foundation for further study in specialized areas of image analysis and interpretation.

Module 30

Code	Course/Module Title	ECTS	Semester
	Information systems	3	Six

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	Lect.	30	45
Description			
Information systems is a field that focuses on the design, development, and management of information technology systems used by organizations to support their operations and decision-making processes. Information systems are used in a wide range of industries and settings, including healthcare, finance, manufacturing, and government. A brief course on information systems might cover topics such as: 1. The components and architecture of information systems, including hardware, software, databases, and networks. 2. The principles of database design and management, including data modeling, normalization, and database security. 3. The development and implementation of software applications, including programming languages, software development methodologies, and quality assurance. 4. The role of information systems in decision making, including data analytics, business intelligence, and decision support systems. 5. The management of information systems projects and teams, including project management methodologies and team dynamics. 6. The ethical and legal issues associated with information systems, such as data privacy and security, intellectual property, and cybercrime. Overall, a course on information systems would provide students with a comprehensive understanding of the principles and practices of information technology systems. Students would learn how to design, develop, and manage information systems, and how to apply these systems to solve real-world problems in a variety of industries and settings. The course would be useful for professionals in fields such as information technology, business, healthcare, and government.			

Module 31

Code	Course/Module Title	ECTS	Semester
	Land uses and land cover	7	Seven
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87
Description			
Land use and land cover are important concepts in geography and environmental science, and refer to			

the ways in which humans use and modify the natural landscape. A course on land use and land cover would explore the ways in which humans interact with and modify the natural environment, and the implications of these interactions for environmental sustainability and social equity.
A brief course on land use and land cover might cover topics such as:

1. The types and patterns of land use, including urban, agricultural, industrial, and recreational land use.
2. The factors that influence land use, including economic, social, political, and environmental factors.
3. The impacts of land use on the environment, including soil degradation, deforestation, and climate change.
4. The tools and techniques used to map and analyze land use, including remote sensing, GIS, and spatial analysis.
5. The policies and strategies used to manage land use and promote sustainable development, including land use planning, zoning, and conservation.
6. Case studies of land use and land cover change, including examples of successful and unsuccessful land use management practices.

Overall, a course on land use and land cover would provide students with the technical skills and knowledge needed to analyze and manage land use in a way that promotes sustainability and social equity. The course would be useful for professionals in fields such as environmental science, urban planning, and natural resource management, where knowledge of land use and land cover is critical for effective decision-making and sustainable development.

Module 32

Code	Course/Module Title	ECTS	Semester
	Medical Image Analysis	8	Eight
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	112
Description			

Medical Image Analysis is a rapidly growing field that involves the use of advanced image processing and machine learning techniques to analyze medical images for diagnosis, treatment planning, and research. A course in medical image analysis will typically cover the following topics:

1. Introduction to medical imaging: Understanding the principles and applications of medical imaging modalities, including X-ray, CT, MRI, and ultrasound.
2. Pre-processing and image enhancement: Learning how to pre-process medical images to remove noise, correct for artifacts, and enhance image quality.
3. Segmentation: Understanding how to segment medical images to identify and isolate regions of interest, such as organs, tumors, or lesions.
4. Registration: Learning how to register images from different modalities or time points to enable quantitative analysis.
5. Feature extraction: Understanding how to extract quantitative features from medical images using advanced image processing and machine learning techniques.
6. Classification: Learning how to use machine learning algorithms to classify medical images based on specific features or patterns.
7. Applications of medical image analysis: Understanding the diverse applications of medical image analysis, including diagnosis and treatment planning, medical research, and surgical guidance.

Overall, a course in medical image analysis will provide students with the knowledge and skills needed to analyze medical images using advanced image processing and machine learning techniques, enabling them to contribute to the development of new medical imaging technologies and applications.

Module 33

Code	Course/Module Title	ECTS	Semester
	Meteorology and climate change		
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
Description			

Meteorology and climate change are two critical fields of study that explore the Earth's atmosphere and its impact on the planet. A course on meteorology and climate change would provide students with the knowledge and skills needed to understand the science behind weather and climate, and the implications of climate change on society and the environment.

A brief course on meteorology and climate change might cover topics such as:

1. The principles of meteorology, including atmospheric composition, weather patterns, and climate zones.
2. The tools and techniques used in meteorology, including weather forecasting, meteorological instruments, and satellite imagery.
3. The principles of climate change, including the causes and effects of climate change, and the impacts of greenhouse gas emissions on the atmosphere and biosphere.
4. The tools and techniques used in climate science, including climate modeling, climate data analysis, and the use of paleoclimate data.
5. The impacts of climate change on natural and human systems, including sea level rise, changes in precipitation patterns, and impacts on agriculture, water resources, and human health.
6. Strategies for mitigating and adapting to climate change, including policy and societal responses, technological innovations, and ecosystem-based approaches.

