



Course Syllabus: Data Analysis in Geosciences - ErSE 253

Division	Physical Science and Engineering Division
Course Number	ErSE 253
Course Title	Data Analysis in Geosciences
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	10:30 AM - 12:00 PM Mon Wed

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Ibrahim Hoteit	ibrahim.Hoteit@kaust.edu.sa	+966128080344		Tuesdays 16:00-18:00
Sigurjon Jonsson	sigurjon.jonsson@kaust.edu.sa	+966128080291	3136, 1, Al-Khwarizmi (bldg. 1)	Tuesdays 16:00-18:00

Teaching Assistant(s)	
Name	Email
TPD	TBD

Course Information	
Comprehensive Course Description	Processing of multidimensional data, spatial statistics including variogram, covariance analysis and modeling, multipoint estimation, spatial interpolation including statistical methods (kriging), time series analysis, uncertainty assessment, cross validation, multivariate analysis including principal component analysis and canonical analysis.
Course Description from Program Guide	Time Series (filtering, correlation, deconvolution, spectral analysis, regression), processing of multidimensional data, spatial statistics including variogram, covariance analysis and modeling, multipoint estimation, spatial interpolation including statistical methods (kriging) and dynamical methods (Kalman filter), uncertainty assessment, cross validation, multivariate analysis including principal component analysis and canonical analysis.
Goals and Objectives	Understand and apply spatial and temporal data analysis techniques to geophysical problems. Analyze space-time geophysical datasets. Space-time data fillings and predictions. Think critically about issues associated with the analysis of spatial and temporal data.
Required Knowledge	Undergraduate statistics, analysis and linear algebra Coding and Matlab programming
Reference Texts	Edward H. Isaaks and R. Mohan Srivastava, An introduction to applied geostatistics, Oxford University Press, New York, USA, (1989).

Method of evaluation	10.00% - Attendance and Participation 30.00% - Midterm exam 40.00% - Homework /Assignments 20.00% - Course Project(s)
Nature of the assignments	Written assignments Group project
Course Policies	Attend classes, participate in discussions, and read assigned material. No late homeworks.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 08/26/2019	Introduction to data analysis in geosciences and applied geostatistics
1	Wed 08/28/2019	Univariate and bivariate data description
2	Mon 09/02/2019	Spatial data description
2	Wed 09/04/2019	Exhaustive and sample data sets
3	Mon 09/09/2019	Sample data sets
3	Wed 09/11/2019	Spatial continuity
4	Mon 09/16/2019	Estimation
4	Wed 09/18/2019	Global and point estimation
5	Mon 09/23/2019	Saudi National Day
5	Wed 09/25/2019	Kriging
6	Mon 09/30/2019	More kriging
6	Wed 10/02/2019	Cross validation, search strategies, block kriging
7	Mon 10/07/2019	Modeling sample variograms
7	Wed 10/09/2019	Co-kriging
8	Mon 10/14/2019	Estimating a distribution
8	Wed 10/16/2019	Change of support
9	Mon 10/21/2019	Assessing uncertainty
9	Wed 10/23/2019	Midterm exam
10	Mon 10/28/2019	Mid-semester break
10	Wed 10/30/2019	Principial component analysis
11	Mon 11/04/2019	More principal component analysis
11	Wed 11/06/2019	More principal component analysis
12	Mon 11/11/2019	Time-series analysis
12	Wed 11/13/2019	Fourier and z-transforms
13	Mon 11/18/2019	Spectral analysis
13	Wed 11/20/2019	Aliasing
14	Mon 11/25/2019	Spectral leakage
14	Wed 11/27/2019	Time-series processing
15	Mon 12/02/2019	Filtering
15	Wed 12/04/2019	Final project presentations
16	Mon 12/09/2019	Exams

Note

The instructor reserves the right to make changes to this syllabus as necessary.