

Department of Earth Sciences
Indian Institute of Technology Kanpur

Proposal for a new course

1. Course No: ES6XX
2. Course title: Reservoir Characterization
3. Department: Earth Sciences
4. Proposing Instructor: Dr Hiranya Sahoo
5. Units: 3-0-0-0 (9 credits)
6. Course Type: Departmental Elective (PG)
7. Prerequisite: with permission of the instructor
8. Other Potentially Interested Faculties: Dr Indra Sen

Course Description

Successful reservoir analysis is critically linked to optimal exploration, production and management of natural resources (oil, gas, coal, water), and associated approaches (e.g., environmental measures); it therefore influences societal and economic prosperity at national and international scales. This course will help students gain a sound understanding of various concepts and tools for reservoir characterization at multiple scales: from pore to basin. Teaching topics will focus on: formation mechanism of seal, reservoir and source rocks, emplacement of these rock types in various traps (e.g., stratigraphic vs. structural); Reservoir conditioning mechanisms at different settings (fluvial, eolian, shallow water, deep water) and environments (clastic; non-clastic: carbonate); Use of data types (outcrop, core, well-log, GPR, seismic) and tools (e.g., lithostratigraphy, biostratigraphy, sequence stratigraphy) for reservoir prediction; how effects of pore-scale to meso-scale to macro-scale features constrain reservoir heterogeneity and associated risks (e.g., variability in reservoir properties such as porosity and permeability); syn-depositional and post-depositional (e.g., fractures, joints) effects on reservoir compartmentalization and drainage. Students will get to know how to use multi-dimensional datasets to evaluate: reservoir attributes (e.g., thickness, area, drainage, net-to-gross); facies- to architecture- to geobody-scale reservoir complexity by analyzing (1) lithologs (2) Bioturbation Index (BI) logs, and (3) object-based and process-based models. With use of case studies, students will comprehend reservoir characterization in conventional vs. unconventional (e.g., tight gas) systems, in energy sectors (oil, gas, coal), in water management (aquifer analysis), in new energy frontiers (e.g., geothermal), and in emerging scientific thrust areas such as geologic carbon sequestration.

Course Contents	Suggested number of lectures
Basic building blocks: seal, reservoir and source rock types. Formation mechanism of different traps (e.g., stratigraphic vs. structural)	3

Use of data types (outcrops, cores, well logs, GPR, seismic)	4
Reservoir characterization approaches in several settings (fluvial, eolian, paralic, shallow water, deep water)	5
Reservoir characterization techniques in various environments: clastics vs. non-clastics (carbonate).	4
Reservoir compartmentalization and property variability (porosity and permeability) by effects of syn-depositional (at pore- to meso- to macro-scale) and post-depositional (e.g., fractures) features.	4
Object-based and process-based reservoir models	4
Reservoir characterization across domains: conventional vs. unconventional systems; energy sectors (oil, gas, coal); water management (aquifer analysis); new energy frontiers (e.g., geothermal); emerging thrust areas such as geologic carbon sequestration.	5
Exercises on multidimensional dataset to evaluate reservoir risks at various scales (pore- to meso- to macro-scale features)	4
Exercises on generating and analyzing lithologs and Bioturbation Index (BI) logs for reservoir attribute analysis	4
Synthesis: Reservoir modelling – from cakewalk to catwalk	3
Total number of lectures	40

Recommended Books/Resources:

- Allen, P.A., and Allen, J.R., 2013, Basin Analysis: Principles and Application to Petroleum Play Assessment, 3rd Edition, Wiley-Blackwell. ISBN: 978-0-470-67377-5
- Slat, R. M., 2013, Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists, and Engineers, 2nd Edition, Elsevier. ISBN: 978-0-444-56365-1
- Lucia, F.J., Carbonate Reservoir Characterization: An Integrated Approach, 2nd Edition, Springer. ISBN: 978-3-540-72740-8
- Published research articles/guidebooks/reports

Dated: 11 March 2026


Proposer: Dr. Hiranya Sahoo

Dated: 12 March 2026


DUGC/DPGC Convener, ES

The course is approved/ not approved

Chairman, SUGC/SPGC

Dated: _____