Jordan University of Science and Technology

Faculty of Institute Of Nanotechnology

Nanotechnology And Engineering Department

NANO714 Water Desalination Using Nanotechnology - JNQF Level: 9

Second Semester 2023-2024

Course Catalog
3 Credit Hours. 3 Credit hours (3 h lectures). This course provides comprehensive insight into water classification, addressing water scarcity issues, and various desalination technologies, including thermal and membrane-based methods. Students will gain in-depth knowledge of membrane processes, with a focus on reverse osmosis membranes and emerging nanotechnology-driven advancements in membrane development for water desalination. Additionally, the course will enable students to distinguish between desalination processes and other pre- and post-treatment methods employed in water treatment, including pollutant decontamination using advanced technologies such as photocatalytic degradation using nanomaterials. By the conclusion of the course, students will be equipped to assess the potential impact of nanotechnology on membrane processes for water desalination. Course objectives: 1. To recognize nanotechnology as a central subject in the broader and interdisciplinary context of water desalination. 2. To learn the advancements of nanotechnology in membrane development for water desalination.
Teaching Method: On Campus

Text Book	
Title	Reverse Osmosis Industrial Processes and Applications
Author(s)	Jane Kucera
Edition	2nd Edition
Short Name	1
Other Information	Scrivener Publishing Wiley/ 2015

Course References

Short name	Book name	Author(s)	Edition	Other Information
2	Membrane and Desalination Technologies	Wang L. K., Chen J.P., Hung Y., Shamas N.K., (Eds.)	13th Edition	Humana Press/ 2010/Volume 13
3	Fundamentals of Saltwater Desalination	Hisham T. El-Dessouky and Hisham M. Ettouney	1st Edition	2002

4	Reverse Osmosis and Nanofiltration	American Water Works Association	2nd Edition	(AWWA MANUAL M46), 2007
5	Application of nanotechnology in Membranes for Water Treatment	Alberto Figoli, Jan Hoinkis, Sacide Alsoy Altinkaya, and Jochen Bundschuh	5th Edition	Taylor & Francis, Volume 5, 2017
6	Micellar enhanced ultrafiltration Fundamentals & Applications	Sirshendu De and Sourav Mondal	1st Edition	CRC Press, 2012
7	Handouts	Dr. Ayat Bozeya	1st Edition	

Instructor	
Name	**Dr. Ayat Bouzieh**
Office Location	Institute of Nanotechnology
Office Hours	Sun : 10:30 - 11:15 Mon : 12:30 - 14:00 Tue : 10:45 - 11:45 Thu : 10:30 - 13:30
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Class Schedule & Room
Section 3: Lecture Time: Mon : 09:30 - 12:30 Room: NANO 1

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	Introduction to Water Desalination	**Ch. # 1** From **1**, **Ch. # 1** From **3**, **Ch. # 1** From **4**, **L1** From **7**
Week 2	Basic Terms and Definitions	**Ch. # 3** From **1**, **Ch. # 3** From **2**, **L2** From **7**
Week 3	Membrane processes, with a focus on reverse osmosis membranes	**Ch. # 2** From **1**, **Ch. # 1** From **2**, **Ch. # 1** From **4**, **L3** From **7**
Week 4	Membranes: Transport Models, Membrane Materials, and Membrane Modules	**Ch. # 4** From **1**, **Ch. # 2** From **2**, **L4** From **7**

Week 5	Membranes: Basic flow patterns	**Ch. # 5** From **1**, **Ch. # 7** From **3**, **L5** From **7**
Week 6	Pretreatment and Post Treatment	**Ch. # 6** From **1**, **Ch. # 1** From **2**, **L6** From **7**
Week 7	Midterm Exam	**L1-L5** From **7**
Week 8	Source of Water Pollution	**Ch. # 7** From **1**, **Ch. # 1** From **6**, **L7** From **7**
Week 9	Polymerizable microemulsion membranes	**Ch. # 1** From **5**, **L8** From **7**
Week 10	layer-by-layer membranes	**Ch. # 2** From **5**, **L9** From **7**
Week 11	Mixed matrix flat-sheet membranes	**Ch. # 3** From **5**, **L10** From **7**
Week 12	Micellar enhanced ultrafiltration	**Ch. # 14** From **1**, **Ch. # 7** From **6**, **L11** From **7**
Week 13	Facility design and construction	**Ch. # 9** From **1**, **Ch. # 3** From **4**, **L12** From **7**
Week 14	Forward osmosis	**L13** From **7**
Week 15	Selected Application of Nanomaterials	**L14** From **7**
Week 16	Final Exam	**According to the University final examination schedule** From **7**

