

**Course Title:**

Seawater Desalination

**Duration:**

15 Week, 1 session per week, 3 hours per session

**Course Description:**

This course provides detailed information about the history of desalination and various types of desalination processes with different source of energy namely, renewable and non-renewable sources. The principle of major desalination technologies such as Multi Stage Flash, Multi Effect Distillation and Reverse Osmosis and their application is discussed. A basic mathematical simulation including thermodynamics and heat and mass transfer principles of major technologies is explained. Students learn to perform economic evaluation of a desalination plant to find out the unit product cost and compare two or more alternatives by cash flow analysis. Most important environmental impacts of desalination processes are described. Moreover, a group based student project (3 to 4 persons per group) is assigned to do a thermo-economic evaluation of a selected desalination process and present as a *power point* presentation during the last three sessions as shown in the course outline table.

**Pre-requisites:**

Thermodynamics  
Heat Transfer

**Course Outline:**

Session	Topic
1	Introduction and Course Description Historical Review of Desalination (World and Iran)
2	Water Chemistry (Seawater, Brackish water, Brine and Freshwater) Desalination Process
3	Desalination Technologies
4	Renewable Energy Desalination Thermodynamics and heat and mass transfer (Review)
5	Single Effect Distillation (SED <sup>1</sup> ) Multi Effect Distillation (MED <sup>2</sup> )
6	Multi Effect Distillation Thermal Vapour Compression (MED-TVC <sup>3</sup> ,) Multi Effect Distillation Mechanical Vapour Compression (MED-MVC <sup>4</sup> )
7	Multi Stage Flash (MSF <sup>5</sup> )

---

<sup>1</sup> Single Effect Distillation

<sup>2</sup> Multi Effect Distillation

<sup>3</sup> Thermal Vapour Compression

<sup>4</sup> Mechanical Vapour Compression

<sup>5</sup> Multi Stage Flash

8	Low Temperature Multi Effect Distillation (LT-MED)
9	Reverse Osmosis (RO)
10	Thermo-Economic Evaluation (CAPEX, OPEX, Unit Product Cost, Cash Flow Analysis)
11	Environmental impacts (Intakes, Brine disposal, Greenhouse gas emission)
12	Environmental impacts (Intakes, Brine disposal, Greenhouse gas emission)
13	Case studies
14	Project presentations
15	Project presentations

#### Grading:

Attendance	10	%
Quizzes and Assignments	10	%
Project presentation	30	%
Final Exam	50	%
<b>Total:</b>	<b>100</b>	<b>%</b>

#### Textbook:

There is not a single textbook to recommend. Wide range of relevant publications and texts can be used such as:

1. Bijan Rahimi, Hui Tong Chua, "Low Grade Heat Driven Multi Effect Distillation and Desalination", Elsevier, 2016.
2. N. Voutchkov, "Desalination Engineering Planning and Design", McGraw Hill, 2013
3. Michael Schorr, "Desalination trends and technologies", InTech, 2011
4. H. T. El-Dessouky, H. M. Ettouney, "Fundamental of Salt Water Desalination", Elsevier, 2002.

*Bijan Rahimi*  
03-Aban-1395

