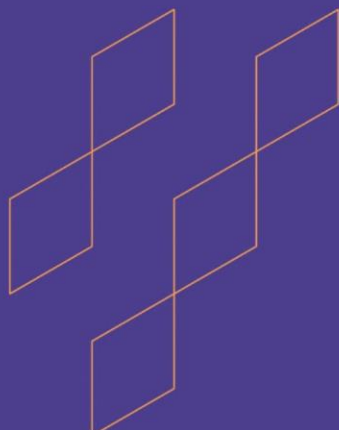




# Course Specification

## (Postgraduate Programs)

|                     |                                                 |
|---------------------|-------------------------------------------------|
| Course Title:       | Spatial Analysis                                |
| Course Code:        | GIS5002                                         |
| Program:            | Higher Diploma in Geographic Information System |
| Department:         | Geography                                       |
| College:            | Social Sciences                                 |
| Institution:        | Umm Al-Qura University                          |
| Version:            | V1                                              |
| Last Revision Date: | 14 October 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:

This course introduces students to the fundamental concepts and advanced spatial analysis techniques using Geographical Information Systems (GIS) and statistical methods. Students will learn to manage, analyze, and model spatial data, gaining practical skills in data visualization, synthesis, and real-world application. The course also covers spatial data properties, metadata, and cartographic principles. Thus, students will be prepared to apply spatial analysis techniques across various fields and gain hands-on experience in GIS projects.

#### 5. Pre-requirements for this course (if any):

N/A

#### 6. Pre-requirements for this course (if any):

N/A

#### 7. Course Main Objective(s):

The main purpose of the Spatial analysis course is to develop students' ability to observe, analyze, describe, and model real-world problems geographically, then derive results by computer processing, and then explore and examine those results.

### 2. Teaching Mode: (mark all that apply)

| No | Mode of Instruction                                                                                | Contact Hours | Percentage |
|----|----------------------------------------------------------------------------------------------------|---------------|------------|
| 1  | Traditional classroom                                                                              | 75            | 100%       |
| 2  | E-learning                                                                                         |               |            |
| 3  | Hybrid <ul style="list-style-type: none"> <li>Traditional classroom</li> <li>E-learning</li> </ul> |               |            |





| No | Mode of Instruction | Contact Hours | Percentage |
|----|---------------------|---------------|------------|
| 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  | To explain GIS concepts and spatial analysis techniques in an interdisciplinary setting. | K1                                    | Brainstorming<br>Scientific discussions<br>Questions<br>Lectures<br>Lab. work | Practical duties<br>Direct/ indirect questions |
| 1.2  | To apply different approaches to spatial data exploration.                               | K2                                    |                                                                               |                                                |
| 1.3  | To describe spatial relationships with their role in GIS                                 | K3                                    |                                                                               |                                                |
| 2.0  | Skills                                                                                   |                                       |                                                                               |                                                |
| 2.1  | To apply ArcGIS for spatial data preparation,                                            | S1                                    | Scientific discussions                                                        | Practical duties/ reports<br>Written Exams     |





| Code | Course Learning Outcomes                                                                   | Code of PLOs aligned with the program | Teaching Strategies                           | Assessment Methods                                        |
|------|--------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------------|-----------------------------------------------------------|
|      | analysis, and visualization                                                                |                                       | Lab. Work                                     |                                                           |
| 2.2  | To demonstrate proficiency in integrating GIS data analysis                                | S2                                    | Project-Based Learning (PBL)                  |                                                           |
| 2.3  | To develop and manage geodatabases                                                         | S3                                    |                                               |                                                           |
| 3.0  | Values, autonomy, and responsibility                                                       |                                       |                                               |                                                           |
| 3.1  | The ability to use spatial analysis within GIS capabilities judiciously                    | V1                                    |                                               |                                                           |
| 3.2  | To show awareness of the environmental, social, and economic impacts of spatial decisions  | V2                                    | Presentations<br>Problem-Based Learning (PBL) | Projects/ Oral Presentation during the scientific seminar |
| 3.3  | To critically analyze spatial scenarios with solutions to real-world problems and mapping. | V3                                    |                                               |                                                           |

### C. Course Content:

| No | List of Topics                                                                                                                                                                                                                                                                                                                                                                                                                                   | Contact Hours |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1. | <b>Filtering Data Using Queries</b> <ul style="list-style-type: none"> <li>Attribute Queries: Selecting data based on specific attribute values.</li> <li>Spatial Queries: Filtering data based on spatial relationships, including proximity, adjacency, or containment.</li> <li>SQL for Spatial Data: Writing and using SQL queries for filtering geospatial data, including Select by Attribute and Select by Location functions.</li> </ul> | 10            |



