MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information****معلومات المادة الدراسية** |
| **Module Title** | Radiometric Method الطريقة الاشعاعية  | **Module Delivery** |
| **Module Type** | Core | * **☒ Theory**
* **☒ Lecture**
* **☒ Lab**
* **☐ Tutorial**
* **☐ Practical**
* **☒ Seminar**
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| **Module Code** | GEO41127 |
| **ECTS Credits**  | 6 |
| **SWL (hr/sem)** | 150 |
| **Module Level** | UGII | UGIV | **Semester of Delivery** | Seven |
| **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** | ------- | **Semester** | ------ |

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| **Module Aims, Learning Outcomes and Indicative Contents****أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** |
|  **Module Aims****أهداف المادة الدراسية** | * **The Radiometric geophysical Method course is aiming to achieve the following:**
* **1- The wide scope of application of Radiometric geophysical method for exploring the Earths crustal characteristics and investigating subsurface geological features and targets by studying the Earth’s natural radiometric field variations.**
* **2- Radiometric data acquisition, processing and Interpretation. This would be helpful in obtaining results which used to detect the at surface, near surface and subsurface rocks radioactivity.**
* **3- Improving the student’s qualifications through the application of manual, mathematical and computer software skills which related to the processing and interpretation of geophysical data.**
* **4- Improvement of student qualifications as an explorer and 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 radioactivity of earth rocks and its variations, Basement crustal rocks radioactivity 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 other geophysical methods and searching for strong evidences which helps in solving interpretational problems, 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** | * **Introduction**
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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 Radiometric geophysical method. This includes the explanation of the method principle of application, instrumentation and data acquisition, processing and interpretation.**
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** | 100 |  |  |
| **Unstructured SWL (h/sem)****الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 50 |  |  |
| **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 Radiometric geophysical method and its applications in geophysical exploration and the methods of field surveying and measurement** |
| **Week 2** | **The Radioactive decay and types of radiometric rays** |
| **Week 3** | **Radioactive minerals in rocks** |
| **Week 4** | **Radiation measuring units and radiation natural and artificial sources** |
| **Week 5** | **Single radionuclide’s , decay series radio-nuclides and radio-nuclides series minerals** |
| **Week 6** | **Radiation measurement instruments**  |
| **Week 7** | **Geophysical Radiometric Field Surveys**  |
| **Week 8** | **Airborne radiometric Survey and radiometric survey design** |
| **Week 9** | **Counting Statistics , line spacing and type of detector selection** |
| **Week 10** | **Spectrometer calibration and data corrections**  |
| **Week 11** | **Acquisition , Processing and Interpretation of Radiometric maps and profiles(part1)** |
| **Week 12** | **Acquisition , Processing and Interpretation of Radiometric maps and profiles(part2)** |
| **Week 13** | **Acquisition , Processing and Interpretation of Radiometric maps and profiles(part3)** |
| **Week 14** | **Airborne Radiometric Survey of Iraq (Part1)** |
| **Week 15** | **Airborne Radiometric Survey of Iraq (Part2)** |
| **Week 16** | **Qualitative and Quantitative interpretations for some radiometric anomalies in Iraq** |

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| **Delivery Plan (Weekly Lab. Syllabus)****المنهاج الاسبوعي للمختبر** |
| **Week**  | **Material Covered** |
| **Week 1-2** | **Aero-Radiometric data Mapping and profiling (part1)** |
| **Week 3-4** | **Aero-Radiometric data Mapping and profiling (part2)** |
| **Week 5-6** | **Ground Radiometric data Mapping and profiling (part1)** |
| **Week 7-8** | **Ground Radiometric data Mapping and profiling (part2)** |
| **Week 9-10** | **Residual Radiometric anomaly deduction and Qualitative interpretation** |
| **Week 11-12** | **Residual Radiometric anomaly Quantitative interpretation** |
| **Week 13-14** | **Calculations related to the radiometric anomaly causative body** |

