

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Geostatistics		Module Delivery
Module Type	Core		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar
Module Code	PE323		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	2	Semester of Delivery	
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	e-mail		
Module Leader's Acad. Title	Professor	Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PE223	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	By the end of this module, students will be able to: 1. Apply fundamental geostatistical methods to analyze and interpret spatial petroleum data. 2. Perform variogram modeling and spatial interpolation techniques to estimate reservoir properties. 3. Utilize applied mathematics tools, including linear algebra, calculus, and probability, for petroleum engineering problems. 4. Implement stochastic simulation methods, particularly Monte Carlo techniques, to quantify uncertainty in reservoir characterization. 5. Understand and apply basic drilling modeling concepts to support drilling planning and optimization. 6. Integrate geostatistical and mathematical approaches to improve decision-making in exploration, production, and drilling operations.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students will be able to: • Understand and apply key geostatistical concepts for petroleum data analysis. • Perform variogram modeling and spatial interpolation to estimate reservoir properties. • Use applied mathematics and Monte Carlo simulation to model uncertainty. • Understand basic drilling modeling and relate it to reservoir data. • Integrate these techniques to support decision-making in exploration, production, and drilling.
Indicative Contents المحتويات الإرشادية	1. Introduction to geostatistics and spatial data analysis 2. Variogram calculation and modeling 3. Kriging and spatial interpolation techniques 4. Applied mathematics fundamentals: linear algebra, calculus, probability 5. Stochastic simulation and Monte Carlo methods 6. Basics of drilling modeling and parameter analysis 7. Reservoir characterization and uncertainty quantification 8. Integration of geostatistical and mathematical methods in petroleum engineering applications

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	• Hands-on Tutorials: Practical exercises using geostatistical and mathematical software (e.g., R, Python, Petrel). • Case Studies: Analyze real petroleum datasets to apply theoretical knowledge. • Group Projects: Foster collaboration and problem-solving on applied reservoir and drilling modeling problems. • Interactive Discussions: Encourage critical thinking and interpretation of results
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Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Geostatistics - Reservoir Heterogeneity - Reservoir Modeling in the Presence of Heterogeneity - Use of Geostatistics in reservoir Description
Week 2-3	Principles of Statistics - Descriptive statistics - Inferential Statistics
Week 4-5	Spatial Relationships: Estimation and Modeling - Random Function Model - Spatial Relationship - Estimation of Variogram - Modeling Variograms - Alternative Methods of Spatial Relationships

Week 6-7	Conventional Estimation Techniques • Preliminary Considerations • Linear Kriging Procedure • Nonlinear Kriging Techniques • Estimation of Uncertainty
Week 8	Conditional Simulation Techniques • Definition • Distinguishing Features • Simulation Methods
Week 9-10	Grid-Based Simulation Methods • Sequential Conditional Simulation Methods • Probability Field Simulation • Simulated Annealing • Simulation Process
Week 11-12	Object-Based Simulation Techniques • Marked Point Process Technique • Criteria for Choosing Object Modeling • Hybrid Conditional Simulation Approaches • Field Case Studies • Other Applications of Object Modeling
Week 13-14	Stochastic Simulation Fundamentals and Conditional Simulation • Unconditional vs. conditional simulation • Simulation algorithms for reservoir heterogeneity
Week 15	Scaleup • Scaleup of Static Properties • Scaleup for Dynamic Properties—Single-Phase Flow

Delivery Plan (Weekly Lab. Syllabus) المناهج الاسبوعي للمختبر	
	Material Covered
Week 1	•
Week 2	•
Week 3	•
Week 4	•
Week 5	•
Week 6	•
Week 7	•

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?

Required Texts	Applied Geostatistics for Reservoir Characterization, Mohan Kelka, Godofredo Perez, Society of Petroleum Engineers Inc., 2002	Yes
Recommended Texts	A n Introduction to Applied Geostatistics, Edward H. Isaaks, R. Mohan Srivastava, Oxford University Press, 1989	Yes
Websites	Geostatisticslessons.com Geostat-framework.org	

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
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.				