MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information****معلومات المادة الدراسية** |
| **Module Title** | معالجة الخرائط الجيوفيزيائيةGeophysical Maps Processing | **Module Delivery** |
| **Module Type** | Core | * **☒ Theory**
* **☒ Lecture**
* **☒ Lab**
* **☐ Tutorial**
* **☐ Practical**
* **☒ Seminar**
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| **Module Code** | GEO42133 |
| **ECTS Credits**  | 6 |
| **SWL (hr/sem)** | 150 |
| **Module Level** | UGII | UGIV | **Semester of Delivery** | Eight |
| **Administering Department** | Department of Geophysics |  **College** | College of Geophysics and Remote Sensing |
| **Module Leader** | Assistant Professor Dr.Wadhah Mahmood Shakir | **e-mail** | wadhah.mah@kus.edu.iq  |
| **Module Leader’s Acad. Title** | Assistant Professor Doctor of Geophysics | **Module Leader’s Qualification** | PhD. In Geology / Geophysics |
| **Module Tutor** | ---- | **e-mail** | ----- |
| **Peer Reviewer Name** | ----- | **e-mail** | ----- |
| **Scientific Committee Approval Date** | Approved | **Version Number** |  |

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| **Relation with other Modules****العلاقة مع المواد الدراسية الأخرى** |
| **Prerequisite module** | Fundamentals of Geophysics | **Semester** | UGI , 2nd Semester  |
| **Co-requisites module** | Gravity method , Magnetic Method , Electrical Methods , Radiometric Method  | **Semester** | UGI , UGII , UGIII , UGIV , 1st and 2nd Semesters |

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| **Module Aims, Learning Outcomes and Indicative Contents****أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** |
|  **Module Aims****أهداف المادة الدراسية** | * **The Geophysical Maps Processing course is aiming to achieve the following:**
* **1- The wide scope of applying different geophysical methods to explore the Earths crustal characteristics and investigating subsurface geological features and targets by studying the Earth’s natural fields variation and artificial applied geophysical investigation fields processing and interpretation .**
* **2- 2D Data acquisition, processing and Interpretation. This would be helpful in obtaining results which used to detect the at surface, near surface and subsurface rocks different geophysical parameters.**
* **3- Improving the student’s qualifications through the application of mathematical and computer software skills which related to the processing and interpretation of geophysical data.**
* **4- Improvement of student qualifications as an explorer and as a detective geophysicist who detects the subsurface geological evidences and to apply this scientific topic precisely in order to exploit it in different goals like: studying the natural fields of earth rocks and its variations, Basement crustal rocks investigations, petrol and mineral radiometric investigations, Engineering and environmental Investigations ….etc.**
* **5- Understanding the ambiguity causes which related to the results of geophysical surveying data and looking for its solutions. This includes the assisting with the results of different digital filtering and visualization interpolation / extrapolation methods and searching for the most suitable two dimensional contouring method which helps in visualizing subsurface targets, in order to reach to the best logical, correct and less ambiguous geophysical interpretations.**
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| **Module Learning Outcomes****مخرجات التعلم للمادة الدراسية** | 1. **Attendance of theoretical lectures.**
2. **Attendance of practical part application Laboratories.**
3. **Presenting seminars within the material topic.**
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| **Indicative Contents****المحتويات الإرشادية** | * **Characteristics of Numerical 2D Modeling**
* **General conditions of creating a Geophysical Map**
* **General Gridding Methods Recommended for Geophysical Mapping**
* **Importance of Applying Different Interpolation – Extrapolation Methods**
* **The most commonly used interpolation methods**
* **Comparison among different types of interpolation passing through 2D data points.**
* **1st and 2nd Directional Horizontal Derivative Filtering.**

