UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Desalination Technology
Module Code	CPE7002-B
Academic Year	2024/5
Credits	20
School	School of Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Tutorials	20
Directed Study	160
Lectures	20

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 1

Module Aims

The aim of this module is to provide you with a detailed technological understanding of strategically important issue of sustainable production of freshwater via different desalination methods.

Outline Syllabus

- Water demand & supply
- multistage flash desalination
- evaporative desalination
- reverse osmosis desalination
- freeze desalination
- solar desalination
- fouling
- non-condensable gases
- scaling
- energy recovery
- environmental pollution
- costing, modelling & optimisation.

Learning Outcomes	
Outcome Number	Description
01	Explain the global water demand and supply
02	Critically evaluate the alternative technologies for sustainable fresh water production
03	Apply knowledge of mass and energy balance in modelling thermal and membrane based desalination processes
04	Apply the optimisation techniques to trade-off between design and operation of desalination processes with maximum energy recovery
05	Analyse and assess the effect of brine disposal on marine life
06	Develop skills in process modelling and optimisation. 6.1 Membrane Process 6.2 Thermal process.

Learning, Teaching and Assessment Strategy

1. Interactive lectures to provide the state of the art knowledge on desalination technologies;

2. Directed learning-students will be referred to books, journals in each sub topics of desalination so that they can build up their knowledge to take part effectively in interactive lecture sessions. In the interactive sessions, students are paired up to discuss their understanding of the topics amongst themselves for 5 minutes and their learning with the rest of the class. They pair up again with different partner and do the same thing. Each 2 hrs lecture will have about 1 hr of interactive sessions.

3. Tutorial sessions are used to carry out hand calculations on reverse osmosis (RO) process and single stage flash (SSF) desalination process. The students analyse the system equations, degrees of freedom and specifications in an interactive mode (through peer support). Dynamic process models for the systems are developed in the classroom together with the students.

4. Laboratory experiments are carried out on reverse osmosis (RO) to learn and demonstrate (via the group report) the impact of design and operation parameters on the recovery of freshwater from saline water. In the computer lab sessions, the students will develop the mathematical model for the RO process. The model predictions are then compared with the experiments and they study the reasons for any plant-model mismatch in group. Through background reading (directed learning) and tutorial support during lab sessions the students learn how to mitigate plant-model mismatch.

5. The students develop SSF model using modelling software (gPROMS) check the model predictions against their hand calculations and then they extend the model for Multi Stage Flash (MSF) desalination process and study the interactions of design and operation parameters on the recovery of fresh water. These lab sessions are interactive where the tutor and the students support each other.

Assessment is by Coursework - Portfolio of Different Activities.

1. To write a group report (as part of the coursework) on water demand forecast, energy consumption and recovery.
To write a group lab report based on experimentation. Experimentation with RO based desalination process. Evaluation of water and salt permeability constants.
Formative assessment will be carried out during the lab session.
Submission: Week 7 or 8
Weighting 50%. 2000 words per student.
Assess LO 1,2,3, 6.1.
Individual mark will be assigned based on performance in 10 minutes individual PowerPoint presentation on the group report .

2. To write a full report modelling, simulation, design and operation optimisation, fouling, energy consumption for both RO and MSF desalination processes. The report must contain critical analysis of your observations and findings.
Formative assessment will be carried out during computer lab sessions.
Weighting 50%. 2000 words and computer models.
Submission in week 12.
Feedback in week 2 Semester 2.
Assess LO4,5,6.2

Supplementary assessment if required will be to produce an individual report of 4000 words, assessing all learning outcomes.

Mode of Assessment

Type	Method	Description	Weighting
Summative	Coursework - Written	Group Lab Report. 2000 words per student	50%
Summative	Coursework - Written	Individual Report 2000 words and computer models	50%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

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