

**Kingdom of Saudi Arabia**  
**The National Commission for**  
**Academic Accreditation & Assessment**



**COURSE SPECIFICATION**  
**Industrial Water and Wastewater Treatment, )**  
**(402336-2**  
**1435 / 1436 H**

# Course Specification

|   |
|---|
| Institution: <b>Umm Al-Qura University</b>                                    |
| College/Department: <b>Faculty of Applied Sciences / Chemistry Department</b> |

## A. Course Identification and General Information

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| 1. Course title and code: <b>Industrial Water and Wastewater Treatment-402336-2</b>  |
| 2. Credit hours: <b>2 theoretical hrs.</b>   |
| 3. Program(s) in which the course is offered (If general elective available in many programs indicate this rather than list programs): <b>Industrial Chemistry</b> |
| 4. Name of faculty member responsible for the course:<br><b>Prof. Dr. Abdul Hady M. Aloumary</b>   |
| 5. Level/year at which this course is offered: <b>6<sup>th</sup> / third year</b>  |
| 6. Pre-requisites for this course (if any): <b>Analytical Chemistry 2</b>  |
| 7. Co-requisites for this course (if any): <b>Nothing</b>  |
| 8. Location if not on main campus: <b>Chemistry Department</b>   |

## B. Objectives

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| <p><b>1. Summary of the main learning outcomes for students enrolled in the course</b></p> <p>By finishing of this course, the students will be able to discuss and understand:</p> <ul style="list-style-type: none"><li>• of physical, chemical, and biological phenomena to the successful design and operation of industrial water and wastewater treatment plants</li><li>• the essential steps needed for any water treatments</li><li>• how to reduce the cost and efforts during design a new plant for water treatment.</li></ul> |
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2. **Briefly describe any plans for developing and improving the course that are being implemented.** (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)
- Variegation of learning sources for the course, so that students benefit from more than one reference.
  - Encourage students to prepare reports include the bonding theories, the prosperities and uses of selected main group and transition metal elements and types of acids and bases.
  - The use of teaching intelligent classes for lectures.

**C. Course Description** (Note: General description in the form to be used for the Bulletin or Handbook should be attached):

| <b>1. Topics to be covered:</b>   |                    |                      |
|---|--------------------|----------------------|
| <b>Topic</b>  | <b>No of Weeks</b> | <b>Contact hours</b> |
| <ul style="list-style-type: none"> <li>▪ Requirement of water and sources.</li> <li>▪ Water quality standards.</li> <li>▪ Physico chemical parameters and significance-odor.</li> </ul>   | <b>2</b>           | <b>4</b>             |
| <ul style="list-style-type: none"> <li>▪ Temperature turbidity, density, solids, hardness, acidity.</li> <li>▪ Alkalinity-dissolved oxygen-organic chemicals and BOD, COD.</li> <li>▪ Determination of pH, CO<sub>2</sub>, alkalinity</li> </ul>  | <b>2</b>           | <b>4</b>             |
| <ul style="list-style-type: none"> <li>▪ A brief idea of sedimentation, coagulation and flocculation, filtration, disinfection of water. Activated sludge process, trickling filters, sludge treatment and disposal. Softening of water, corrosion and its control.</li> <li>▪ Removal of toxic compounds, refractory organics, and dissolved inorganic substances. Reverse osmosis.</li> </ul> | <b>2</b>           | <b>4</b>             |
| <ul style="list-style-type: none"> <li>▪ Setting the Stage for Industrial Wastewater Treatment.</li> <li>▪ Pre- and primary treatment.</li> </ul>   | <b>2</b>           | <b>4</b>             |
| <ul style="list-style-type: none"> <li>▪ Chemical precipitation/coagulation.</li> <li>▪ Aeration and mass transfer.</li> <li>▪ Aerobic biological oxidation.</li> </ul>   | <b>2</b>           | <b>4</b>             |

|   |   |   |
|---|---|---|
| ▪ Biological wastewater treatment processes.      | 2 | 4 |
| ▪ Adsorption and ion exchange.                    | 2 | 4 |
| ▪ Chemical oxidation and miscellaneous processes. |   |   |

|   |                 |                                     |              |
|---|-----------------|-------------------------------------|--------------|
| <b>2. Course components (total contact hours per semester):</b> |                 |                                     |              |
| Lecture: <b>28</b>  | Tutorial: _____ | Practical/Fieldwork/In<br>ternship: | Other: _____ |

**3. Additional private study/learning hours expected for students per week** (this should be an average: for the semester not a specific requirement in each week):

- Students spend two hours during the whole semester to discuss, and resolve questions and duties of the course.