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| **Learning and Teaching Resources****مصادر التعلم والتدريس** |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | **Kearey P. , Brooks M. , Hill I.,2002,”An Introduction to Geophysical Exploration”, 3rd ed., Blackwell Science Ltd., USA, 281 pages.****-** [**http://spmphysics.onlinetuition.com.my/2013/08/geiger-muller-tube.html**](http://spmphysics.onlinetuition.com.my/2013/08/geiger-muller-tube.html)**-** [**https://us.vwr.com/store/product/16550066/geiger-counter**](https://us.vwr.com/store/product/16550066/geiger-counter)**-** [**https://www.ga.gov.au/scientific-topics/disciplines/geophysics/radiometrics**](https://www.ga.gov.au/scientific-topics/disciplines/geophysics/radiometrics)**-** [**https://www.ntanet.net/how-do-sodium-iodide-scintillation-detectors-work**](https://www.ntanet.net/how-do-sodium-iodide-scintillation-detectors-work)**-**[**https://satisgeo.com/spectrometers/gs-512i-portable-gamma-ray-spectrometer/**](https://satisgeo.com/spectrometers/gs-512i-portable-gamma-ray-spectrometer/)**- Abdoh, A. & Pilkington, M. (1989) Radon emanation studies of the Ile Bizard Fault, Montreal. *Geoexploration*, 25, 341–54.****- Telford,W.M. (1982) Radon mapping in the search for uranium.*In*: Fitch, A.A. (ed.), *Developments in Geophysical Exploration Methods*.Applied Science, London, 155–94.** | Not all |
| **Recommended Texts** | **- Al-Khafaji W. M. S. and Al-Dabbagh H.A., 2019, A geophysical correlation between near-surface radioactivity and subsurface faults detected by gravity method for a region located in the western desert of Iraq, Iranian Journal of Earth Sciences, Vol. 11, No. 2, 2019, 95-103.****- Al-Nahab M, Hanafi A (1978) a Ground spectrometric survey at Shithatha, State Department of Geological Survey and Mining, Laboratory Report No. 929, 21 pages.****- Al-Marsoumi AH (1982) Geochemical Detection of radioactive Materials Accumulation at Heet- shithatha region, Ph.D. Dissertation, University of Baghdad, College of Science, (unpublished).****- Al-Bassam KS, Beni TJ, Ameen GF, Al-Basrawi NH, Raheem AS (2013) Environmental Geochemical and Radiometric Survey in the Vicinity of Abu Skhair Uranium Mine, Najaf, Iraq, *Iraqi Bulletin Of Geology and Mining* 9:131-149.****- Al-Atia M, Mahdi M (2005) Origin and Mode of Formation of Abu Skhair uranium deposits, middle Iraq, *Iraqi Bulletin of Geological Mining* 1:15-27 (in Arabic).****- Mahdi M, Al-Tamimi M (2009) Preliminary evaluation of the uranium contaminant level in the groundwater of the Iraqi Southern and Western Deserts, *Iraqi Bulletin Of Geology and Mining* 5:21-28, (in Arabic).****- Kearey P. , Brooks M. , Hill I.,2002,”An Introduction to Geophysical Exploration”, 3rd ed., Blackwell Science Ltd., USA, 281 pages.****-** [**http://spmphysics.onlinetuition.com.my/2013/08/geiger-muller-tube.html**](http://spmphysics.onlinetuition.com.my/2013/08/geiger-muller-tube.html)**-** [**https://us.vwr.com/store/product/16550066/geiger-counter**](https://us.vwr.com/store/product/16550066/geiger-counter)**-** [**https://www.ga.gov.au/scientific-topics/disciplines/geophysics/radiometrics**](https://www.ga.gov.au/scientific-topics/disciplines/geophysics/radiometrics)**-** [**https://www.ntanet.net/how-do-sodium-iodide-scintillation-detectors-work**](https://www.ntanet.net/how-do-sodium-iodide-scintillation-detectors-work)**-**[**https://satisgeo.com/spectrometers/gs-512i-portable-gamma-ray-spectrometer/**](https://satisgeo.com/spectrometers/gs-512i-portable-gamma-ray-spectrometer/)**- Abdoh, A. & Pilkington, M. (1989) Radon emanation studies of the Ile Bizard Fault, Montreal. *Geoexploration*, 25, 341–54.****- Telford,W.M. (1982) Radon mapping in the search for uranium.*In*: Fitch, A.A. (ed.), *Developments in Geophysical Exploration Methods*.Applied Science, London, 155–94.****- Khattak N. U., Asif Khan M., Nawab Ali and Muntazir Abbas S., 2011, Radon Monitoring for geological exploration: A review, Journal of Himalayan Earth Sciences 44(2) , 91-102****-**[**https://geosiamservices.com/services/airborne-services/airborne-radiometric-survey/**](https://geosiamservices.com/services/airborne-services/airborne-radiometric-survey/)* **Grasty R.L. 1974, Application of Gamma radiation in remote sensing, Dept. of Energy, mines and resources , Geosurv of Canada.**
* **Hamza K.A. and Alkhatib G.H. , 1989, Nuclear Energy and their uses, publications of the IONE, 2nd Ed. , Baghdad.**
* **Baird G. and Nargowalla S. , 1982 , Nuclear Exploration Techniques, application brief, pp1-75, pub. By Scintrex, Canada.**
* **Al-Dabbagh H.A. , 1999, Qualitative Interpretation of Regional Radiometric Airborne Survey for Gaara – higher Euphrates Region Western Iraq, PhD. Thesis , University of Baghdad, College of Science , Dept. of Geology, 142 pages.**
* **Telford W. M. , Geldart L.P. , Sheriff R.E. , Keys R.E. 1976, Applied Geophysics, Cambridge Univ. Press.**
* **Mar Shield , Custom radiation shielding products,2022** [**https://marshield.com/choosing-the-right-radiation-shielding-factors-considered-by-a-shielding-materials-expert/**](https://marshield.com/choosing-the-right-radiation-shielding-factors-considered-by-a-shielding-materials-expert/)
* **AL-Enezi M. ,2017,** **Klein-Nishina Electronic Cross Section, Compton Scattering Cross Section, Linear Attenuation Coeffiecient And Build Up Factor Of Wax For Radiation Protectio And Safety, MSc. Thesis , Ball State University, Muncie, Indiana, 32 pages.**
* **Alberts J.J. , Wahlgren M.A. , Orlandini K.A. , and Durbahn C.A. , 1989 , The distribution of Pu239-240 , Pu 238 , Am 241 and Cs137 among chemically defined components of sediments setteling particles and plankton of lake Michigan , Journal of Environmental radioactivity, 9:89-103**
* **Eisenbud M. and Gesell T. , 1997, environmental radioactivity, 4th Ed. Academic Press , USA.**
* **Darnley A.G. 1973, Airborne Gamma ray survey techniques present and future in Uranium Exploration methods , Proc. Series, IAEA., Vienna, pp.67-108.**
* **Ashkenazy Y. , 2016,The surface temperature of Europa, Preprint submitted to Physica A**, DOI:[10.1016/j.heliyon.2019.e01908](http://dx.doi.org/10.1016/j.heliyon.2019.e01908) ,17 pages.
* **Al-Bassam K.S. , 1988, Geochemical investigation of Potassium anomalies in the western desert, Iraq, Iraqi Journal of Science, Vol.29 No.3**.
* **Merkel, B., und Sperling, B. (1998), *Schriftenreihe des Deutschen Verbandes für Wasserwirtschaft und Kulturbau (DVWK)*, DVWK, Schriften 117: Hydrogeochemische Soffsysteme Teil II,**[**ISSN**](https://en.wikipedia.org/wiki/ISSN_%28identifier%29)[**0170-8147**](https://www.worldcat.org/issn/0170-8147)