|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|    | <ul style="list-style-type: none"> <li>Use Cases: Applying filtering techniques to real-world datasets (urban zoning, environmental risk zones, and land-use planning).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |
| 2. | <b>Spatial Relationships:</b> <ul style="list-style-type: none"> <li>Topological Relationships: Analyzing how different spatial features are connected (adjacency, containment, intersection).</li> <li>Proximity Relationships: Calculating distances and buffers around features, such as identifying areas within a certain radius of a water body.</li> <li>Overlay Relationships: Techniques like Intersect and Union to analyze how different spatial layers overlap, identifying common areas or differences.</li> <li>Distance Analysis: Methods for calculating the shortest path, distance to nearest features, and network analysis for transportation and infrastructure planning.</li> </ul>                                                                                                                                          | 10 |
| 3. | <b>Spatial Statistics:</b> <ul style="list-style-type: none"> <li>Spatial Autocorrelation: Measuring how spatial features relate to one another across space, using indices (Moran's I or Geary's C).</li> <li>Point Pattern Analysis: Techniques for analyzing the distribution of point features, such as hotspots and clustering using statistical measures</li> <li>Hotspot Analysis: Identifying areas with statistically significant concentrations of high or low values (crime analysis or environmental risk assessment).</li> <li>Kriging and Interpolation: Geostatistical methods for predicting values in areas where data is missing, based on the spatial correlation of known data points.</li> <li>Spatial Regression Models: Modeling relationships between spatial data points while considering spatial dependence.</li> </ul> | 15 |
| 4. | <b>Spatial Data Infrastructure:</b> <ul style="list-style-type: none"> <li>Introduction to SDI: The framework for organizing, sharing, and accessing geospatial data across different systems and organizations.</li> <li>Key Components of SDI: Data standards metadata, technology, and governance structures for effective spatial data management.</li> <li>Interoperability: Methods for ensuring that different GIS systems can work together and share data seamlessly, using open standards and protocols.</li> <li>SDI Implementation: Best practices for building and managing an SDI at different levels, including policy development and data sharing.</li> </ul>                                                                                                                                                                     | 10 |
| 5. | <b>Spatial Decision Support Systems (SDSS):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 15 |





|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|              | <ul style="list-style-type: none"> <li>• Introduction to decision-making with GIS</li> <li>• Building spatial decision support models</li> <li>• Suitability Modeling: Identifying the best locations for specific activities by considering multiple factors like distance, environment, and infrastructure.</li> <li>• Multi-criteria decision analysis (MCDA) Combining multiple evaluation criteria into a comprehensive suitability model</li> </ul> |           |
| 6.           | <b>Project: Spatial Analysis</b><br>Real-world projects could involve environmental studies (e.g., assessing land degradation), urban planning (e.g., site selection for new schools), or disaster management (e.g., identifying evacuation routes).                                                                                                                                                                                                      | 15        |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>75</b> |

#### D. Students Assessment Activities:

| No | Assessment Activities *                                                      | Assessment timing (in week no) | Percentage of Total Assessment Score |
|----|------------------------------------------------------------------------------|--------------------------------|--------------------------------------|
| 1. | Laboratory exercises                                                         | 2                              | 5 %                                  |
| 2. | Practical report                                                             | 7                              | 5 %                                  |
| 3. | Midterm Exam                                                                 | 10                             | 20 %                                 |
| 4. | Project (Individual and/or group)                                            | 12                             | 10 %                                 |
| 5. | Related oral presentation for the selected project (Individual and/or group) | 15                             | 10 %                                 |
| 6. | Final Exam                                                                   | 16 /17 Exam week               | 50                                   |

#### E. Learning Resources and Facilities:

##### 1. References and Learning Resources:

|                          |                                                                                                                                                                                     |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Essential References     | <ul style="list-style-type: none"> <li>• De Smith, M. J., Goodchild, M. F., &amp; Longley, P, Geospatial Analysis - A comprehensive guide - 6th edition, 2018-2021</li> </ul>       |
| Supportive References    | <ul style="list-style-type: none"> <li>• Spatial Analysis Using Big Data: Methods and Urban Applications (Spatial Econometrics and Spatial Statistics) 1st Edition, 2019</li> </ul> |
| Electronic Materials     | <ul style="list-style-type: none"> <li>• Get started with Spatial Analyst in ArcGIS Pro: <a href="https://pro.arcgis.com">https://pro.arcgis.com</a></li> </ul>                     |
| Other Learning Materials | Several related research papers and video tutorials will be provided up to 2 weeks prior to the start of the teaching period                                                        |



## 2. Educational and Research Facilities and Equipment Required:

| Items                                                                                     | Resources                                                                             |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>facilities</b><br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | <b>Classroom at the university headquarters</b><br><b>Practical laboratory</b>        |
| <b>Technology equipment</b><br>(Projector, smart board, software)                         | <b>Spatial analyses will be carried out using mainly ESRI's ArcGIS, and projector</b> |
| <b>Other equipment</b><br>(Depending on the nature of the specialty)                      |                                                                                       |

## F. Assessment of Course Quality:

| Assessment Areas/Issues                            | Assessor                                  | Assessment Methods                                                                                                                     |
|----------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Effectiveness of teaching</b>                   | Students                                  | Indirect (Survey form to measure students' satisfaction with the effectiveness of the used teaching methods)                           |
| <b>Effectiveness of students' assessment</b>       | Program Leaders, Students                 | Direct (student grades) + Indirect (Survey form to measure students' satisfaction with the effectiveness of the used teaching methods) |
| <b>Quality of learning resources</b>               | Program Leaders, Peer Reviewers, Students | Indirect (Forms for evaluating the availability of learning resources for the course)                                                  |
| <b>The extent to which CLOs have been achieved</b> | Program Leaders, Peer Reviewers           | Direct) project, reports etc.)<br>Indirect (Evaluation form for the availability of learning resources for the course)                 |
| <b>Other</b>                                       |                                           |                                                                                                                                        |

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

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval Data:

COUNCIL /COMMITTEE







REFERENCE NO.

DATE

