

MODULE DESCRIPTION FORM

Module Information			
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	3	Semester of Delivery	
Administering Department	Petroleum Engineering	College	College of Engineering
Module Leader		e-mail	
Module Leader's Acad. Title	Asst. Lec.	Module Leader's Qualification	MSc
Module Tutor	Hussam Wheed Maktooff	e-mail	H564127@gmail.com
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
Prerequisite module	Engineering Analytics(PE223)	Semester	5
Co-requisites module	NON	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Apply fundamental geostatistical methods to analyze and interpret spatial petroleum data, Perform variogram modeling and spatial interpolation techniques to estimate reservoir properties, Utilize applied mathematics tools, including linear algebra, calculus, and probability, for petroleum engineering problems, Implement stochastic simulation methods, particularly Monte Carlo techniques, to quantify uncertainty in reservoir characterization, Understand and apply basic drilling modeling concepts to support drilling planning and optimization, Integrate geostatistical and mathematical approaches to improve decision-making in exploration, production, and drilling operations.



Module Learning Outcomes	Knowledge	A2	A2.1: Define the geographical statistical concepts for petroleum data analysis. A2.2: Understand basic drilling modeling and relate it to reservoir data. A2.3: Use applied mathematics and Monte Carlo simulation to model uncertainty.
	Skills	B1	B1.1 Function efficiently as an individual B1.2 Function as a member of multidisciplinary and multicultural teams
		B2	B2.1 Communicate effectively – graphically with a range of audiences using contemporary tools. B2.2 Communicate verbally and in writing with a range of audiences using contemporary tools.
	Ethics	C1	C2.1 Recognize professional and ethical responsibility. C1.2 Adhere and respect diversity.
Indicative Contents	Indicative content includes the following. Unit 1: Introduction to Geostatistics, Reservoir Heterogeneity, Reservoir Modeling in the Presence of Heterogeneity, Use of Geostatistics in reservoir Description, Principles of Statistics, Descriptive statistics, Inferential Statistics, Spatial Relationships: Estimation and Modeling, Random Function Model, Spatial Relationship, Estimation of Variogram, Modeling Variograms, Alternative Methods of Spatial Relationships [8 hours]. Unit 2: Conventional Estimation Techniques, Preliminary Considerations, Linear Kriging Procedure, Nonlinear Kriging Techniques ,Estimation of Uncertainty, Conditional Simulation Techniques, Definition, Distinguishing Features, Simulation Methods [8 hours]. Unit 3: Grid-Based Simulation Methods, Sequential Conditional Simulation Method, Probability Field Simulation, Simulated Annealing, Simulation Process, 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 [8 hours]. Unit 4: Stochastic Simulation Fundamentals and Conditional Simulation, Unconditional vs. conditional simulation, Simulation algorithms for reservoir heterogeneity, Scaleup, Scaleup of Static Properties, Scaleup for Dynamic Properties—Single-Phase Flow [6 hours].		
Learning and Teaching Strategies			
Strategies	• Presentations • Discussions • Tutorial and graphics • Problem solving • Brain storming		

	• Research and reporting • Problem Solving • Report & discussion assessment		
Student Workload (SWL)			
Structured SWL (h/sem)	63	Structured SWL (h/w)	4.2
Unstructured SWL (h/sem)	87	Unstructured SWL (h/w)	5.8
Total SWL (h/sem)	125		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري		
	Material Covered	LOs
Week 1	Introduction to Geostatistics • Reservoir Heterogeneity • Reservoir Modeling in the Presence of Heterogeneity • Use of Geostatistics in reservoir Description	A2, B1, B2, C1
Week 2-3	Principles of Statistics • Descriptive statistics • Inferential Statistics	A2, B1, B2, C1
Week 4-5	Spatial Relationships: Estimation and Modeling • Random Function Model • Spatial Relationship • Estimation of Variogram • Modeling Variograms • Alternative Methods of Spatial Relationships	A2, B1, B2, C1
Week 6-7	Conventional Estimation Techniques • Preliminary Considerations • Linear Kriging Procedure • Nonlinear Kriging Techniques • Estimation of Uncertainty	A2, B1, B2, C1
Week 8	Conditional Simulation Techniques • Definition • Distinguishing Features • Simulation Methods	A2, B1, B2, C1
Week 9-10	Grid-Based Simulation Methods • Sequential Conditional Simulation Methods • Probability Field Simulation • Simulated Annealing • Simulation Process	A2, B1, B2, C1
Week 11-12	Object-Based Simulation Techniques • Marked Point Process Technique • Criteria for Choosing Object Modeling • Hybrid Conditional Simulation Approaches • Field Case Studies	A2, B1, B2, C1

	• Other Applications of Object Modeling	
Week 13-14	Stochastic Simulation Fundamentals and Conditional Simulation • Unconditional vs. conditional simulation • Simulation algorithms for reservoir heterogeneity	A2, B1, B2, C1
Week 15	Scaleup • Scaleup of Static Properties • Scaleup for Dynamic Properties—Single-Phase Flow	A2, B1, B2, C1

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	A2
	Assignments	2	10% (10)	2, 4,6,8,10,12 and 14	A2
	Classroom interaction	ALL	10% (10)	ALL	A2
	Presentation	1	10% (10)	13	A2,B1,B2
Summative assessment	Midterm Exam	1hr	10% (10)	7	A2
	Final Exam	3hr	50% (50)	15	A2
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	

Week 7	
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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	https://eng.alayen.edu.iq//colleges/e/42	

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.				