Overall, a course on meteorology and climate change would provide students with the technical skills and knowledge needed to understand and address the challenges posed by climate change. The course would be useful for professionals in fields such as environmental science, meteorology, policy-making, and sustainable development, where knowledge of meteorology and climate change is critical for effective decision-making and sustainable development. The course would also provide a foundation for further study in specialized areas of meteorology and climate science.

Module 34

Code	Course/Module Title	ECTS	Semester
	Numerical Analysis	5	Four
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2+2	Lect.+ Lab.	60	65
Description			

Numerical analysis is the study of algorithms and techniques used to obtain numerical approximations to mathematical problems. It is a fundamental area of mathematics that has important applications in various fields, including engineering, physics, economics, and computer science.
A brief course on numerical analysis might cover topics such as:

1. Approximation of functions and numerical differentiation and integration.
2. Root finding methods, including the bisection method, Newton's method, and the secant method.
3. Interpolation and curve fitting techniques, such as Lagrange interpolation, cubic splines, and least squares fitting.
4. Numerical linear algebra, including methods for solving systems of linear equations and eigenvalue problems.
5. Numerical solutions of differential equations, including Euler's method, Runge-Kutta methods, and finite difference methods.
6. Error analysis and convergence of numerical methods.

Overall, a course on numerical analysis would provide students with the mathematical foundation and technical skills necessary to analyze problems and develop numerical solutions. Students would learn how to apply numerical algorithms to solve problems in various fields, and how to evaluate the accuracy and efficiency of numerical methods. The course would be useful for professionals in fields such as engineering, physics, economics, and computer science, where numerical methods are commonly used to solve complex problems.

Module 35

Code	Course/Module Title	ECTS	Semester
	Physics	8	One
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	112
Description			

Physics is a branch of science that deals with the study of matter, energy, and their interactions. It has important applications in various fields, including engineering, medicine, and technology.
A brief course on physics might cover topics such as:

1. Classical mechanics, including Newton's laws of motion, work and energy, momentum, and simple harmonic motion.
2. Thermodynamics, including the laws of thermodynamics, heat transfer, and thermodynamic cycles.
3. Electromagnetism, including electric and magnetic fields, circuits, and electromagnetic waves.
4. Waves and optics, including wave properties, interference, diffraction, and geometric optics.
5. Quantum mechanics, including the wave-particle duality, uncertainty principle, and Schr?dinger's equation.
6. Special relativity, including time dilation, length contraction, and the equivalence of mass and energy.

Overall, a course on physics would provide students with the mathematical foundation and technical skills necessary to analyze and solve complex problems in various fields. Students would learn how to apply mathematical concepts to real-world problems, and how to use physics to model and solve problems involving matter and energy. The course would be useful for professionals in fields such as engineering, medicine, and technology, where knowledge of physics is commonly used to design and develop new technologies and solve complex problems.

Module 36

Code	Course/Module Title	ECTS	Semester
	Remote sensing applications	7	Eight
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87
Description			

Remote sensing applications involve the use of remote sensing techniques and technologies to gather information about the Earth's surface and atmosphere and to solve real-world problems in various fields. Remote sensing applications have important implications in fields such as environmental science, ecology, geology, and agriculture.

A brief course on remote sensing applications might cover topics such as:

1. The principles of remote sensing and the properties of electromagnetic radiation.
2. The types of remote sensing data, including passive and active sensors, and the characteristics of different types of sensors, such as multispectral, hyperspectral, and synthetic aperture radar (SAR).
3. Image processing and analysis techniques, including image enhancement, classification, and change detection.
4. Applications of remote sensing in environmental science, such as monitoring land use and land cover change, detecting forest fires, and mapping coastal zones.
5. Applications of remote sensing in agriculture, such as crop yield estimation, soil moisture monitoring, and precision agriculture.
6. Applications of remote sensing in geology, such as mineral exploration, geological mapping, and landslide detection.

Overall, a course on remote sensing applications would provide students with the technical skills and knowledge needed to apply remote sensing techniques to solve real-world problems in various fields. Students would learn how to analyze remote sensing data, interpret the information it provides, and use this information to manage and protect the environment, improve agricultural practices, and explore geological resources. The course would be useful for professionals working in environmental science, geology, ecology, agriculture, and other fields that require a detailed understanding of the Earth's surface and atmosphere.