[Zeki Ünal Yümün](https://www.researchgate.net/profile/Zeki-Yuemuen-2), [Namık Kemal Üniversitesi](https://www.researchgate.net/institution/Namik-Kemal-Ueniversitesi), [Erol Kam](https://www.researchgate.net/profile/Erol-Kam),[Yildiz Technical University](https://www.researchgate.net/institution/Yildiz_Technical_University) [Melike Önce](https://www.researchgate.net/profile/Melike-Oence), [Namık Kemal Ünivers](https://www.researchgate.net/institution/Namik-Kemal-Ueniversitesi), 2020,Gamma Dose Values Of Stratigraphic Units Surfaced In BehramkaleÇanakkale) Zeytinli (Edremit-Balikesir) Section Of Kaz Mountains, Journal of the Turkish chemical society , 2020, 7(1): 207-214.* **Robert W.L.,1974,Encyclopedia of Minerals, Van Nostard, Reinhod Co.**
* **Mamdouh A.H. , 2000, Introduction about Uranium ores and and nuclear fuel cycle, the training program of nuclear fuel cycle from ore to yellow concentration, the Arabian agency of nuclear energy , Cairo.**
* [**https://www.radiansa.com/en/radon/radon-detectors.htm**](https://www.radiansa.com/en/radon/radon-detectors.htm)
* **Telford,W.M., Geldart, L.P. & Sheriff, R.E. (1990) *Applied Geophysics*,2nd edn. Cambridge University Press, Cambridge.**
* **Al- Hili A. M. & Othman M. A.,2021, Determination of Uranium, Thorium and Potassium Concentrations in Different Clay Types by Spectral Gamma Ray Log, in Hawaz Formation in Well O6iNC115, Murzuq basin, SW Libya, University Bulletin – ISSUE No.23- Vol. (3) – September- 2021**
* [**https://www.geoexplo.com/airborne\_survey\_workshop\_rad.html**](https://www.geoexplo.com/airborne_survey_workshop_rad.html)
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| **Websites** | <https://www.researchgate.net/publication/369650051_Radiometric_method_in_Geophysics_Lectures>  |

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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. |