

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MINERAL RESOURCES ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	MRE507	SEMESTER	5
COURSE TITLE	APPLIED GEOSTATISTICS		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		WEEKLY TEACHING HOURS	CREDITS
Lectures		2	2.5
Laboratory exercises		2	2.5
Total		4	5
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Special background		
PREREQUISITE COURSES:	MRE301 – Mathematics III – Numerical Analysis		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.uowm.gr/courses/MRE145/		

(2) LEARNING OUTCOMES

<p>Learning outcomes <i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
<p>The course aims to enable students to:</p> <ul style="list-style-type: none"> • Learn the theory and application field of geostatistics • Use special software applications in problems that can be approached using geostatistics • Create exploration sample databases and perform statistical analysis and validation • Perform structural analysis (variography) of data to form a model of spatial correlation • Perform kriging estimations and assess the estimation results.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Adapting to new situations

Decision-making

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive thinking

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Others...

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- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Project planning and management
- Decision-making
- Working independently
- Teamwork

(3) SYLLABUS

Introduction to mineral resource estimation, sampling, and estimates classification.

Introduction to statistics, probability theory, random variables, probability distributions, weighted and moving averages, regression, correlation.

Introduction to geostatistics, spatial distributions, support effect, dispersion, structural analysis —variography, variogram models, geometrical and zonal anisotropy, nested models, extension and estimation variances, kriging, clustering, data transformation.

Applied kriging, forms of kriging, kriging neighbourhood analysis (KNA), sampling density analysis, geostatistical simulation.

(4) TEACHING and LEARNING METHODS - EVALUATION

<p style="text-align: center;">DELIVERY <i>Face-to-face, Distance learning, etc.</i></p>	<p style="text-align: center;">Face-to-face, webinars, computer lab exercises using specialised geostatistical software</p>	
<p style="text-align: center;">USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i></p>	<p style="text-align: center;">Use of data projector, specialised geostatistical software, asynchronous training platform – eclass.</p>	
<p style="text-align: center;">TEACHING METHODS <i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i></p> <p><i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></p>	Activity	Semester workload
	Lectures	28
	Lab work	28
	Home study and bibliography	24
	Coursework	20
	Lectures study	50
	Course total	150
<p style="text-align: center;">STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i></p> <p><i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>Weekly assessment of interactive lab exercises (40% of total grade), final written exam of theory (50% of total grade) and final written exam of lab exercises (10% of total grade).</p> <p>Assessment criteria are provided in the course page on the eclass platform and are available to students from the start of the semester.</p>	