Application of Gradient Operator on 2D data  |

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| **Learning and Teaching Strategies****استراتيجيات التعلم والتعليم** |
| **Strategies** | 1. **Theoretical lecturing which includes educating the scientific material in the topic of Geophysical maps Processing. This includes the explanation of 2D maps or surfaces digital filtering and visualizing causative subsurface bodies principle of application, Data handling with computer software, calculus processing , targets visualization and correlating different profiles for different visualizing methods.**
2. **A practical part laboratory includes the processing of geophysical data in different methods to obtain the results. The results would be displayed and interpreted, discussed by the student who ought to present his laboratory report in a weekly basis.**
3. **Quizzes in a weekly basis.**
4. **Midterm examination.**
5. **Final theoretical and practical examination.**
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| **Student Workload (SWL)****الحمل الدراسي للطالب** |
| **Structured SWL (h/sem)****الحمل الدراسي المنتظم للطالب خلال الفصل** | 114 |  |  |
| **Unstructured SWL (h/sem)****الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 36 |  |  |
| **Total SWL (h/sem)****الحمل الدراسي الكلي للطالب خلال الفصل** | 150 |

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| **Module Evaluation****تقييم المادة الدراسية** |
| **As** | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 2 | 10 | 10 | 10 |
| **Assignments** | 2 | 10 | 10 | 10 |
| **Projects / Lab.** | 1 | 10 | 10 | 10 |
| **Report** | 1 | 10 | ---- | ---- |
| **Summative assessment** | **Midterm Exam** | 2 hr | 10 | 20 | 20 |
| **Final Exam** | 2hr | 50 | 50 | 50 |
| **Total assessment** | 100% (100 Marks) | 100 | 100 |

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| **Delivery Plan (Weekly Syllabus)****المنهاج الاسبوعي النظري** |
| **Week**  | **Material Covered** |
| **Week 1** | **An introduction about the Importance of using calculus 2D models as maps ,surfaces and profiles** |
| **Week 2** | **Characteristics of Numerical 2D Modeling** |
| **Week 3** | **General conditions of creating a Geophysical Map** |
| **Week 4** | **General Gridding Methods Recommended for Geophysical Mapping** |
| **Week 5** | **Single radionuclide’s , decay series radio-nuclides and radio-nuclides series minerals** |
| **Week 6** | **Importance of Applying Different Interpolation – Extrapolation Methods** |
| **Week 7** | **Kriging and Inverse Distance to a power in visualizing Geophysical Data** |
| **Week 8** | **Minimum Curvature and Radial Basis to a function in visualizing Geophysical Data** |
| **Week 9** | **Comparison among different interpolation methods in distinguishing 2D geophysical anomalies** |
| **Week 10** | **Natural neighbor and Nearest neighbor interpolation methods** |
| **Week 11** | **Interpolation based on a Triangulated Irregular Network (TIN) method** |
| **Week 12** | Polynomial Regression and regional geophysical fields visualization |
| **Week 13** | **Surface definition and visualization of regional fields and how to deduce 2D residual fields** |
| **Week 14** | **1st Directional Horizontal Derivative Filtering.** |
| **Week 15** | **2nd Directional Horizontal Derivative Filtering.** |
| **Week 16** | **Gradient Operator Filtering** |

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| **Delivery Plan (Weekly Lab. Syllabus)****المنهاج الاسبوعي للمختبر** |
| **Week**  | **Material Covered** |
| **Week 1-2** | **Kriging , Inverse distance , Minimum Curvature and Radial Basis to Function interpolation/ extrapolation methods application on 2D resistivity data** |
| **Week 3-4** | **Kriging , Inverse distance , Minimum Curvature and Radial Basis to Function interpolation/ extrapolation methods application on Bouguer anomaly data** |
| **Week 5-6** | **Kriging , Inverse distance , Minimum Curvature and Radial Basis to Function interpolation/ extrapolation methods application on Magnetic data** |
| **Week 7-8** | **Different orders of Polynomial Regression application on gravity and magnetic data and regional fields deduction** |
| **Week 9-10** | **Residual anomaly deduction by using different polynomial regression orders regional fields** |
| **Week 11-12** | **Regional and Residual anomaly maps 1st and 2nd Derivative 2D filtering** |
| **Week 13-14** | **Regional and Residual anomaly maps Gradient filtering** |

