

## *The Hebrew University of Jerusalem*

### *Syllabus*

## *Water and Environment - 73908*

*Last update 20-08-2018*

*HU Credits:* 3

*Degree/Cycle:* 2nd degree (Master)

*Responsible Department:* Environmental Quality Sciences

*Academic year:* 0

*Semester:* 1st Semester

*Teaching Languages:* English

*Campus:* Rehovot

*Course/Module Coordinator:* Dr. Haim Cikurel

*Coordinator Email:* [chikurel@netvision.net.il](mailto:chikurel@netvision.net.il)

*Coordinator Office Hours:* By appointment (T:0544464015)

*Teaching Staff:*

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Mr. Ben Gido

Course/Module description:

Understanding conventional and advanced physical, chemical, biological processes related to water, municipal and industrial wastewater treatment and water reuse.

Course/Module aims:

To impart to the student, knowledge on water and wastewater treatment and reuse processes which help to preserve human health, soil and water resources

Learning outcomes - On successful completion of this module, students should be able to:

On successful completion of this course the student should be able to understand:

- a. The nature of impurities in waters and wastewaters.
- b. The basic principles of conventional and advanced treatment processes in water and wastewater treatment and reuse.
- c. Select appropriate processes depending on the nature of impurities to be removed and the intended use of the treated water or effluent.

Attendance requirements(%):

At least 80-90% of the time. Full attendance required for the technical visits day

Teaching arrangement and method of instruction: Frontal teaching by presentations which will be previously posted in the course web site. Two assignments and two problem solving sessions (water, wastewater), one technical visits day, written report on the technical visit day learning, end of year written exam (closed book multiple answers part, open book problem solving part).

Course/Module Content:

DETAILED COURSE PROGRAM (Responsible – Dr.Haim Cikurel)

17.10.18 Water and wastewater quality parameters and standards. Nature of impurities in water and wastewater V&H 7.2(8.2), 7.4(8.4), 3.5, 3.6, 9.6, 7.9(8.9), 12.11, 14.1, 14.15, 14.16

24.10.18 Water purification processes (general over-view): Aeration, softening, coagulation-flocculation, precipitation, granular filtration, membrane filtration, carbon adsorption, ion exchange, disinfection V&H 9.7, 9.8, 9.9

31.10.18 Theory and principles of clarification. Particle settling. Types of clarifiers. Dissolved air floatation. V&H 10.11, 10.12, 10.13

14.11.18 Physicochemical processes for water purification: Coagulation-flocculation,

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*granular media filtration, disinfection V&H, (10.9, 10.10, 10.18, 10.21, 11.7, 11.8, 11.9, 11.18, 11.35, 11.37)*

*21.11.18 Natural and hybrid engineered and natural treatment systems for drinking water production and wastewater reuse. Bank filtration, Soil Aquifer Treatment, Constructed wetlands. Pre and post treatments for natural systems (coagulation-flocculation-filtration, chlorination, ozonation, UV, Biological active carbon, membrane systems (UF, NF, RO). (Related papers, WEB). (First assignment on water treatment)*

*28.11.18 Membrane systems for water and wastewater treatment and water reuse. MF, UF, NF, RO and MBR.*

*5.12.18 Water reuse. The importance of water reuse. Advanced treatments (tertiary and quaternary treatments). Indirect and Direct Potable Reuse. V&H 14.3, 14.5, 14.6, 14.16(14.17), 14.19*

*12.12.18 Water treatment – Problem solving session*

*19.12.18 Wastewater treatment systems (general overview). Basic treatment processes: Pretreatment (Prefiltration systems, precipitation, primary settling), biotreatment (activated sludge, nitrification -denitrification, Aerobic and anaerobic ponds (lagoons), trickling filters, biofilters, anaerobic digestors, sludge treatment, chemical and thermal oxidation V&H 9.4*

*26.12.18 Principles of biological treatment. Activated sludge and sludge treatment principles. Suspended biological growth processes. Attached growth processes. Nitrification-denitrification processes. Sludge treatment V&H (12.7, 12.8, 12.9, 12.21, 13/10, 13.11, 13.12, 13.13, 13.14, 13.15). (Second assignment on wastewater treatment)*

*2.1.19 Industrial wastewater treatment. Characteristics of Chemical process Industries wastewater. Food industries wastewater. Good house-keeping in different industries to minimize wastewater. Different conventional and modern treatment technologies. Zero discharge. (V&H 7.7, 8.7, 9.1).*

*6.1.19. Technical visits day – Desalination plant, wastewater treatment plant and/or soil aquifer treatment (SAT) site (water reuse) and/or pilot system for wastewater treatment and reuse (including UF-RO and Advanced Oxidation Processes -SAT systems).*

*9.1.19 Wastewater – Problem solving session*

*16. 1.19 General review and completion of study material*

### Required Reading:

- Presentations posted on the web site.
- Viessman, Jr., W. and Hammer, M.J. *Water Supply and Pollution Control*. 6th Ed. Harper Collins College Publishers, N.Y. (1998)

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Additional Reading Material:

*Different papers that will be distributed during the course*

Grading Scheme:

Additional information:

*End of year written examination: Multiple answer part (Close books), 16 questions, 3 points each ( 48%\_)*

*2 to 4 problem solving questions (open books). (52%)\_\_*

*Presentations The student is required to be present during the contact hours to understand the presentations and is encouraged to ask questions. Besides it is suggested to consult the presentations through the course web site. It is recommended to be present during the problem solving contact hours (4 contact hours).*

*Assignments\_ 2 (One on water treatment and one on wastewater treatment)*

*Reports – Report on the Technical visit day (water and wastewater treatment sites)*

*The final score consists of: 65% End of year written examination (48% multiple questions, 52% problem solving), 25% Technical visit report, 10% (assignments, water and wastewater treatment problems solving, each 5%).*