## Well Logging

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<thead>
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<th>Module Title</th>
<th>Well Logging</th>
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<tbody>
<tr>
<td><strong>Level</strong></td>
<td>5</td>
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<tr>
<td><strong>Reference No.</strong></td>
<td>EAX_5_280/PTRL04H04</td>
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<tr>
<td><strong>Credit Value</strong></td>
<td>10 credit points</td>
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<tr>
<td><strong>Student Study Hours</strong></td>
<td>Contact hours: 22 lectures + 14 Tutors</td>
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<td>Student managed learning hours: 100</td>
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<tr>
<td><strong>Pre-requisite learning</strong></td>
<td>-</td>
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<td><strong>Co-requisites</strong></td>
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<tr>
<td><strong>Excluded combinations</strong></td>
<td>-</td>
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<tr>
<td><strong>Module co-ordinator</strong></td>
<td>Dr. Aly El-Hamzy</td>
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<tr>
<td><strong>Faculty/Department</strong></td>
<td>Engineering/Petroleum and Natural gas technology</td>
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### Short Description

This module is concerned with petrophysics, self potential, resistivity tools, calipers, gamma ray, density, neutron, sonic, porosity, water saturation, log interpretation, formation evaluation, optimum logging programme, cased-hole logging.

### Aims

The aim of this module is for the student to understand the principles and practices of log analysis in order to evaluate the subsurface formations and hydrocarbon bearing reservoirs. Wire line log is the most universal, comprehensive and concise document on oil and gas wells. Familiarity with the purposes and optimum applications of well logs is therefore essential in both exploration and production activities.

### Learning Outcomes

**Knowledge and understanding**

*On completion of this module students should be able to demonstrate knowledge and understanding of:*

1. Principles and practices of wire-line logs and their importance in formation and reservoir evaluation;
2. How to identify reservoirs
3. To determine mineralogy, porosity and saturation in various lithologies

**Subject-specific cognitive skills**

*On completion of this module students should be able to/demonstrate ability in:*

4. Examine various logging tools: advantages and limitations; read and comprehend different log responses; apply integrated log interpretation techniques in formation evaluation;
5. Differentiate between reservoir and non reservoir rocks;
6. Develop optimum tools and logging programs

**Subject-specific practical skills**

*On completion of this module students should be able to/demonstrate ability in:*

7. solve formation evaluation problems and demonstrate results;
8. diagnose the effect of downhole conditions on tool response
and log quality;

9. interpret pressure profiles

**Key/transferable skills**

*On completion of this module students should be able to/demonstrate ability in:*

10. Use software in log analysis and use it to interpret and establish reliability of data.

11. apply quick look methods of formation evaluation

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### Employability

To prepare student to get job and be professional graduate in future, the development of one or more of top engineering skills, namely problem solving, communication, management and environment and economics, is addressed in this module. Personal development planning is also one of our focuses in this module.

### Teaching and learning pattern

1. 22, 1h lectures. This method informs learning outcomes 1, 2, 3, 5, 7, 8, 9, 11.

2. 7, 2h practical problem solving sessions comprising of analysing well logging data. This method informs learning outcomes 4, 6, 7, 8, 9, 10, 11.

### Indicative content

- well logging objectives;
- Invasion profile
- Passive electrical properties of earth minerals
- self potential log;
- Resistivity measuring tools
- Reservoir and non reservoir discrimination
- Matrix sensitive logs
- Depth measurements. Pore hole calipers
- Porosity mineralogy logs, density, neutron, sonic, EPT
- Nuclear magnetic resonance
- Porosity determination in clean formation
- Formation resistivity factor
- Gamma ray log
- Conductivity of shales
- Mineralogy identification
- Saturation and Archie equation
- Linear movable oil plot
- Porosity – resistivity cross plots and cross plot techniques
- Permeability relationship
- Use of pressure measurements
- Computerized log evaluation and use all log measurements to estimate various rock properties and initial hydrocarbon in place
- Sidewall coring
- Logging programs

### Assessment

**Elements & weightings**

- **Examination:** A 180 minute unseen written examination. This method assesses learning outcomes 1, 2, 3, 5, 7, 8, 9, 11.  **70%**

- **Course Work:** A group (4 to 6 students) class assignments and interpretation of well logging data. This method assesses learning outcomes 4, 6, 7, 8, 9, 10, 11.  **30%**

- Students must achieve (i) 40% for the total module mark and (ii) at least 30% in the unseen examination and the course work in order to achieve an overall passing mark for this module.
Indicative Sources (Reading lists)