MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
| **Module Title** | Well Logging | | | | **Module Delivery** | | |
| **Module Type** | Core | | | | * **☒ Theory** * **☒ Lecture** * **☒ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | GEO35119 | | | |
| **ECTS Credits** | 5 | | | |
| **SWL (hr/sem)** | 125 | | | |
| **Module Level** | | III | **Semester of Delivery** | | | | FIVE |
| **Administering Department** | | Geophysics | **College** | College of Geophysics and Remote Sensing | | | |
| **Module Leader** | Dr. Rami M. Idan | | **e-mail** | [Ramisc3@kus.edu.iq](mailto:Ramisc3@kus.edu.iq) | | | |
| **Module Leader’s Acad. Title** | | Assistant Professor | **Module Leader’s Qualification** | | | | Petroleum geology |
| **Module Tutor** | Dr. Rami M. Idan | | **e-mail** | [Ramisc3@kus.edu.iq](mailto:Ramisc3@kus.edu.iq) | | | |
| **Peer Reviewer Name** | | Dr. Rami M. Idan | **e-mail** | [Ramisc3@kus.edu.iq](mailto:Ramisc3@kus.edu.iq) | | | |
| **Scientific Committee Approval Date** | | 16 / 6 / 2023 | **Version Number** | | | 1 | |

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| **Relation with other Modules**  **العلاقة مع المواد الدراسية الأخرى** | | | |
| **Prerequisite module** | Fundamentals of Geophysics GEO1102 | **Semester** | One |
| **Co-requisites module** | Null | **Semester** | - |

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| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| **Module Aims**  **أهداف المادة الدراسية** | This module deals with:  1. To provide detailed information about the subsurface geology and rock formations to aid in the exploration and production of oil and gas reservoirs.  2. To identify and evaluate potential hydrocarbon-bearing zones within a well, helping to optimize drilling and completion strategies.  3. To determine the physical and chemical properties of the rocks and fluids in the subsurface, such as porosity, permeability, lithology, and fluid saturation.  4. To monitor the wellbore condition and integrity, including detecting any potential problems such as formation damage, fluid influx, or wellbore instability.  5. To assist in reservoir characterization and modeling, allowing for better understanding of reservoir behavior and performance.  6. To provide real-time data for decision-making during drilling and completion operations, helping to improve operational efficiency and reduce costs.  7. To ensure compliance with regulatory and environmental standards by providing accurate and reliable data on the subsurface environment. |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | 1. Understand the principles and techniques of well logging and how it is used in the oil and gas industry.  2. Interpret well logging data to identify and evaluate potential hydrocarbon-bearing zones within a well.  3. Analyze the physical and chemical properties of subsurface rocks and fluids using well logging data.  4. Evaluate wellbore condition and integrity using well logging data.  5. Apply well logging data to assist in reservoir characterization and modeling.  6. Utilize real-time well logging data for decision-making during drilling and completion operations.  7. Understand the importance of well logging in ensuring compliance with regulatory and environmental standards. |
| **Indicative Contents**  **المحتويات الإرشادية** | 1. Introduction to well logging and its role in the oil and gas industry  - Definition and purpose of well logging  - Importance of well logging in reservoir evaluation and management  - Historical development of well logging techniques  2. Types of well logging tools and techniques  - Wireline logging tools and their applications  - Logging while drilling (LWD) and measurement while drilling (MWD) technologies  - Advanced well logging techniques such as nuclear magnetic resonance (NMR) and acoustic logging  3. Interpretation of well logging data for identifying hydrocarbon-bearing zones  - Logging data acquisition and quality control  - Identification of lithology, porosity, permeability, and hydrocarbon saturation from well logging data  - Integration of well logging data with seismic and core data for reservoir characterization  4. Analysis of rock and fluid properties using well logging data  - Determination of rock types, mineralogy, and texture  - Evaluation of fluid properties such as viscosity, density, and resistivity  5. Wellbore condition evaluation using well logging data  - Detection of formation damage, fractures, and borehole instability  - Assessment of wellbore integrity and cement bond quality  6. Reservoir characterization and modeling using well logging data  - Construction of reservoir models based on well logging data  - Prediction of reservoir performance and recovery factors  7. Real-time well logging data for decision-making during drilling and completion operations  - Application of LWD and MWD technologies for real-time formation evaluation  - Optimization of drilling parameters based on continuous well logging data  8. Regulatory and environmental standards for well logging  - Compliance with industry regulations and best practices for well logging operations  - Environmental considerations and mitigation measures for well logging activities  9. Case studies and practical applications of well logging in the oil and gas industry  - Examples of successful reservoir evaluation and management using well logging data  - Challenges and lessons learned from well logging projects in different geological settings |