Module 37

Code	Course/Module Title	ECTS	Semester
	Remote Sensing Fundamentals	8	One
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	112
Description			

Remote Sensing is the science of acquiring and interpreting information about the Earth's surface

without direct physical contact. A course in Remote Sensing Fundamentals will typically cover the following topics:

1. Introduction to Remote Sensing: Understanding the basic concepts of remote sensing, including the electromagnetic spectrum, sensors, and platforms.
2. Remote Sensing Data: Learning about the types of remote sensing data, including optical, thermal, and radar data.
3. Image Processing: Understanding the principles of image processing, including image enhancement, filtering, and classification.
4. Digital Image Analysis: Learning how to use digital image analysis techniques to extract quantitative information from remote sensing data, including feature extraction, change detection, and classification.
5. Remote Sensing Applications: Understanding the diverse applications of remote sensing, including environmental monitoring, natural resource management, urban planning, and disaster management.
6. Geospatial Technology Integration: Understanding the integration of remote sensing with other geospatial technologies, such as GIS and GPS.
7. Remote Sensing in the Future: Understanding the trends and emerging technologies in remote sensing, including hyperspectral imaging, LiDAR, and unmanned aerial systems (UAS).

Overall, a course in Remote Sensing Fundamentals will provide students with a strong foundation in the principles and applications of remote sensing, enabling them to analyze and interpret remote sensing data for a variety of real-world applications.

Module 38

Code	Course/Module Title	ECTS	Semester
	Remote sensing physics	7	Four
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87

Description

Remote Sensing Physics is a specialized course that focuses on the physical principles and theories underlying remote sensing technologies. A course in Remote Sensing Physics will typically cover the following topics:

1. Electromagnetic Radiation: Understanding the properties and behavior of electromagnetic radiation, including the electromagnetic spectrum, the nature of waves, and the principles of radiometry.
2. Interaction of Radiation with Matter: Understanding how radiation interacts with different materials and surfaces, including reflection, absorption, and transmission.
3. Sensors and Platforms: Learning about the different types of sensors used in remote sensing, including passive and active sensors, and the platforms used to carry them, including satellites, aircraft, and unmanned aerial systems (UAS).
4. Atmospheric Effects: Understanding how atmospheric conditions affect the transmission, absorption, and scattering of electromagnetic radiation.
5. Radiative Transfer: Understanding the principles of radiative transfer and how they apply to remote sensing, including the mathematical models used to simulate radiative transfer in different media.
6. Image Processing: Learning how to process and analyze remote sensing data using advanced image processing techniques, including image enhancement, filtering, and classification.

7. Remote Sensing Applications: Understanding the diverse applications of remote sensing, including environmental monitoring, natural resource management, urban planning, and disaster management.

Overall, a course in Remote Sensing Physics will provide students with a deep understanding of the physical principles that underlie remote sensing technologies, enabling them to analyze and interpret remote sensing data with a high degree of accuracy and precision.

Module 39

Code	Course/Module Title	ECTS	Semester
	Remote sensing software packages	5	Four
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect.	58	67

Description

A course on Remote Sensing Software Packages will typically cover the following topics:

1. Introduction to Remote Sensing Software Packages: Understanding the different types of remote sensing software packages available, their capabilities, and their applications.
2. ENVI: Learning about the ENVI software package, its features, and its applications. Topics covered may include image enhancement, classification, feature extraction, and hyperspectral/multispectral data analysis.
3. ArcGIS: Understanding the ArcGIS software package, its features, and its applications for remote sensing. Topics covered may include image classification, change detection, spatial analysis, and geospatial modeling.
4. ERDAS Imagine: Learning about the ERDAS Imagine software package, its capabilities, and its applications. Topics covered may include image processing, classification, feature extraction, and change detection.
5. QGIS: Understanding the QGIS software package, its features, and its applications for remote sensing. Topics covered may include importing, processing, and analyzing remote sensing data, image classification, and segmentation.
6. MATLAB: Learning about MATLAB programming language and its applications in remote sensing. Topics covered may include programming techniques, image processing, and analysis algorithms.
7. GRASS GIS: Understanding the GRASS GIS software package, its features, and its applications for remote sensing. Topics covered may include image processing, classification, feature extraction, and change detection.

