

# **Petrophysical Measurements of Conventional and Unconventional Reservoir Rocks**

---

## **1.1 Broad Area**

Systematic theoretical and laboratory study of physical properties of petroleum reservoir rocks; lithology, rock stress, fluid-rock interaction, seismic anisotropy, optical interferometry, ultrasonic behaviour of conventional and unconventional rocks

## **1.2 Overview**

A major application of petrophysics is in studying reservoirs for the hydrocarbon industry. It is very important to understand the rock properties of the reservoir, particularly how pores in the subsurface are interconnected, controlling the accumulation and migration of hydrocarbons. Some of the key properties studied in petrophysics are lithology, porosity, water saturation, permeability and density. A key aspect of petrophysics is measuring and evaluating these rock properties by acquiring well log measurements - in which a string of measurement tools is inserted in the borehole, core measurements - in which rock samples are retrieved from subsurface, and seismic measurements.

These studies are then combined with geological and geophysical studies and reservoir engineering to give a complete picture of the reservoir. Very recently, researchers have understood the importance of deducing the properties of reservoir rocks in laboratories. Lab-scale measurements of Petroleum Reservoir Rocks, hence, have secured its place in most Research Institutes.

## **2. Objectives**

1. This course is aimed at helping the participants to grasp basic concepts, theories, calculations and experimental skills, with the purpose of laying solid foundation.
2. The students are required to learn the physical properties of reservoir rocks, reservoir fluids, determination method and engineering application.
3. The students are also required to understand and grasp the physical properties of the rock and porous media, physics and mechanics behind the rock-fluid interactions, their lab-scale measurements and applications in petroleum engineering.

<b>Modules</b>	<p><b>October 7<sup>th</sup> Monday</b>  <b>Module A: Mechanics of Rocks</b>  <b>Lecture 1:</b> 9:30 to 10:30 AM  Introduction to Physics of Earth Materials  <b>Lecture 2:</b> 10:45 to 11:45 AM  Stresses and Strain, Elasticity and Elastic Properties, In-situ stress measurement  <b>Lecture 3:</b> 2:00 to 3:00 PM  Fundamentals of Well-Logging  <b>Lecture 4:</b> 3:30 to 4:30 PM  Formation Evaluation  <b>October 8 Tuesday</b>  <b>Module B: Petrophysics</b>  <b>Lecture 5:</b> 9:30 to 10:30 AM  Petrophysics as a basis for geophysical measurements  <b>Lecture 6:</b> 10:45 to 11:45 AM  Physical properties of minerals and rocks and physical fields in geophysics  <i>Tutorial: Problem solving session with examples (2:00 to 4:00 PM)</i>  <b>October 9 Wednesday</b>  <b>Lecture 7:</b> 9:30 to 10:30 AM  Laboratory investigation in comparison to field measurements (on Earth surface and in wells), scale and resolution  <b>Lecture 8:</b> 10:45 to 11:45 AM  Bore-hole Logging and Seismic Measurements  <i>Tutorial: Problem solving session with examples (2:00 to 4:00 PM)</i>  <b>October 10 Thursday</b>  <b>Lecture 9:</b> 9:30 to 10:30 AM  Optical Interferometry as applied to Petrophysical Measurements  <b>Lecture 10:</b> 10:45 to 11:45 AM  Fundamentals of Petroleum Geomechanics  <i>Tutorial: Problem solving session with examples (2:00 to 4:00 PM)</i>  <b>Case Study Practical and Examination</b>  <b>October 11 Friday</b>  <b>Lecture 11:</b> 9:30 AM to 10:30 AM  Time-Lapse Seismic Monitoring Techniques  <b>Lecture 12:</b> 10:45 to 11:45 PM  Working in teams, Opportunity to put into practice the concepts learnt, interactive sessions  2:00 PM to 4:00 PM  Examination</p>
<b>You Should Attend If...</b>	<ol style="list-style-type: none"> <li>1. Geoscientists and Petroleum Engineers from R&amp; D Laboratories of Oil and Gas Industry.</li> <li>2. Students at all levels (B.Tech/MSc/M.Tech/PhD) with fundamental knowledge of Mathematics, Physics and Computing</li> <li>3. Faculty from reputed academic and technical institutions</li> </ol>

<b>Fees</b>	<p>The participation fees for taking the course is as follows:</p> <p><b>Participants from abroad : US 500 \$</b></p> <p><b>Student participants: 1000 INR    Faculty participants: 15,000</b></p> <p><b>Industry participants: 20,000    Research Organizations: 15,000</b></p> <p>The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility.</p> <p><b>Modes of payment:</b></p> <p><u>Online transfer:</u></p> <p>Account Name: CCE IIT Madras  Acc. No: <b>3640111110</b>                      Branch: SBI, IIT Madras  IFSC Code: SBIN0001055              Swift Code: SBININBB453</p> <p>Note: The participants should be mentioned the purpose of GIAN while the transaction and have to send the transaction details to <a href="mailto:gian@iitm.ac.in">gian@iitm.ac.in</a></p> <p style="text-align: center;"><b>OR</b></p> <p>Demand draft in favour of “<b>CCE IIT Madras</b>” payable at <b>Chennai</b>. The demand draft is to be sent to the course coordinator at the address given below.</p> <p><u>Address of the Course Coordinator:</u>  Prof. Rajesh Nair  Head, Petroleum Geomechanics Laboratory  Associate Professor of Petroleum Engineering  Department of Ocean Engineering  IIT Madras  Chennai  600036</p>
	<p>The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link:  <a href="http://hosteldine.iitm.ac.in/iitmhostel/">http://hosteldine.iitm.ac.in/iitmhostel/</a></p>
<b>Registration Procedure</b>	<p>Please follow the following steps for the registration:</p> <p>1. Go to GIAN website (<a href="http://www.gian.iitkgp.ac.in/GREGN/index">http://www.gian.iitkgp.ac.in/GREGN/index</a>)  <b>Petrophysical Measurements of Conventional and Unconventional Reservoir Rocks</b></p> <p>First time users need to register and pay a one-time fee of INR 500 /</p> <p>2. Enroll for the course: Once you enroll for the course, an Enrollment/Application number will be generated, and the course coordinators will be notified.</p>

# The Faculty



Prof. Doug Schmitt, is a Professor and Stephen and Karen Brand, Endowed Chair of Unconventional Energy. His research interests are Experimental rock physics and mechanics. Porous media characterization. Scientific Drilling (geophysical logging and crustal stress determination). Near-surface and borehole seismology. Optical interferometry for deformation analysis.



**Prof. Rajesh Nair** is Head of Petroleum Geomechanics Laboratory and an Associate Professor of Petroleum Engineering, Department of Ocean Engineering, Indian Institute of Technology, Madras. His research interest is Petroleum Geomechanics, Fracturing and Recovery process, Geostatistics for Reservoir Modeling and Seismic characterization and Near surface geophysics including ground penetrating radar data analysis and seismic refraction

## Course Co-ordinator

**Prof. Rajesh Nair**  
Head, Petroleum Geomechanics Laboratory  
Associate Professor of Petroleum Engineering  
Phone: 044 2257 4824  
E-mail: rajeshnair@iitm.ac.in

.....  
<http://www.gjan.iitkgp.ac.in/GREGN>