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| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| **Strategies** | The learning and teaching strategies for the well logging module will include a combination of theoretical concepts, practical applications, case studies, and hands-on exercises. The following strategies will be employed:  1. Lectures: The module will begin with lectures to introduce the fundamental concepts of well logging, including the definition, purpose, historical development, and types of well logging tools and techniques. These lectures will provide a theoretical foundation for understanding the role of well logging in the oil and gas industry.  2. Practical demonstrations: Hands-on demonstrations of wireline logging tools, LWD, MWD, and advanced well logging techniques will be conducted to familiarize students with the equipment and technology used in well logging operations. This will help students understand how different tools and techniques are utilized in real-world scenarios.  3. Case studies: Real-life case studies of well logging projects in various geological settings will be presented to illustrate the practical applications of well logging in reservoir evaluation and management. These case studies will highlight the challenges faced, the solutions implemented, and the lessons learned from different well logging projects.  4. Data interpretation exercises: Students will be given the opportunity to interpret well logging data sets to identify hydrocarbon-bearing zones, analyze rock and fluid properties, evaluate wellbore conditions, and characterize reservoirs. These exercises will allow students to apply their knowledge of well logging techniques to real data and make informed decisions based on their interpretations.  5. Field trips: Visits to well logging facilities or operational drilling sites may be organized to give students a first-hand experience of the equipment, technology, and processes involved in well logging operations. This will provide practical exposure and enhance students' understanding of the real-world application of well logging techniques.  6. Group projects: Collaborative group projects may be assigned to students to work on reservoir characterization and modeling using well logging data. This will encourage teamwork, critical thinking, and problem-solving skills as students analyze and interpret well logging data to construct reservoir models and predict reservoir performance.  7. Guest lectures: Industry experts and professionals with experience in well logging operations may be invited to deliver guest lectures, sharing their insights, best practices, and practical tips for successful well logging projects. This will provide students with valuable industry perspectives and networking opportunities. |

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| **Student Workload (SWL)**  **الحمل الدراسي للطالب** | | | |
| **Structured SWL (h/sem)**  **الحمل الدراسي المنتظم للطالب خلال الفصل** | 81 |  |  |
| **Unstructured SWL (h/sem)**  **الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 44 |  |  |
| **Total SWL (h/sem)**  **الحمل الدراسي الكلي للطالب خلال الفصل** | 125 | | |

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| **Module Evaluation**  **تقييم المادة الدراسية** | | | | | |
| **As** | | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 3 | 5% (5) | All |  |
| **Assignments** | 5 | 10% (10) | All |  |
| **Projects / Lab.** | 7 | 15% (15) | All |  |
| **Report** | 2 | 10% (10) | All |  |
| **Summative assessment** | **Midterm Exam** | 2hr | 10% (10) | Determine in time |  |
| **Final Exam** | 4hr | 50% (50) |  |  |
| **Total assessment** | | | 100% (100 Marks) |  |  |

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| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| **Week** | **Material Covered** |
|  | Introduction |
|  | Borehole environment |
|  | Resistivity and conductivity logs: |
|  | * The Laterolog |
|  | * Induction Logs |
|  | * Microresistivity Logs |
|  | Gamma ray logs |
|  | Porosity logs: |
|  | * Density log |
|  | * Neutron log |
|  | * Sonic logs |
|  | Self-potential SP logs |
|  | Image logs |
|  | Quick Look Methods |
|  | Revision |
|  | **Preparatory week before the final Exam** |

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| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| **Week** | **Material Covered** |
|  | GR log |
|  | Porosity logs  1- Density log  2- Neutron log  3- sonic log |
|  | -porosity types |
|  | - Resistivity logs |
|  | -saturation determination |
|  | -log charts |
|  | - MN cross plot |

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| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | 1- The Geological Interpretation of well logs (2000), Malcolm Rider (second edition), Whittles Publishing.  2- Basic Well Log Analysis, (2004), George Asquith and Daniel Krygowski, (second edition), AAPG. | Y |
| **Recommended Texts** | 1- Principles of Wireline Logging Technology, China National Logging Corporation (CNLC).  2- Log Analysis of Subsurface Geology (1985) John H. Doveton.  3- Well Logging for Earth Scientists, 2nd Edition (2008), by Darwin V. Ellis and Julian M. Singer.  4- Well Logging and Formation Evaluation (2005), by Toby Darling.  5- Brown, A., 2004, Interpretation of three-dimensional seismic data; AAPG Memoir 42, 534 p. | y |
| **Websites** | <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/well-logging> | |

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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. | | | | |