MPE 140 "ENGINEERING METHODS IN PETROLEUM SCIENCES"

Engineering Methods and Their Application to Petroleum Engineering and Management

The course is intended for civil engineering students specializing in production and reservoir engineering.

The course will be given in autumn 2005 with 4 lecture hours a week (or equivalent) via “It’s learning” system.

Contents of the course:

Module I. Deterministic and probabilistic models

Building models. Deterministic and probabilistic models. The least squares method.

Equally and non-equally important data. Classification task. Other areas of application.

Module II. Fuzzy sets, Fuzzy and interval numbers

Fuzzy sets and handling fuzzy data. Crisp and fuzzy sets. Operations defined on fuzzy sets. Areas of application of fuzzy sets. Engineering and non-engineering applications. Fuzzy and interval numbers.

Evaluation of hydrocarbon volumes in place and recoverable reserves by using probabilistic approach (Monte Carlo) and fuzzy methods.

Module III. Fractals

Fractals and their application to the resources evaluation. Fractals. Fractal nature of many phenomena. Fractal analysis of hydrocarbon resources in a basin.

Module IV. Dimensional analysis and similarity

Dimensional analysis and similarity. Dimensional analysis. Similarity and self-similarity.

Engineering applications.

Module V. Modeling reservoir performance

Modeling reservoir performance. Models based on principles of continuum mechanics, network models, micro-models. Phenomenological models. Hierarchy of models.

Fractional flow model: application to the waterflooding performance evaluation.

Module VI. Systems approach and decision making

Basics of a systems approach.

Assigning objectives. Setting up a problem. Objectives structuring: local and global objectives. Assigning importance of the objectives.

Basics of a decision analysis.

Decision under certainty. Methods of solution to optimization problems under certainty: linear programming, integer linear programming, method of Lagrange multipliers. The assignment problem. Engineering applications.

Multiple-objective problems.

Reducing a multiple-objective problem. Pareto optimal solutions. Evaluating importance of objectives. Examples of applications.

Decision under uncertainty.

Decision under risk. Sensitivity analysis. Cost of information. Using a utility function. Decision tree analysis. Decision under uncertainty – a fuzzy approach.

Examples of application

Course prerequisites: Petroleum Geology (TE 160), Reservoir Engineering 1 (TE 195), Production of Oil and Gas (TE 584).

Exam: At the end of semester students are required to take 5 hrs written or verbal exam.

Subject responsible: Prof. Anatoly B. Zolotukhin