(5) SUGGESTED BIBLIOGRAPHY

<p>- Suggested bibliography:</p> <p>Agterberg, F.P., 1974, <i>Geomathematics – Mathematical Background and Geo-science Applications, Developments in Geomathematics 1</i>, Elsevier Scientific Publishing Company (Amsterdam), 596 pp.</p> <p>Armstrong, M., 1998, <i>Basic Linear Geostatistics</i>, Springer-Verlag (Berlin), 154 pp.</p> <p>Clark, I., 2001, <i>Practical Geostatistics</i>, Geostokos Limited, 119 pp.</p> <p>David, M., 1977, <i>Geostatistical Ore Reserve Estimation, Developments in Geomathematics 2</i>, Elsevier Scientific Publishing Company (Amsterdam), 363 pp.</p> <p>Delfiner, P., 1979. <i>Basic introduction to geostatistics. Centre de Geostatistique (Fontainebleau) course CGMM-C78.</i></p> <p>Deutsch, C.V., Journel, A.G., 1992, <i>GLSIB: Geostatistical Software Library and User's Guide</i>, Oxford University Press (Oxford), 340 pp.</p> <p>Goovaerts, P., 1997, <i>Geostatistics for Natural Resources Evaluation, Applied Geostatistics Series</i>, Oxford University Press (Oxford), 483 pp.</p> <p>Guibal, D.G. 1990. <i>Geostatistics for exploration and mining. Australian Mineral Foundation (Adelaide)</i>, 208 pp.</p> <p>Gy, P.M., 1979. <i>Sampling of Particulate Materials Theory and Practice. Developments in geomathematics 4</i>. Elsevier (Amsterdam), 431 pp.</p> <p>Hohn, M.E., 1988. <i>Geostatistics and petroleum geology. Van Nostrand Reinhold (New York)</i>, 264 pp.</p> <p>Institution of Mining and Metallurgy, 2001. <i>Code for reporting of mineral exploration results, mineral resources and mineral reserves (the reporting code). Institution of Mining and Metallurgy, European Federation of Geologists, The Geological Society of London and the Institute of Geologists of Ireland</i>, 34 pp.</p> <p>Isaaks, E.H., και Srivastava, R.M., 1989. <i>An introduction to applied geostatistics. Oxford University Press (New York)</i> 561 pp.</p> <p>Καπαγερίδης, Ι., <i>Εισαγωγή στη Γεωστατιστική</i>, Εκδόσεις ΙΩΝ, 2006.</p> <p>Journel, A.G., και Huijbregts, Ch.J., 1978. <i>Mining geostatistics. Academic Press (London)</i>, 600 pp.</p> <p>Journel, A.G., Kyriakidis, P.C., 2004, <i>Evaluation of Mineral Reserves – A Simulation Approach, Applied Geostatistics Series</i>, Oxford University Press (Oxford), 216 pp.</p> <p>Krige, D.G., 1981, <i>Lognormal-de Wijsian Geostatistics for Ore Evaluation, South African Institute of Mining and Metallurgy (Johannesburg)</i>, 51 pp.</p> <p>Koch, G.S. και Link, R.F., 1971. <i>Statistical analysis of geological data. Dover (New York)</i>, 813 pp.</p>

- Matheron, G., 1981. *La selectivite des distributions*. Centre de Geostatistique, Ecole Des Mines De Paris (Fontainebleau) Report N-686, 45 pp.
- Matheron, G., 1982. *La destructure des haute teneurs et le krigeage des indicatrices*. Centre de Geostatistique, Ecole Des Mines De Paris (Fontainebleau) Report N-761, 33 pp.
- Nobbie, A.C., 1992. *Ore reserve/resource estimation*. Mining Engineering Handbook, Vol. 2, Δεύτερη Έκδοση, SME-AIME (New York), pp. 344-359.
- Olea, R.A. (Ed.), 1991. *Geostatistical glossary and multilingual dictionary*. International Association for Mathematical Geology, Studies in Mathematical Geology Volume 3. Oxford University Press (New York), 177 pp.
- Remy, N., Boucher, A., Wu, J., 2009, *Applied Geostatistics with SGeMS – A User's Guide*, Cambridge University Press (Cambridge), 264 pp.
- Rivoirard, J., 1987b. *Geostatistics for skew distributions*. South African Short Course Notes, C-131, Centre de Morphology Mathematique (Fontainebleau) 31 pp.
- Rivoirard, J., 1990. *Introduction to disjunctive kriging and non-linear geostatistics*. Centre de Morphology Mathematique (Fontainebleau) 90 pp.
- Royle, A.G., 1987. *A workshop course in geostatistics*. Department of Mining and Mineral Engineering, University of Leeds (Leeds).
- Rossi, M., Deutsch, C., *Mineral Resource Estimation*, Springer, 2014.
- Sichel, H.S., 1952. *New methods in the statistical evaluation of mine sampling data*. Trans. Inst. Mining Metallurgy, 61:261-288.
- Vann, J., 1997. *Applied mining geostatistics – Short course notes*. GEOVAL (Perth), 244 pp.
- Verly, G.W., et al., 1984. *Geostatistics for natural resources characterisation*. NATO ASI Series C122. Reidel (Dordrecht).
- Webster, R. και Oliver, M.A., 1990. *Statistical methods in soil and land resource survey*. Oxford University Press (New York), 316 pp.

- Related academic journals:

Applied Computing and Geosciences, Elsevier

Computers & Geosciences, Elsevier

Mathematical Geosciences, Springer-Verlag