1.3.6 Geographic Information Systems (GIS) for water and natural resources applications (Cologne University of Applied Sciences)

Name of Module/Course	Geographic Information Systems (GIS) for natural water resources applications
Short description	• The GIS is a powerful and widely used as a tool for spatial analysis of natural resources, city planning, and environmental hazards representation and mapping. Also, it can be a useful tool for preparing inputs of models and other tools. • This course is meant for students and professionals in the field of water and natural resources with very basic information about GIS and it is functionalities. • After completing the course, the participant will be able to use the QGIS tool for their professional work and know where to find and download different data sources. • The exercises will be done using QGIS software. Thus, it is recommended to install the required software on your computer before the first session.
Name of Programme	
Name of University	TH-Köln, University of Applied Sciences
Name of Lecturer	Eng. Zryab Babker Bilal Al-Saeedi
Responsible University lecturer	Eng. Zryab Babker

Credit Points	SWS	Attendance (h)	Self-study (h)	Total workload (h)
-		24	12	36

Start & end dates, WS	timeslot:
6 sessions on Saturdays morning: ., 08.11.2025, 13.12.2025	

Registration until	Number of possible AGEP participants
17. 10.2025	15-20 participants

Content and goals of qualification	*Content:* *Lecture1:* • Introduction to QGIS software (main features and tools). • Establish appropriate databases.

	o Difference between raster, vectors (features), tables, and other data formats. • Download, organize and visualize spatial data from different open sources (e.g. population, country boundaries, Digital Elevation Models (DEM), climatic data…etc.). • Import and export data to and from QGIS and how to save and share data. ***Lecture 2:*** • Perform some vector and raster analysis (Buffering, projecting, clipping, merging, mosaic to a new raster…etc.). • DEM download, analysis, and manipulation. • Extracting values from a raster (i.e. land cover type at specific location). • Hands on ***Lecture 3:*** • Catchment and stream delineation. • Understand advanced geo-processing tools in the field of Natural and water resources planning and management- i.e. using map algebra and other tools to: • Perform Simple water balance using geo-processing tools. ***Lecture 4:*** • Introduction to open source data and tools. • Automating processing using a model builder. • Styling and professional map design. • Hand on. ***Lecture 5:*** • Digitizing points, lines, polygon vector (Using the basic tools) o Digitizing points, line, and polygon vector (Using AI plugin) • Styling and labeling • Short introduction to AI tools in QGIS with example applications • Hands on ***Lecture 6:*** • Interpolation in QGIS: • Import a spreadsheet and CSV data • prepare the data by merging editing tables • interpolate using nearest neighbor (Thiessen polygons), inverse distance weighted interpolation IDW • creating contour lines in QGIS • Hands on • Recap and Q&A (open discussion)

	Learning outcomes:
	The participants will be able to:
	• Use QGIS in its main functionalities. Download, organize, and visualize spatial data from different open sources.
	• Import and export data to and from QGIS.
	• Do some vector and raster analysis (converting, projecting, clipping, merging, mosaic to a new raster…etc.).
	• Create their own spatial data and present / visualize it.
	• Analyse spatial data, and create their own maps out of this analysis.
	• Understand advanced geoprocessing tools in the field of Natural and water resources planning and management- i.e. using map algebra and other tools.
	• DEM analysis and manipulation.
	• Perform catchment and stream delineation.
	• Knowledge about the state of the art regarding open-source data and tools. In addition to and how to download different data.
	• Designing and producing a publication ready map in QGIS.
Preconditions for participation	Basic knowledge about GIS and its functionalities
Teaching Methods	Online lectures and partially self-study
lesson format (online/face-to-face)	Online
Assessment method	Attendance and submitting the given exercises
language	English
Inscription external student	