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
By the end of the course, the students are expected to provide comprehensive insight into water classification based on sources of pollutant. [5PLO1] [15L9K1]	15%	
By the end of the course, the students are expected to explain the principles of membrane technology and desalination requirements. [12PLO3] [12L9K3]	12%	
By the end of the course, the students are expected to appreciate enhanced pollutant decontamination [15PLO3] [15L9K3]	15%	
By the end of the course, the students are expected to explain the membrane fouling characterization and prevention. [10PLO4] [10L9K3]	10%	

By the end of the course, the students are expected to achieve the ability to choose appropriate membrane for appropriate water desalination [14PLO4] [7L9S2, 7L9C1]	14%	
By the end of the course, the students are expected to correlate Recent advancements in practices related to desalination by means of nanotechnology. [20PLO5] [10L9S1, 10L9C2]	20%	
By the end of the course, the students are expected to be able to Describe various membrane systems planning and design [14PLO7] [7L9C4, 7L9S3]	14%	

Relationship to Program Student Outcomes (Out of 100%)								
PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9
15		27	24	20		14		

Relationship to NQF Outcomes (Out of 100%)							
L9K1	L9K3	L9S1	L9S2	L9C1	L9C2	L9C4	L9S3
15	37	10	7	7	10	7	7

Evaluation	
Assessment Tool	**Weight**
Midterm exam	35%
Final Exam	50%
Homework & Quizzes	5%
Term Paper	10%

Policy

Exams	- Applied projects and term papers are required for graduate students. - Plagiarism laws will be enforced on all class assignments, papers, projects, and tasks. - Exams Could be a mix of (Short essays, short answers, multiple choice, fill-in-the-blank, matching, etc.). They cover all lectures including all readings, lectures, handout material, and postings on the E-Learning module. - Exam makeup is accepted only for emergencies. Students absent from an examination must report immediately to the graduate registrar?s office following JUST regulation. A student who is absent on account of illness must submit a medical certificate evidence. No make-up for quizzes __During exams__ * You are not allowed to access or consult any materials, resources, websites, or applications whatsoever (both hardcopy and digital) that your examiner has not provided as part of the exam questions and any accompanying appendices (where applicable). * You are not allowed to communicate with another student during the exam, nor look at another?s answers. * You may not leave the exam until the midway point of the examination time. * You may not continue writing after the supervisor has announced the end of the examination. * You must ONLY use blue or black pens (no pencils). * You must provide your materials (pens, calculators, etc.). No spare materials will be provided, and no material in an exam may be shared. * Late students are allowed to enter the exam room during the first half midway point of the examination time, but they will not be given any extra time.
Cheating	Prohibited; The commitment of the acts of cheating and deceit such as copying during examinations, altering examinations for re-grade, plagiarism of homework assignments, and in any way representing the work of others as your own is dishonest and will not be tolerated. Standard JUST policy will be applied. المادة 7: إذا ضُبط الطالب أثناء الامتحان أو الاختبار متلبساً بالغش فتوقع عليه العقوبات التالية مجتمعة أ- اعتباره راسباً في ذلك الامتحان أو الاختبار. ب- الغاء تسجيله في بقية المساقات المسجل لها في ذلك الفصل. جـ- فصله من الجامعة لمدة فصل دراسي واحد، و هو الفصل التالي للفصل الذي ضبط فيه.
Attendance	- Attendance is mandatory and will be recorded regularly. - Excellent attendance is expected. - Students who miss more than 20% of the classes will be dropped from the course as per JUST policy. - If you miss class, it is your responsibility to find out about any announcements or assignments you may have missed.
Withdraw	The last day of courses withdrawal (without reimbursement of tuition fees) is the day before the 1st day of the final examination period

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