

<p>Kingdom of Saudi Arabia Ministry of Higher Education <b>Qassim University</b> College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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## Desalination

**College: Engineering**

**Department: Mechanical**

**First: Course Definition**

**1- Course Code : ME680**

**2- Units : 3 credit hrs**

**3 – Semester**

**4 -Prerequisite : None**

**5- Co-requisite: None**

**6- Location (if not on main Campus): N/A**

**Second: Course Objectives**

1. To provide students with the basic principles required for understanding different desalination methods.
2. To provide students with insight into the nature of desalination.
3. To help students understanding fouling, scaling, and pretreatment
4. To help students develop the ability to calculate permeates flow rate of RO systems and the total productivity of the other systems.

**Third: Course Specifications**

1- Topics to be covered		
Subject	No of Weeks	Units
<i>Concepts in thermodynamics; Water treatments; Fouling and scaling on tubes; fouling removal.</i>	<b>4</b>	<b>12</b>
<i>Thermal desalination: Multistage evaporation systems (MES); Multistage Flash systems (MSF); Vapor compression desalination systems(VCD); Solar desalination systems; co-generation power</i>	<b>4</b>	<b>12</b>

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systems.		
<b>Reverse osmosis systems:</b> Types of membranes; membrane arrangements; Energy recovery; back washing; membrane fouling; Ultra and nanofiltration.	<b>4</b>	<b>12</b>
<b>Project:</b> Analysis of Desalination Plant	<b>3</b>	<b>9</b>

## 2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	Other	Total
45	---	--	45

## 3- Intended Learning Outcomes of the Course (ILO's)

### a. Knowledge

#### i) Description of the knowledge to be acquired:

On successful completion of this course, students should be able to:

- Outline the basics, theory and physical concepts of water treatments..
- Recognize the different configurations of thermal desalination Plants.
- Recognize the different configurations of vapor compression desalination Plants
- Recognize the different configurations of R.O desalination Plants.

#### ii) Teaching strategies to be used to develop that knowledge

- Class lectures.
- Reading assignments.
- Interacting with student in class (active Learning)
- Reports

#### iii) Methods of assessment of knowledge acquired

- Assignments
- Reports
- Quizzes
- Group Project

### b- Cognitive (Intellectual) Skills

#### i) Cognitive skills to be developed

On successful completion of this course, students should be able to:-

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- Analyze the different types of desalination plants.
- Differentiate between the different desalination plants.
- Design different components of the desalination plants.
- cost analysis of cubic meter of desalinated water.

**ii) Teaching strategies to be used to develop these cognitive skills**

- Class lectures.
- Tutorial sessions
- Case study (data collection, Internet search, and reporting)
- Problem assignments and Students' presentations.
- Reports.
- Group discussion.

**iii) Methods of assessment of students cognitive skills**

- Exams.
- Quizzes.
- Homework
- Assignments.

**c. Interpersonal Skills and Responsibility**

**i) Description of the interpersonal skills and capacity to carry responsibility to be developed**

On successful completion of this course, students should be able to:

- Participate in class discussions with colleagues and with teachers.
- Work in team
- Develop ideas and share with others
- Appreciate the need for make use desalination plants and its optimal operation.
- Recognize the conflicting issues between using desalination and environmental issues

**ii) Teaching strategies to be used to develop these skills**

- Class lectures.
- Reading assignments and Students' presentations.
- Case study (data collection, Internet search, and reporting)
- Problem assignments and Students' presentations.
- Reports.

**iii) Methods of assessment of student's interpersonal skills and capacity to carry responsibility**

- Exams.
- Quizzes.

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- Homework
- Assignments.

#### **d. Communication, Information Technology and Numerical Skills**

##### **i) Description of the skills to be developed in this domain**

On successful completion of this course, students should be able to:

- Use of the internet search for course related issues.
- Write acceptable technical report.
- Verbally present technical report.

##### **ii) Teaching strategies to be used to develop these skills**

- Reading assignments and Students' presentations.
- Case study (data collection, Internet search, and reporting)
- Reports.
- Group discussion.

##### **iii) Methods of assessment of students numerical and communication skills**

- Homework
- Assignments.

#### **e. Psychomotor (if applicable) & Other Non-cognitive Skills**

##### **i) Description of the psychomotor or other skills to be developed and the level of performance required**

Not Applicable

##### **ii) Teaching strategies to be used to develop these skills-**

Not Applicable

##### **iii) Methods of assessment of student's psychomotor skills**

Not Applicable

#### **4- Student Assessment Schedule**

<b>Serial</b>	<b>Assessment tool (test, group project, examination etc.)</b>	<b>Week due</b>	<b>Weight</b>
1	Four quizzes	Weeks 5, 8, 9 and 14	10 %
2	Two mid-term exams	Weeks 6 and 12	20 %

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3	Mostly eight assignments (in-class/out-class) and homework. This number may increase according to the instructor view.	Weeks 3, 5, 7, 9, 11, 12, 14 and 15	16 %
4	Attendance	All weeks	4 %
5	Final Exam	Week 16	50%

## 5- Student Support

Four office hours per week are offered by the instructor to aid the students and support them. University data base access (electronic library of textbooks and scientific periodicals).

## 6- Learning Resources

### i) Essential Books (References)

- [1] Hisham T. El-Dessouky and Hisham M. Ettouney, *Fundamentals of Salt Water Desalination*, Elsevier Science B.V., 1<sup>st</sup>, 2002.

### ii) Course Notes

- None
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### iii) Recommended Books

- [1] Hisham T. El-Dessouky and Hisham M. Ettouney, *Fundamentals of Salt Water Desalination*, Elsevier Science B.V., 1<sup>st</sup>, 2002.

### iv) Electronic Books & Web Sites:

<http://onlinebooks.library.upenn.edu/webbin/book/lookupid?key=olbp33597>

### v) Periodicals

- [www. Elsevier.com/Desalination](http://www.Elsevier.com/Desalination)
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## 7- Course Evaluation and Improvement Processes

### i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students questionnaires,
- Appeal box

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***ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department***

- Instructor course evaluation report by the end of the course
- Periodical (semester/annual) review of the department subject committee

***iii) Processes for Improvement of Teaching***

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- The educational continuous improvement process which applied in the department according to the ABET criteria are also applied here, moreover
- Evaluation of the course outlines by external staff member from outside the university
- Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.

***iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)***

- Check marking by an independent faculty member of a sample of student work

***v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.***

- Through a committee of evaluation in checking the outcomes.
- Through the students` assessment for continuous improvement process.