# Enhanced Hydrocarbon Recovery

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Enhanced Hydrocarbon Recovery</th>
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<tbody>
<tr>
<td>Level</td>
<td>6</td>
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<tr>
<td>Reference No. <em>(showing level)</em></td>
<td>EAX_6_292/PTRL13H05</td>
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<tr>
<td>Credit Value</td>
<td>10 credit points</td>
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<tr>
<td>Student Study Hours</td>
<td>Contact hours: 22 lectures + 5 Tutorials + 10 Computer Lab. Student managed learning hours: 100</td>
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<tr>
<td>Pre-requisite learning</td>
<td>-</td>
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<tr>
<td>Co-requisites</td>
<td>-</td>
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<tr>
<td>Excluded combinations</td>
<td>-</td>
</tr>
<tr>
<td>Module co-ordinator (Name + Email)</td>
<td>Prof. Attia A. Attia <a href="mailto:attia.attia@bue.edu.eg">attia.attia@bue.edu.eg</a></td>
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<tr>
<td>Faculty/Department</td>
<td>Petroleum &amp; Gas Technology Department</td>
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<td>Short Description</td>
<td>Enhanced oil and gas recovery, micellar-polymers, steam injection, in-situ combustion, microbial enhancement, development geology, reserve calculations, field development, geological model, optimal recovery, geological controls, infill drilling sites, development plan.</td>
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<td>Aims</td>
<td>The aim of this module is for students to apply his/her geological and petrophysical knowledge to the development of an oil and gas field and become familiar with oil and gas recovery enhancement methods in secondary and tertiary stages. Example case studies are presented on projects from around the world that enable students to understand the technical and financial strengths and limitations of each method.</td>
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| Learning Outcomes            | **Knowledge and understanding**  
  On completion of this module students should be able to demonstrate knowledge and understanding of:  
  1. the different methods applied in secondary and enhanced oil and gas recovery;  
  2. how to improve the factors contributing to oil recovery  
  **Subject-specific cognitive skills**  
  On completion of this module students should be able to demonstrate ability in:  
  3. tools and techniques available to deal with enhanced hydrocarbon recovery processes;  
  4. use all methods or materials that use external sources of energy to recover oil that cannot be produced economically by conventional means;  
  5. economic analysis for enhanced hydrocarbon recovery methods  
  **Subject-specific practical skills**  
  On completion of this module students should be able to demonstrate ability in:  
  6. select the best method for enhanced oil and gas recovery using |
7. Case studies, including design, implementation and monitoring and field development

**Key/transferable skills**

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

8. Solve and describe on practical problems in Secondary and enhanced oil recovery

9. Emerging recovery technologies for unconventional resources

**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, 4, 5, 6, 7, 8. |
| 2. 5, 1h tutorials. This method informs learning outcomes 1, 5, 7, 8. |
| 3. 5, 2h computer laboratory sessions. This method informs learning outcomes 4, 5, 7. |

**Indicative content**

- Revision of Primary recovery
- Secondary recovery; fractional flow and frontal advance equations, waterflood recovery calculations in homogeneous and stratified reservoir;
- Factors Influencing waterflood performance,
- factors affecting production performance; wettability, oil and water viscosities, formation dip and Rate, Initial Gas Saturation, Stabilized and Variable Zones, Areal Sweep Efficiencies, Vertical and volumetric sweep efficiencies,
- fundamentals of enhanced oil recovery;
- Enhanced Hydrocarbon Recovery Methods;
  - Chemical Methods (Polymer flooding, Alkaline flooding, Surfactant flooding and Alkaline Surfactant Polymer flooding approaches, design and performance and new techniques in chemical methods);
  - Thermal Methods (Steam injection, cyclic steam, and in-situ-combustion and new techniques in thermal methods);
  - Microbial Enhanced Hydrocarbon Recovery
  - miscible displacement of CH4 by CO2 in depleted gas reservoirs;
  - screening and selection of EOR methods and environmental factors associated with oil recovery,
  - evaluating and monitoring of EOR projects, design a pilot
### Assessment Elements & weightings

- **Examination:** A 180 minute unseen written examination assesses learning outcomes 1, 2, 3, 4, 6, 8.  
  **70%**
- **Course Work:** 15% Oral presentation in HER and 15% coursework in water flooding. This method assesses learning outcomes 1.5, 7, 8, 9  
  **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)