**4. Development of learning outcomes in domains of learning for each of the domains of learning shown below indicates:**

- A brief summary of the knowledge or skill the course is intended to be developed.
- A description of the teaching strategies to be used in the course to develop that knowledge or skill.
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

**a. Knowledge**

**(i) Description of the knowledge to be acquired**

- Physico chemical parameters and significance-odor.
- A brief idea of sedimentation, coagulation and flocculation, filtration, disinfection of water.
- Removal of toxic compounds, refractory organics, and dissolved inorganic substances. Reverse osmosis.
- Biological wastewater treatment processes

**(ii) Teaching strategies to be used to develop that knowledge:**

- Scientific discussions during the lectures.
- The use of library to perform work duties and prepare small research reports about molecular symmetry and packing of spheres and structures of the elements and defects in solid state.
- Resolve problems and questions concerned with the topics presented during lectures as homework.
- Use of the internet to prepare some reports about bonding theories and the chemistry of the main group and transition elements.

**(iii) Methods of assessment of knowledge acquired:**

- Written periodic and final exams.
- Scientific discussions and effective participations during the lectures.
- Preparing scientific reports and weekly homework.

**b. Cognitive Skills**

**(i) Cognitive skills to be developed:**

- The student learns how apply basic understandings of physical, chemical, and biological phenomena to the successful design and operation of industrial water and wastewater treatment plants.
- The student acquires the ability to recognize the properties and the quality of any treatment plant.
- The student understands how to deal with each step in the water treatment process.

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

- Provide the students with examples and practical tasks that performed under the supervision of lecturers.
- Assigning student's duties that include open tasks designed for the application of prediction and analysis skills, problem solving.
- Giving some applied examples and problem and ask the students to find a strategic plan to resolve them.

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| <p><b>(iii) Methods of assessment of student cognitive skills:</b></p> <ul style="list-style-type: none"> <li>• Periodic exams and oral discussions.</li> <li>• Measuring the response of students for the assignments.</li> </ul>   |
| <p><b>c. Interpersonal Skills and Responsibility</b></p>   |
| <p><b>(i) Description of the interpersonal skills and capacity to carry responsibility to be developed:</b></p> <ul style="list-style-type: none"> <li>• Evaluate and develop the student's ability to work in a team.</li> <li>• The development of the ability of students to think and work in individual manner.</li> </ul>  |
| <p><b>(ii) Teaching strategies to be used to develop these skills and abilities</b></p> <ul style="list-style-type: none"> <li>• Divide the students into team works to evaluate their ability to work in groups.</li> <li>• Periodic duties that carried out in individual manner to evaluate the ability of students to take responsibility and self-reliance.</li> </ul>            |
| <p><b>(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility</b></p> <ul style="list-style-type: none"> <li>• Evaluation of the individual tasks such as homeworks and duties and to determine the student's ability to self-reliance.</li> </ul>   |
| <p><b>d. Communication, Information Technology and Numerical Skills:</b></p>   |
| <p><b>(i) Description of the skills to be developed in this domain:</b></p> <ul style="list-style-type: none"> <li>• The ability to perform the mathematical calculations and data analysis and introduce it in a statistical way</li> <li>• The skill to deal with computer and internet in order to download the research papers and articles that related to the course.</li> </ul> |
| <p><b>(ii) Teaching strategies to be used to develop these skills:</b></p>   |