Overall, a course on Remote Sensing Software Packages will provide students with a solid foundation in the capabilities and applications of the most widely-used software packages used in remote sensing analysis. The course will enable students to select and use appropriate software packages for specific remote sensing applications, and to extract meaningful information from remote sensing data.

Module 40

Code	Course/Module Title	ECTS	Semester
	Research methodology	1	Six

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1	Lect.	16	9

Description

Research Methodology is a course that provides students with a systematic approach to conducting research. The course covers the following topics:

1. Introduction to Research: Understanding the nature and purpose of research, its importance, and its limitations.
2. Research Design: Learning about the different types of research designs, including experimental, quasi-experimental, and non-experimental designs, and understanding how to select an appropriate design for a specific research question.
3. Sampling: Understanding the principles of sampling, including random sampling, stratified sampling, and cluster sampling, and how to select a sample that is representative of the population being studied.
4. Data Collection: Learning about the different methods of data collection, including surveys, interviews, focus groups, and observation, and understanding how to select an appropriate method for a specific research question.
5. Data Analysis: Understanding the principles of data analysis, including descriptive and inferential statistics, and learning how to analyze data using statistical software packages.
6. Ethical Considerations: Understanding the ethical considerations involved in research, including informed consent, confidentiality, and privacy, and learning how to ensure that research is conducted in an ethical manner.
7. Writing a Research Proposal: Learning how to write a research proposal that includes a clear research question, a well-designed research design, a feasible sampling strategy, appropriate data collection methods, and a plan for data analysis.

Overall, a course in Research Methodology will provide students with the knowledge and skills needed to conduct research in a systematic and ethical manner, enabling them to contribute to the development of new knowledge in their field of study.

Module 41

Code	Course/Module Title	ECTS	Semester
	spatial analysis	7	Six
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4+2	Lect.+ Lab.	88	87

Description

Spatial Analysis is a course that focuses on the principles and techniques of analyzing spatial data. The course covers the following topics:

1. Introduction to Spatial Analysis: Understanding the basic concepts of spatial analysis, including spatial data types, coordinate systems, and spatial relationships.
2. Spatial Data Acquisition and Management: Learning about the different methods of acquiring

and managing spatial data, including remote sensing, GPS, and GIS.

3. Spatial Statistics: Understanding the principles of spatial statistics, including spatial autocorrelation, spatial interpolation, and spatial regression analysis.
4. Spatial Analysis Techniques: Learning about the different techniques of spatial analysis, including spatial clustering analysis, spatial pattern analysis, and spatial optimization.
5. Spatial Decision Support Systems: Understanding the principles of spatial decision support systems, including multi-criteria decision analysis, spatial decision trees, and spatially-explicit modeling.
6. Spatial Analysis Applications: Understanding the diverse applications of spatial analysis, including environmental modeling, urban planning, transportation analysis, and emergency management.
7. Spatial Analysis Software: Learning how to use GIS software packages, such as ArcGIS, QGIS, and GRASS GIS, to conduct spatial analysis and create maps.

Overall, a course in Spatial Analysis will provide students with a strong foundation in the principles and techniques of spatial analysis, enabling them to analyze and interpret spatial data, identify spatial patterns, and make informed decisions based on spatial information.

Module 42

Code	Course/Module Title	ECTS	Semester
	Statistics	7	Tow
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect.	58	117

Description

Statistics is a branch of mathematics that deals with the collection, analysis, interpretation, presentation, and organization of data. A course in Statistics will typically cover the following topics:

1. Descriptive Statistics: Understanding the basic concepts of descriptive statistics, including measures of central tendency, measures of dispersion, and graphical representation of data.
2. Probability Theory: Learning about the basic principles of probability theory, including random variables, probability distributions, expected values, and variance.
3. Statistical Inference: Understanding the principles of statistical inference, including hypothesis testing, confidence intervals, and p-values.
4. Regression Analysis: Learning about linear and multiple regression analysis and understanding how to use regression analysis to model relationships between variables.
5. Experimental Design: Understanding the principles of experimental design, including randomization, blocking, and factorial design, and learning how to design experiments that test hypotheses and control for confounding variables.
6. Analysis of Variance: Learning about the principles of analysis of variance (ANOVA) and understanding how to use ANOVA to test hypotheses and compare means across multiple groups.
7. Nonparametric Statistics: Understanding the principles of nonparametric statistics, including the Wilcoxon rank-sum test, the Kruskal-Wallis test, and the Mann-Whitney U test.

