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**Department of Geology**

**College of Sciences**

**University of Salahaddin**

**Subject: Resistivity Method**

**Course Book –Year 4**

**Lecturer's name: Harbe Anwar (Ph.D)**

**Academic Year: 2020/2021**

**Course Book**

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| **1. Course name** | **Resistivity method** | |
| **2. Lecturer in charge** | **Harbe Anwar** | |
| **3. Department/ College** | **Geology/Sciences** | |
| **4. Contact** | **e-mail: harbe.muhamad@su.edu.krd**  **Tel: +964 750 4730336** | |
| **5. Time (in hours) per week** | **Theory: 2** | |
| **6. Office hours** | **see the schedule on the departments board and my office door** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | [**https://academics.su.edu.krd/profile-admin/index.php?p=dashboard**](https://academics.su.edu.krd/profile-admin/index.php?p=dashboard) | |
| **9. Keywords** | **Geophysics, Electrical, Resistivity** | |
| **10. Course overview:**  Variations in the conductivity or capacitance of rocks form the basis of a variety of electrical and electromagnetic exploration methods, which are used primarily in metallic mineral prospecting. Both natural and induced electrical currents are measured. Direct currents and low-frequency alternating currents are measured in ground surveys, and ground and airborne electromagnetic surveys involving the lower radio frequencies are made.  This course provides basic training on practical field survey techniques and data interpretation to professionals in the earth sciences. It includes a review of the resistivity method followed by instrumentation, survey techniques (including choice of electrode arrays), data processing and interpretation techniques for the 2-D and 3-D resistivity methods. | | |
| **11. Course objective:**  This course provides principle of Resistivity methods, some fundamental definitions, and  descriptions of many of the ways in which resistivity method is used - ways in which specific way or techniques are employed.   An understanding of 1-D, 2-D and 3-D ER methods.   Select the proper equipment and survey parameters (electrode array, spacing, layout) depending on the geology and objective of the survey.   Select the proper settings in computer inversion methods to model data from ERT surveys. | | |
| **12. Student's obligation**  Attendance is required. | | |
| **13. Forms of teaching**  Different forms of teaching will be used to reach the objectives of the course: power point presentations for the head titles, definitions and summary of conclusions, classification of materials and any other illustrations. Besides of that worksheets in the form of problems (mostly got from field data) will be designed to let the chance for practicing on several aspects of the course in the practical classroom. There will be classroom discussions and the lecture will give enough background to translate, solve, analyze, and evaluate problems sets, and different issues discussed throughout the course.  To get the best of the course, it is suggested that the student attend classes as much as possible, read and understand the required lectures immediately after getting them regularly as all of them are foundations for the course. Lecture’s notes on the power point are for supporting and are not enough for you, you should read the text book as well and participate discussions. | | |
| **14. Assessment scheme**  The students are required to do two or three closed book exam during the year besides short exams (quizzes) either in theoretical or practical class. The exams as well as classroom activities and attendance have 50 marks (15 theory and 35 practical). There will be a final theory exam out of 50 marks. | | |
| **15. Student learning outcome:**  The student will be learned how to choose a survey type for solving certain geological problems, how to design the field plan and prepare logistics, how to collect data, process it and interpret in the simplest ways leaving sophisticated points for further studies. | | |
| **16. Course Reading List and References‌:**  **Text books**  1-Kearey, B. and Brooks, M. (1991), An Introduction to Geophysical Exploration: Blackwell Scientific Publications, 254 p. (dept. library)  2-Reynolds, J.M. (1997), An Introduction to Applied and Environmental Geophysics: John Wiley and Sons. 796p. (Gravity and Magnetic parts are present in dept. library)  3-Dorbin, M.B. (1976-1983), Introduction to Geophysical Prospecting: McGraw Hill book comparison. 630p. (dept. library)  4-Grant, F.S. and West, G.F. (1965), Interpretation theory in applied geophysics: New York, McGraw Hill. 583p. (College's library)  5-Mares, S. (1984), Introduction to applied geophysics: D. Reidel Pub. Co. Dordrecht- Boston- Lancaster, 581p. (College's library)  6-Sharma, V.P. (1986), Geophysical Methods in Geology: PTR Prentice Hall, New Jersy, 2nd Ed. 442p. (The Arabic copy is present in dept. library)  7-Sleep, N.H. and Fujitta, K. (1997), Principles of Geophysics: Blackwell Sci. Massachusetts, U.S. 586p. (College's library)  The student should know that the core materials of the course lecture’s notes consists of some of the above books, articles from internet and personal experience. Make sure you should borrow and read some of the materials and prepare well before going for the exams. It is good to make a daily review for given lectures.  Students are encouraged to search for any other materials that may help improve their English language ability in reading, writing, listening and speaking. | | |
| **17. The Topics:** | | **Lecturer's name** |
| Introduction, Electrical methods, Resistivity method definition  Direct current resistivity method, Applications, Advantages and disadvantages of electrical resistivity method  Theoretical basics of electrical resistivity method, Resistance and Apparent Resistivity  Principles of electrical resistivity method  Electrode spreads, Current penetration depth versus electrode spacing  Petro-physical basics, Archie’s law  Field operation of electrical resistivity method, Survey design, Influence of noise during measurement  Data processing, Interpretation (Qualitative and Quantitative)  Types of electrical sounding curves (Qualitative interpretation)  Geo-electrical section (Quantitative interpretation)  Geological interpretation, Limitations of resistivity interpretation  2D electrical resistivity tomography, 2D electrical surveys – Data acquisition, presentation and arrays  2D forward modeling program  2D inversion program  2D Field examples  3D electrical resistivity tomography, 3D electrical surveys – Data acquisition, presentation and arrays | | Harbe Anwar  (2 hrs)  14/10/2021 |
| **18. Practical Topics (If there is any)** | |  |
| 10 to 13 lab works concerning solving problems in Resistivity method including principle theories, corrections, processing and interpretations. | | Sirwa Qader  (3 hrs)  14/10/2021 |
| **19. Examinations:**  ***1. Compositional:*** In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?  Q/ The presence of clay minerals tend to decrease the Resistivity, why?  ***2. Multiple choices:***  In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase.  Q/ Chose the best of the three answers given in brackets ---------------- (5 marks)  1- The electrical method depend on ( natural source, artificial source, both)  2- The resistivity measurements are normally made by injecting current into the ground through two ( current electrodes, wood electrodes, potential electrodes)  3- The unit of resistivity is ( s/m, Ω.m, ρ)  4- The problem with using resistance as a measurement is that it depends not only on the material from which the wire is made, but also (the length of the wire, the diameter of the wire, both).  5- Since all geological structures are 3-D in nature, a fully 3-D resistivity survey using a 3-D interpretation model should in theory give the most (poor data coverage, large area, accurate results). | | |
| **20. Extra notes:**  Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. | | |
| **21. Peer review**  This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.  *(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).* | | |