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| <ul style="list-style-type: none"> <li>• The use of computers in the training room of the department.</li> <li>• Organization of group visits to the central Library.</li> <li>• The use of the international information network (internet).</li> </ul>   |
| <p><b>(iii) Methods of assessment of students numerical and communication skills:</b></p> <ul style="list-style-type: none"> <li>• Ask questions that measure the student's ability to interpret simple statistical information.</li> <li>• Evaluate the homeworks and duties associated with the proper use of communication skills and numerical process.</li> </ul> |
| <p><b>e. Psychomotor Skills (if applicable)</b></p>  |
| <p><b>(i) Description of the psychomotor skills to be developed and the level of performance required:</b></p> <ul style="list-style-type: none"> <li>• It is not requirement for this course.</li> </ul>  |
| <p><b>(ii) Teaching strategies to be used to develop these skills:</b></p> <ul style="list-style-type: none"> <li>• It is not requirement for this course.</li> </ul>  |
| <p><b>(iii) Methods of assessment of students psychomotor skills</b></p> <ul style="list-style-type: none"> <li>• It is not requirement for this course.</li> </ul>  |

| <b>5. Schedule of Assessment Tasks for Students During the Semester:</b> |   |                     |                                       |
|--|---|---------------------|---------------------------------------|
| <b>Assessment</b>  | <b>Assessment task (eg. essay, test, group project, examination etc.)</b> | <b>Week due</b>     | <b>Proportion of Final Assessment</b> |
| <b>1</b>   | Class activities, Attendances and Duties                                  | Throughout the Term | <b>10%</b>                            |
| <b>2</b>   | Mid-Term Exam (s)   | 5-14                | <b>40%</b>                            |
| <b>3</b>   | Final Exam  | End of the Term     | <b>50%</b>                            |
| <b>4</b>   | <b>Total</b>  |                     | <b>100%</b>                           |

#### **D. Student Support**

**1. Arrangements for availability of faculty for individual student consultations and academic advice.** (include amount of time faculty are available each week):

- The presence of Staff members during the work hours to provide students with guidance and advice.
- Provide the students with the academic mentoring from the suitable members.
- Office hours: during the days of the week work days.

**E. Learning Resources**

**1. Required Text(s):**

- Industrial water pollution control, 3<sup>rd</sup> ed, W. Wesley Eckenfelder, Jr., McGraw-Hill, Inc., 2000.

**2. Essential References**

- Water chemistry, VERNON L. SNOEYINK, JOHN WILEY & SONS, New York' Chichester' Brisbane' Toronto' Singapore, 1980

**3. Recommended Books and Reference Material (Journals, Reports, etc)**

- Basic water treatment, George Smethurst, Thomas Telford Publishing, 2002

**4. Electronic Materials, Web Sites etc:**

- [http://www.cdc.gov/healthywater/drinking/public/water\\_treatment.html](http://www.cdc.gov/healthywater/drinking/public/water_treatment.html)
- <http://www.lenntech.ae/decision/water-treatment.htm>

**5. Other learning material such as computer-based programs/CD, professional standards/regulations**

- CDs contain programs specified to water treatment.

**F. Facilities Required**

**Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)**

**1. Accommodation (Lecture rooms, laboratories, etc.):**

- Equipped lecture halls.

**2. Computing resources:**

- 30 computers, one slide show (Data Show) and TV.

**3. Other resources** (specify --eg. If specific laboratory equipment is required, list



requirements or attach list):

- None.

**G. Course Evaluation and Improvement Processes**

**1. Strategies for obtaining student feedback on effectiveness of teaching:**

- The educational process is evaluated using questionnaire forms or panel discussions with students in order to identify and address weakness and strength points.

**2. Other strategies for evaluation of teaching by the instructor or by the department:**

- Prepare a course report based on the results of the students to give us an indication about the planned outputs.

**3. Processes for improvement of teaching:**

- Training programs and workshops for staff members to improve the educational process level.

**4. Processes for verifying standards of student achievement** (eg. 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):

- We will try to carry it but it does not applied until now.

**5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement:**

- A comparison of the course level should be made with similar courses at foreign universities.