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**Department of Geology**

**College of Sciences**

**University of Salahaddin**

**Subject: Applied Geophysics**

**Course Book –Year 3**

**Lecturer's name: Abdulwehab Noshad (M.Sc.)**

 **Harbe Anwar (Ph.D)**

**Academic Year: 2020/2021**

**Course Book**

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| **1. Course name** | **Applied Geophysics** |
| **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, Gravity method, Seismic Reflection. Seismic Refraction** |
| **10. Course overview:** The course covers step by step the theoretical principles of using physical phenomena in the exploration of the subsurface in both local and regional scales. Present text books together with print media or internet articles which deal with current subject are used. In the third class the student should know some geological basics which are necessary to understand such as physical geology, mineralogy, petrology as well as some information got from (general geology) of the first class. Moreover the student knows something about physics and mathematics which should be in mind when studying geophysics. The course will give students a better understanding of a number of geophysical methods, each depending upon one or more of the physical properties of rocks such as density, magnetic susceptibility, velocity of seismic waves and electrical properties of rocks and fluids. The student should be able how to get data, process data and interpret in view of geology. He should be also able to use the suitable method/s for each geological problem. The methods which will be covered during the academic year are; gravimetric, magnetometric, seismic and electric |
| **11. Course objective:**This should not be less than 100 words |
| **12. Student's obligation**a. Be prepared for class especially for labs; bring your own calculator, graph paper, ruler, pencil…etc. b. The ones that do the best in the class are those that attend regularlyc. Turn off your cell-phone device inside the classd. Pay attention and write every thing given by the instructor in the class.e. Ask questions and participate discussions.f. Review and compare your notes with your colleagues quietly.g. Utilize textbooks and web resources. h. Do your own work by yourself and use office hours (Not just before the exams).i- Do not cheat and do not help others to cheat. |
| **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 geophysical method 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 to Geophysics**Definitions:Geophysics, Geophysics and GeologyApplied Geophysics, Pure Geophysics, Environmental Geophysics, Passive Geophysical Methods, Active Geophysical Methods, Exploration Geophysics methods**Gravity Method**  Definition, Applications, Principles, Newton’s law, Acceleration of gravityMagnitude of Gravity AnomalyStages of a gravity surveyTypes of gravity measurements; Absolute and Relative, Units-Gravity Corrections (Reductions): Instrument drift, Free Air Correction, Bouguer Correction, Latitude  Correction and Terrain (Topographic) CorrectionGravimeters: stable and unstableField Activities:Interpretation of Gravity DataSeparation of Anomalies Graphical Residualizing, Mean Value MethodQualitative and Quantitative interpretations**Magnetic Method**Introduction, Basic concepts and definitions: Colom’s law, permeability, magnetic field, Intensity of magnetization,  Magnetic susceptibility, Curie temperature, Feromagnetic materials and  Remnants.Origin of Geomagnetic field and elementsMagnetic anomalies, how do they form?MagnetometersField procedureVariations of field with time and CorrectionsInterpretation of magnetic data**Seismic Method**Introduction, Wave CharacteristicsSeismic Waves, Stress and Strain, ElasticityTypes of Seismic WavesBody wavesSurface wavesSeismic wave velocitiesTime average equation to estimate rock porosityRay paths in layered mediaReflection and transmission of normally incident seismic raysReflection coefficients, Reflection and refraction of obliquely incident raysSnell's lawCritical refraction Seismic data acquisition systemsSeismic energy sources, TransducersSeismic reflection surveyingGeometry of reflected ray pathsAverage velocity and total one way travel timeSingle horizontal ReflectorIntercept time, Velocity determinationMoveout, MultiplesData acquisitionMultiple shot points and, Common midpoint, Common midpoint gatherSeismic refraction surveyingGeometry of the refracted ray paths, Travel timesCalculation of the depth of the refractorMultilayer caseDipping layer caseTravel time calculations for a dipping refractor | Abdulwehab NoshadHarbe Anwar (2 hrs)14/10/2020 |
| **18. Practical Topics (If there is any)** |  |
| First semester: 10 to 13 lab works concerning solving problems in gravity and magnetic methods including principle theories, corrections, processing and interpretations.Second semester: 10 to 13 lab works concerning solving problems in seismic and resistivity methods including theories principles, corrections, processing and interpretations. | Muhamad Ali(3 hrs)14/10/2020 |
| **19. Examinations:*****1. Compositional:*** In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?Q/ Give reasons (in brief) for the following ---------------------------(6 marks) 1- The equatorial radius is greater than polar.2- We return back to base station every 1-1.5 hours.***2.******True or false type of exams:***In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. *Q/ Correct the following statements if they were not. No marks given without correction-------------------------------- (5 marks)*1-Free Air Gradient is equal to 30.86 Gravity Unit.2-Bouguer Correction value is 0.004191ρ mGal.***3. 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. A/ Chose the best of the three answers given in brackets by underlining them---------------- (9 marks)1- Gravimeters give direct measurements of (acceleration, force, potential).2- Gravity value in different points on the earth’s surface will be the same if the earth was (of homogeneous density, perfectly sphere and not rotating, all together) |
| **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).*  |