



## Course Specifications

|                      |                                  |
|----------------------|----------------------------------|
| <b>Course Title:</b> | Chemistry of Energy Resources    |
| <b>Course Code:</b>  | 4024585-2                        |
| <b>Program:</b>      | Chemistry - Industrial Chemistry |
| <b>Department:</b>   | Department of chemistry          |
| <b>College:</b>      | Faculty of Applied Science/      |
| <b>Institution:</b>  | Umm Al-qura University           |

## Table of Contents

|   |          |
|---|----------|
| <b>A. Course Identification</b> .....   | <b>3</b> |
| 6. Mode of Instruction (mark all that apply) .....  | 3        |
| <b>B. Course Objectives and Learning Outcomes</b> .....   | <b>3</b> |
| 1. Course Description .....   | 3        |
| 2. Course Main Objective.....   | 3        |
| 3. Course Learning Outcomes .....   | 4        |
| <b>C. Course Content</b> .....  | <b>4</b> |
| <b>D. Teaching and Assessment</b> .....   | <b>5</b> |
| 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment<br>Methods ..... | 5        |
| 2. Assessment Tasks for Students .....  | 7        |
| <b>E. Student Academic Counseling and Support</b> .....   | <b>7</b> |
| <b>F. Learning Resources and Facilities</b> .....   | <b>7</b> |
| 1. Learning Resources .....   | 7        |
| 2. Facilities Required.....   | 7        |
| <b>G. Course Quality Evaluation</b> .....   | <b>8</b> |
| <b>H. Specification Approval Data</b> .....   | <b>8</b> |

## A. Course Identification

|  |
|--|
| <b>1. Credit hours:</b> 2  |
| <b>2. Course type</b><br>a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/><br>b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/> |
| <b>3. Level/year at which this course is offered:</b> 8 <sup>th</sup> Level-Fourth year  |
| <b>4. Pre-requisites for this course (if any):</b> Electrochemistry.   |
| <b>5. Co-requisites for this course (if any):</b>  |

## 6. Mode of Instruction (mark all that apply)

| No | Mode of Instruction   | Contact Hours | Percentage |
|----|-----------------------|---------------|------------|
| 1  | Traditional classroom | √             | 73%        |
| 2  | Blended               | --            |            |
| 3  | E-learning            | √             | 27%        |
| 4  | Distance learning     | --            |            |
| 5  | Other                 | --            |            |

## 7. Contact Hours (based on academic semester)

| No | Activity                                   | Contact Hours |
|----|--|---------------|
| 1  | Lecture                                    | 22            |
| 2  | Laboratory/Studio                          | --            |
| 3  | Tutorial                                   | --            |
| 4  | Others (E-learning + Exams + office hours) | 10            |
|    | <b>Total</b>                               | <b>32</b>     |

## B. Course Objectives and Learning Outcomes

|  |
|--|
| <b>1. Course Description</b><br><br>This course the future energy demand of world and nation regarding the available renewable energy resources such as, solar and nuclear energy.   |
| <b>2. Course Main Objective</b> <ul style="list-style-type: none"><li>• Students know renewable energy resources as alternative sources for finite sources.</li><li>• To understand and analyze the present and future energy demand of world and nation regarding the available renewable energy resources such as, solar and nuclear energy.</li><li>• Students familiar with Nuclear chemistry including terminology, Radioactivity and the nature of atoms, Radioactive Decay modes, Radioactive Decay Kinetics and nuclear reactions.</li><li>• Brief introduction on fundamentals of solar energy and photovoltaic cells</li><li>• Brief introduction to fuel cells.</li></ul> |

### 3. Course Learning Outcomes

| CLOs |  | Align ed PLOs |
|------|--|---------------|
| 1    | <b>Knowledge and Understanding</b>   |               |
| 1.1  | <b>Demonstrate broad knowledge and understanding of the underlying theories, principles, and concepts in chemistry of energy resources</b> | K1            |
| 1.2  | <b>Identify the processes, practices, and/or chemical terminology related to chemistry of energy resources</b>                             | K2            |
| 1.3  | <b>Discuss the research development and importance of energy resources and their impact in our life</b>                                    | K3            |
| 2    | <b>Skills :</b>  |               |
| 2.1  | <b>predict the stability of radioactive isotope</b>  | S1            |
| 2.2  | <b>compare types of nuclear reaction</b>   | S1            |
| 2.3  | <b>compare the types of radioactive emissions</b>  | S1            |
| 2.4  | <b>differentiate between solar cells</b>   | S2            |
| 2.5  | <b>compare Fuel cells</b>  | S1            |
| 2.6  | <b>identify types of radiation emitted by radioactive isotopes.</b>  | S2            |
| 2.7  | <b>Relate the stability of nucleus from the ratio of neutrons to protons</b>   | S1            |
| 2.8  | <b>define binding energy</b>   | S1            |
| 2.9  | <b>Recognize the energy accompany nuclear reactions</b>  | S2            |
| 2.10 | <b>mention types of nuclear reactions</b>  | S2            |
| 2.11 | <b>Select instruments for measuring radiation</b>  | S2            |
| 2.12 | <b>mention some applications of radioactive isotopes in medicine, agriculture ...etc.</b>  | S2            |
| 2.13 | <b>write about types of solar cells</b>  | S2            |
| 2.13 | <b>mention types of fuel cells</b>   | S2            |
| 2.14 | <b>Communicate effectively using theoretical basis of energy resources to a variety of audiences</b>                                       | S4            |
| 2.15 | <b>Apply IT and communication technology in gathering and interpreting information and ideas concerning the energy resources.</b>          | S5            |
| 3    | <b>Values:</b>   |               |
| 3.1  | <b>Demonstrate commitment to professional and academic values and ethics</b>   | V1            |
| 3.2  | <b>Write and present a chemical report related to chemistry of energy resources.</b>   | V2            |
| 3.3  | <b>work individually and in a team to prepare a report on energy resources</b>   | V3            |

### C. Course Content

| No | List of Topics  | Cont act Hour s |
|----|---|-----------------|
| 1  | <ul style="list-style-type: none"> <li>- The main sources of energy</li> <li>- Problems associated with the use of conventional energy sources, including fossil fuels, chemistry of fossil foils, with regard to future supply and the environment.</li> </ul> | 1+1E            |

|              |   |           |
|--------------|---|-----------|
| 2            | <ul style="list-style-type: none"> <li>- Nuclear energy:</li> <li>- The atomic nuclei, atomic structure and composition of nuclei.</li> <li>- Nuclear masses and stability of nucleus.</li> </ul>   | 2         |
| 3            | <ul style="list-style-type: none"> <li>- Radioactive decay processes, alpha, beta and gamma decays.</li> </ul>  | 2         |
| 4            | <ul style="list-style-type: none"> <li>- Radioactive decay and growth.</li> <li>- Equations of transformation during nuclear reactions</li> </ul>   | 2+2E      |
| 5            | <ul style="list-style-type: none"> <li>- Fission, charge and mass distribution.</li> <li>- Radioactive decay, Half-life, First order reaction, Source strength – Alpha, beta, gamma-radiation, x-rays, high-energy particles – Accelerators, Synchrotron</li> </ul> | 2+2E      |
| 6            | Solar energy <ul style="list-style-type: none"> <li>- An overview including principles of photovoltaics, dye sensitized solar cells and photoelectrochemical cells.</li> </ul>  | 2+2E      |
| 7            | <ul style="list-style-type: none"> <li>- Solar cells as cost effective alternative</li> <li>- Impact on environment</li> </ul>  | 1+1E      |
| 8            | Fuel cells: The working principles of a Fuel Cell.  | 4         |
| 9            | Fuel cells types  | 2         |
| 10           | Polymer Electrolyte Fuel Cell and Direct Methanol Fuel Cells as examples  | 2         |
| <b>Total</b> |   | <b>28</b> |

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes   | Teaching Strategies         | Assessment Methods   |
|------|--|-----------------------------|--|
| 1.0  | <b>Knowledge and Understanding</b>   |                             |  |
| 1.1  | <b>Demonstrate broad knowledge and understanding of the underlying theories, principles, and concepts in chemistry of energy resources</b> | Lectures<br>E-learning      | Mid-term-final exam<br>Active participation of students within their group on blackboard |
| 1.2  | <b>Identify the processes, practices, and/or chemical terminology related to chemistry of energy resources</b>                             | Lectures                    | Mid-term-final exam  |
| 1.3  | <b>Discuss the research development and importance of energy resources and their impact in our life</b>                                    | Self-Directed private Study | Assignments and activities   |
| 2.0  | <b>Skills</b>  |                             |  |
| 2.1  | <b>predict the stability of radioactive isotope</b>  | Lectures                    | Mid-term-final exam  |
| 2.2  | <b>compare types of nuclear reaction</b>   | E-learning                  | Assignments and activities on blackboard   |
| 2.3  | <b>compare the types of radioactive emissions</b>  | Lectures                    | Mid-term-final exam  |

| Code | Course Learning Outcomes   | Teaching Strategies                          | Assessment Methods  |
|------|--|--|---|
| 2.4  | differentiate between solar cells  | Lectures Scientific discussion               | Quiz  |
| 2.5  | compare Fuel cells   | Lectures                                     | Mid-term-final exam   |
| 2.6  | identify types of radiation emitted by radioactive isotopes.   | Lectures                                     | Mid-term-final exam   |
| 2.7  | Relate the stability of nucleus from the ratio of neutrons to protons  | Lectures                                     | Mid-term-final exam   |
| 2.8  | define binding energy  | Lectures<br>E-learning                       | Mid-term-final exam<br>Assignments and activities on blackboard |
| 2.9  | Recognize the energy accompany nuclear reactions   | Lectures                                     | Mid-term-final exam   |
| 2.10 | mention types of nuclear reactions   | Lectures                                     | Mid-term-final exam   |
| 2.11 | Select instruments for measuring radiation   | Lectures<br>E-learning                       | Mid-term-final exam<br>Assignments and activities on blackboard |
| 2.12 | mention some applications of radioactive isotopes in medicine, agriculture ...etc.   | Lectures<br>E-learning                       | Mid-term-final exam<br>Assignments and activities on blackboard |
| 2.13 | write about types of solar cells   | E-learning                                   | Assignments and activities on blackboard                        |
| 2.13 | mention types of fuel cells  | Lectures<br>E-learning                       | Mid-term-final exam<br>Assignments and activities on blackboard |
| 2.14 | Communicate effectively using theoretical basis of energy resources to a variety of audiences                              | Cooperative learning and Group Presentations | Report and research on Project production                       |
| 2.15 | Apply IT and communication technology in gathering and interpreting information and ideas concerning the energy resources. | Self-Directed private Study                  | Assignments and activities                                      |
| 3.0  | Values   |  |   |

| Code | Course Learning Outcomes  | Teaching Strategies   | Assessment Methods                           |
|------|---|-----------------------|--|
| 3.1  | Demonstrate commitment to professional and academic values and ethics         | Scientific discussion | long and short essays<br>posters lab manuals |
| 3.2  | Write and present a chemical report related to chemistry of energy resources. | Scientific discussion | long and short essays                        |
| 3.3  | work individually and in a team to prepare a report on energy resources       | Scientific discussion | posters lab manuals                          |

## 2. Assessment Tasks for Students

| # | Assessment task*                         | Week Due  | Percentage of Total Assessment Score |
|---|--|-----------|--------------------------------------|
| 1 | Class activities, Attendances and Duties | All weeks | 10%                                  |
| 2 | E-learning                               | All weeks | 10%                                  |
| 3 | Mid-Term Exam                            | 6         | 30%                                  |
| 4 | Final Exam.(2 hours exam)                | 12        | 50%                                  |

\*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :  
Office hours for Faculty member

## F. Learning Resources and Facilities

### 1. Learning Resources

|                                |   |
|--------------------------------|---|
| Required Textbooks             | Textbook of Nuclear Chemistry, A. Singh, R. Singh, Campus Publishers, 2006  |
| Essential References Materials | Applied Photovoltaics, Stuart Wenham, Martin Green, and Muriel Watt, Earthscan, 2007, ISBN 1- 84407-407<br>Fuel cells: problems and solutions, Vladimir S. Bagotsky, Second Edition, John Wiley & Sons, 2012. |
| Electronic Materials           | Power point lectures.   |
| Other Learning Materials       | Web sites   |

### 2. Facilities Required

| Item  | Resources                |
|---|--------------------------|
| Accommodation<br>(Classrooms, laboratories, demonstration rooms/labs, etc.) | Classrooms, laboratories |

| Item   | Resources |
|--|-----------|
| <b>Technology Resources</b><br>(AV, data show, Smart Board, software, etc.)  | data show |
| <b>Other Resources</b><br>(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | None      |

### G. Course Quality Evaluation

| Evaluation Areas/Issues                           | Evaluators      | Evaluation Methods |
|---|-----------------|--------------------|
| Effectiveness of teaching and assessment          | Program Leaders | Direct             |
| Extent of achievement of course learning outcomes | Faculty         | Indirect           |
| Quality of learning resources                     | Faculty         | Direct             |
|   |                 |                    |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

**Assessment Methods** (Direct, Indirect)

### H. Specification Approval Data

|                            |  |
|----------------------------|--|
| <b>Council / Committee</b> | Quality committee and department Council |
| <b>Reference No.</b>       | 1 <sup>st</sup> meeting                  |
| <b>Date</b>                | 2022                                     |

**Head of Chemistry Department**

  
**Dr Moataz Morad**