Overall, a course in Statistics will provide students with a strong foundation in the principles and applications of statistical analysis, enabling them to apply statistical techniques to analyze data, test hypotheses, and draw conclusions in a variety of real-world settings.

Module 43

Code	Course/Module Title	ECTS	Semester
	sustainable energy	3	Three
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	Lect.	30	45
Description			

Sustainable Energy is a course that focuses on the principles and applications of renewable energy technologies and their role in achieving sustainable development. The course covers the following topics:

1. Introduction to Sustainable Energy: Understanding the concept of sustainable energy, its importance, and its potential for mitigating climate change and promoting sustainable development.
2. Renewable Energy Technologies: Learning about the different types of renewable energy technologies, including solar, wind, hydro, geothermal, and bioenergy, and understanding their principles of operation, advantages, and limitations.
3. Energy Efficiency: Understanding the principles of energy efficiency and conservation, including building design, energy-efficient appliances, and smart grid technologies.
4. Energy Storage: Learning about the different types of energy storage technologies, including batteries, hydrogen storage, and pumped hydro storage, and understanding their roles in balancing the intermittent nature of renewable energy sources.
5. Energy Policy and Economics: Understanding the policies and regulations that promote the development of sustainable energy, including feed-in tariffs, tax incentives, and renewable portfolio standards, and learning about the economic considerations of sustainable energy, including the levelized cost of energy and the social cost of carbon.
6. Sustainable Energy Systems: Learning about the principles of sustainable energy systems and their design, including the integration of renewable energy sources, energy storage, and energy efficiency measures.
7. Case Studies: Examining case studies of sustainable energy projects and their impacts on energy security, economic development, and environmental sustainability.

Overall, a course in Sustainable Energy will provide students with a broad understanding of the principles and applications of sustainable energy technologies, enabling them to contribute to the development of sustainable energy systems that promote economic development, environmental sustainability, and social equity.

Module 44

Code	Course/Module Title	ECTS	Semester
	sustainable environmental management	5	Seven
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect.	58	67

Description
Sustainable environmental management is the practice of managing natural resources in a way that meets the needs of the present without compromising the ability of future generations to meet their own needs. A course on sustainable environmental management would provide students with the knowledge and skills needed to understand and address environmental challenges and promote sustainable development. A brief course on sustainable environmental management might cover topics such as: 1. The principles of sustainable development and the triple bottom line (economic, social, and environmental sustainability). 2. The major environmental challenges facing the world today, such as climate change, biodiversity loss, and pollution. 3. The role of environmental policies and regulations in promoting sustainable development. 4. The use of environmental assessments and life cycle assessments to evaluate the environmental impact of products and processes. 5. The principles of green design and the use of sustainable materials and technologies. 6. The importance of stakeholder engagement and public participation in sustainable environmental management. Overall, a course on sustainable environmental management would provide students with a comprehensive understanding of the principles and practices of sustainable development. Students would learn how to evaluate and address environmental challenges, develop and implement sustainable practices, and engage stakeholders in the process of sustainable environmental management. The course would be useful for professionals in a wide range of fields, including environmental science, engineering, business, and policy.

Module 45

Code	Course/Module Title	ECTS	Semester
	Sustainable urban planning	6	Seven
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	Lect.	58	92
Description			
Sustainable urban planning is an interdisciplinary field that focuses on designing and managing cities in a way that promotes social, economic, and environmental sustainability. A course on sustainable urban planning would explore the challenges and opportunities of urbanization, and the strategies used to create livable and sustainable cities. A brief course on sustainable urban planning might cover topics such as: 1. The principles of sustainable urban planning, including smart growth, compact urban form,			

mixed-use development, and green infrastructure.

2. The challenges of urbanization, including urban sprawl, traffic congestion, air pollution, and social inequality.
3. The tools and techniques used in sustainable urban planning, including land use planning, transportation planning, and environmental impact assessment.
4. The role of community engagement and participation in sustainable urban planning, including stakeholder analysis, public consultation, and community-based planning.
5. Case studies of sustainable urban planning in practice, including examples of successful and unsuccessful sustainable urban development projects.
6. The role of policy and governance in promoting sustainable urban planning, including the use of incentives, regulations, and public-private partnerships.

Overall, a course on sustainable urban planning would provide students with the technical skills and knowledge needed to design and manage cities in a way that promotes social, economic, and environmental sustainability. The course would be useful for professionals in fields such as urban planning, architecture, environmental science, and public policy, where knowledge of sustainable urban planning is essential for effective decision-making and sustainable development.

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