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| **Learning and Teaching Resources****مصادر التعلم والتدريس** |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | **-Van den Berg A.P., 2015, Computational geophysics, Institute of Earth Sciences Utrecht University, 116 pages.****- Cressie, Noel A. C., 1991, Statistics for Spatial Data, New York: John Wiley & Sons 900 pp.****-Schwartz, Abraham, (1974), Calculus and Analytic Geometry, 3rd edition, Holt, Rinehart, and Winston, New York, 1140 pp.** | Not all |
| **Recommended Texts** | **- Van den Berg A.P., 2015, Computational geophysics, Institute of Earth Sciences Utrecht University, 116 pages.****-Bakkali1 S. and Amrani M. 2008, About the use of spatial interpolation methods to denoising Moroccan resistivity data phosphate “Disturbances” map , Acta Montanistica Slovaca Ročník 13 (2008), číslo 2, 216-222.****-Briggs I.C., 1974, Machine contouring using minimum curvature. Geophysics 39:39-48.****- Chen, W., Wang, X., Zhong, T., 1996, The structure of weighting coefficient matrices of harmonic differential quadrature and its applications, Commun. Numer. Methods Engng., 12: 455-460.****- Cressie, Noel A. C., 1991, Statistics for Spatial Data, New York: John Wiley & Sons 900 pp.****-Franke, R., 1982, Scattered Data Interpolation: Test of Some Methods, Mathematics of Computations, 33(157):181.** **- Franke, R and Nielson, G., 1980, Smooth Interpolation of Large Sets of Scattered Data, International Journal for Numerical Methods in Engineering, 15(2):1691.** **-Hugo Ledoux and Christopher Gold, 2001,”’ Spatial Interpolation: From Two to Three Dimensions “, GIS Research Centre, School of Computing** **University of Glamorgan, Pontypridd, CF37 1DL, Wales, UK ,4(2):148–159 .****-Briggs IC. Machine Contouring Using Minimum Curvature [J], Geophysics, 1974,39(1):39.****- Barnett V. Interpreting multivariate data [M].New York, 1981:21.****- Franke R. Scattered Data Interpolation: Test of Some Methods [J]. Mathematics of Computations, 1982,33(157):181.****-Franke R, Nielson G. Smooth Interpolation of Large Sets of Scattered Data [J]. International Journal for Numerical Methods in Engineering, 1980,15(2):1691.****-Lee DT, Schachter BJ. Two Algorithms for Constructing a Delaunay Triangulation, International Journal of Computer and Information Sciences [J].1980,9(3):219.****- SURFER on-line instructions manual** **- Al-Khafaji Wadhah M. S. , Nawal A. Alridha , Ameen I. Al-Yasi and Suad A. Abdulridha ,2016,The Use of Interpolation Filtering Approach of Resistivity Data to Delineate Fresh Groundwater Aquifers South of Sinjar Anticline Area, Iraqi Journal of Groundwater, Vol.1, No.0, p 43 – 52****- AL-Khafaji Wadhah M. Shakir , 2014 , A geophysical study to evaluate the groundwater reserve and structural situation of south Sinjar anticline region – NW Iraq , PhD, dissertation, University of Baghdad- college of Science – department of Geology, 223 pages.****-Schwartz, Abraham, (1974), Calculus and Analytic Geometry, 3rd edition, Holt, Rinehart, and Winston, New York, 1140 pp.****-Tuma, Jan J., (1979), Engineering Mathematics Handbook, 2nd edition, McGraw-Hill Book Company, New York, 394 pp.** | Not all |
| **Websites** | None  |

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|  **Grading Scheme****مخطط الدرجات** |
| **Group** | **Grade** | التقدير | **Marks (%)** | **Definition** |
| **Success Group****(50 - 100)** | **A -** Excellent | **امتياز** | 90 - 100 | Outstanding Performance |
| **B -** Very Good | **جيد جدا**  | 80 - 89 | Above average with some errors |
| **C -** Good | **جيد** | 70 - 79 | Sound work with notable errors |
| **D -** Satisfactory | **متوسط**  | 60 - 69 | Fair but with major shortcomings |
| **E -** Sufficient | **مقبول**  | 50 - 59 | Work meets minimum criteria |
| **Fail Group****(0 – 49)** | **FX –** Fail | **راسب (قيد المعالجة)** | (45-49) | More work required but credit awarded |
| **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
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| **Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |