The University of Jordan

الجامعة الاردنية

| Form: Course Syllabus | Form Number | EXC-01-02-02A |
|---|---|---|
| | Issue Number and Date | 2/3/24/2022/2963 05/12/2022 |
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| | Number of Pages | 07 |

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| 1. | Course Title | **Environmental Geophysics** |
| 2. | Course Number | **0305971** |
| 3. | Credit Hours (Theory, Practical) | 3 theoretical |
| | Contact Hours (Theory, Practical) | 3 hr theory |
| 4. | Prerequisites/ Corequisites | |
| 5. | Program Title | Environmental and applied Geology |
| 6. | Program Code | |
| 7. | School/ Center | School of science |
| 8. | Department | Geology |
| 9. | Course Level | PhD in Geology |
| 10. | Year of Study and Semester (s) | Fall 2025/2026 |
| 11. | Other Department(s) Involved in Teaching the Course | none |
| 12. | Main Learning Language | English |
| 13. | Learning Types | ■Face to face learning ☐Blended ☐Fully online |
| 14. | Online Platforms(s) | ☐Moodle ☐Microsoft Teams |
| 15. | Issuing Date | 10/10/2025 |
| 16. | Revision Date | 10//10/2025 |

**17. Course Coordinator:**


Name: Dr.Wadah F. Mahmoud Contact hours: Sunday 13:30-17:30

Office number: 203 Phone number: 23972 mob.: 0798515490

Email: w.mahmoud@ju.edu.jo


**18. Other Instructors: (None)**

*Office numbers, office hours, phone numbers, and email addresses should be listed.*

Name:

Office number:

Phone number:

Email:

Contact hours:

## 19. Course Description:

As stated in the approved study plan.

Importance of geophysics and environmental problems, earthquakes and earthquake hazard; assessment and mitigation of earthquake risk; landslides and geological factors, the role of geophysics in the study of landslides, cavities and sinkholes, groundwater pollution, dams and water-reservoirs and environmental problems, and field applications.

## 20. Course aims and outcomes:

**A.** Aims:

Having completed this course, students should be able to:

- Learn on the development of Engineering and Environmental Geophysics and its importance in solving many environmental problems
- Know the geophysical and geological characteristics of some environmental problems, namely: landslides, subsurface cavities and sinkholes, contamination of groundwater, water seepage from dams and water reservoirs, buried objects, natural radiation.
- Study shallow seismic surveys and their role in solving environmental problems. Mapping horizontal and deformed layers and locating geological structures. Field applications.
- Study electrical and electromagnetic surveys and their role in delineating contamination plumes, subsurface cavities and odd bodies. Field applications.
- Understand the importance of electrical and electromagnetic methods in locating water seepage from dams and water reservoirs.
- Learn shallow magnetic and gravity surveys and their role in environmental studies.
- Understand reduction of gravity and magnetic data. Qualitative and quantitative interpretation. Field applications.
- Interpret geophysical anomalies and understand the limitations of each method

**B- Intended Learning Outcomes (ILOs):** Upon successful completion of this course students will be able to

Differentiate between Environmental Geophysics and Applied Geophysics and their main applications Learn the main geological and geophysical characteristics of some selected environmental problems, particularly landslides, contamination of groundwater, seepage from dams and water reservoirs, subsurface cavities and sinkholes.

Understand the importance of some geophysical methods in solving the above-mentioned environmental problems.
Learn how shallow seismic refraction is designed and executed to evaluate the hazard of landslides, subsurface cavities and other problems
Travel time equations for horizontal and deformed layers and mapping geological structures Conduct shallow seismic surveys and analyse and evaluate the obtained seismic data

1. Get to know the importance of electrical and electromagnetic methods in solving environmental problems, and the assessment of their hazard, particularly contamination of underground water, subsurface cavities and sinkholes, landslides and water seepage.
2. Learn the importance of both electrical trenching and sounding in solving the different problems and evaluating their hazard.
3. Conduct field applications and quantitative evaluation of the obtained electrical & electromagnetic data.
4. Know the importance of gravity and magnetic techniques in solving some environmental problems
5. Reduction and interpretation of gravity and magnetic data.
6. Conduct some gravity and magnetic surveys and train on the qualitative and quantitative interpretations of the collected data.
7. Learn the importance of ground penetrating radar in solving some environmental problems, radar propagation parameters, data acquisition and processing.
8. Design investigative approaches and select appropriate geophysical methods for environmental site characterizations, locating buried structures, groundwater investigations, and identifying geotechnical conditions and hazards.

## 21. Topic Outline and Schedule:

| Topic | Wee k | Achieved ILOs | Reference |
|---|---|---|---|
| Introduction & Geophysics Applications<br>Review of practical applications and case studies | 1 | 1 | Chapter 1 |
| Geological & geophysical characteristics of some environmental problems | 1 | 2 | Chapter 2 |
| Importance of Environmental Geophysics | 1 | 3 | Chapter 2 |
| Shallow seismic refraction and its role in environmental studies | 1 | 4 | Chapter 4 |
| Travel time equations for horizontal and deformed layers.<br>Field demonstration recording, seismic survey using Multichannel Analysis of Surface Waves (MASW).<br>**Field applications, Seismic Field Methods (MASW)** | 2 | 5 & 6 | Chapter 4 |
| Electrical & electromagnetic studies and their importance in studies of water seepage and contamination | 2 | 7 & 8 | Chapters 6 & 7 |
| Electrical and electromagnetic **field applications** | 1 | 9 | Chapter 7 |
| Gravity and magnetic methods and their role in environmental studies | 1 | 10 | Chapters 2 & 3 |
| Reduction and interpretation of gravity and magnetic data | 1 | 11 | Chapters 2 & 3 |
| Gravity and magnetic **field applications** | 1 | 12 | Chapters 2 & 3 |
| Ground penetration radar, propagation parameters | 1 | 13 | Chapter 8 |
| Radar data acquisition, processing and interpretation and field applications.<br>**GPR Field Methods, Field demonstration** of GPR with various antennas, recording. | 1 | 14 | Chapter 8 |

## 22. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

Detailed lectures are presented on each subject. PowerPoint is utilized when needed. Weekly exercises are given on the interpretation of geophysical data. Geophysical field surveys are conducted at some selected environmental sites. Students are trained on the processing and interpretation of the collected data.

## 23. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

First Exam 20%; second Exam 20%, Practical Exam 10%; Final Exam 50%; Total = 100%

**24.Course Policies:**

A- Attendance policies: **university regulations**
B- Absences from exams and submitting assignments on time: **university regulations**
C- Health and safety procedures:
For field application, the following safety must be taken in consideration:

1. Suitable cloths depending on weather conditions
2. Every student must take general safety precautions while working, not disturb others and the local community, adhere to lecture etiquette and university regulations, and wear comfortable walking shoes.

D- Honesty policy regarding cheating, plagiarism, misbehavior: **university regulations**
E- Grading policy: **May subjected to changes (depends on the overall results)**

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| 0 - 39 | **F** |
| 40 - 44 | **D-** |
| 45 – 49 | **D** |
| 50 - 54 | **D+** |
| 55 – 59 | **C-** |
| 60 – 64 | **C** |
| 65 – 69 | **C+** |
| 70 - 74 | **B-** |
| 75 – 79 | **B** |
| 80 - 84 | **B+** |
| 85 - 89 | **A-** |
| 90- 100 | **A** |

F- Available university services that support achievement in the course:
internet connection, geophysical instruments, field trips, self-equipment (compasses, hummers, GPS, etc…….).

**24. Course Requirements:**

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):
The available geophysical instruments will be introduced.
A Multi-channel seismograph and all accessories
A Resistivity meter
A Gravimeter
A Magnetometer
A Ground Penetration Radar Computers
Students need a computer (or smartphone) and internet access to watch important videos and applications.

**25.References:**

Required book (s), assigned reading and audio-visuals:

- Burger, Sheehan, & Jones, **Introduction to APPLIED GEOPHYSICS: Exploring the Shallow Subsurface**, 2006. W.W. Norton & Company; Reissue 2024 Cambridge University Press
- Reynolds, J. M., **An Introduction to Applied and Environmental Geophysics,** 2nd Ed. 2011, Wiley-Blackwell
- Sharma, P. V., 1997, **Environmental and engineering geophysics**, Cambridge University Press, Cambridge.

B- Recommended books, materials, and media:

- Dobrin, M. B. and Savit, C. H., 1988, **Introduction to Geophysical Prospecting**, McGraw-Hill, New York.

## 26. Additional information:

Introduce different geophysical/geological software/s and mobile applications.

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| Name of the Instructor or the Course Coordinator: | Signature: | Date: |
| …**Dr. Wadah F. Mahmoud**…… | ……..…… | ……..…… |
| Name of the Head of Quality Assurance Committee/ Department | Signature: | Date: |
| **Dr Najel Yaseen**……. | ……..…… | ……..…… |
| Name of the Head of Department | Signature: | Date: |
| ……**Abdalla M. Abu Hamad** …… | ……..…… | ……..…… |
| Name of the Head of Quality Assurance Committee/ School of Science | Signature: | Date: |
| **Prof. Emad A. Abuosba** | ……..…… | ……..…… |
| Name of the Dean or the Director | Signature: | Date: |
| **Prof. Mahmoud I. Jaghoub** | ……..…… | ……..…… |