



**Department of Chemistry**  
**Forman Christian College (A Chartered University)**  
Spring 2023

Instructor: Dr. Muhammad Tariq Qamar

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Class & Discussion Timings: 11:00-11:50 AM (M, W & F), Classroom: S-341

## Course Information

### CHEM 372: Chemistry & Energy (3 Credits)

Prerequisite: CHEM 250 or CHEM 261 or CHEM 270

#### 1. Introduction

This course is designed to enable students to study the role of chemistry in solving energy related issues. Emphasis will be placed on various methods to develop alternative energy generation systems while applying the few fundamental and progressive concepts of chemistry.

#### 2. Learning Objectives

At the end of this course students will be able to:

- Understand the different energy generating systems.
- Explain the route or mechanism behind the energy generation.
- Explain and understand the role of electrochemistry and thermodynamics in energy setups.
- Understand the working of fuel cells and dye-sensitized solar cells (DSSCs).
- Know the importance of nanostructured materials to produce Hydrogen energy.
- Understand the role of nanostructured photoanodes in the exploration of efficient DSSCs.

#### 3. Textbooks

- Basics Photovoltaic Principles and Methods by Technical Information Office, Solar Energy Research Institute.
- Solar Energy: Fundamentals, Technology, and Systems by Klaus Jager.
- Fuel Cell Handbook EG & G Technical Services, 7<sup>th</sup> Edition.
- Dye-Sensitized Solar Cells Principles and New Designs by Yang Jiao and Fan Zhang.
- Class lectures and readings by the instructor.

#### 4. Grading System and Weightage

##### Weightage and Grading:

Activity	Weightage	A	4.00	93-100%	C	2.00	73-76%
• Quizzes	: 15%	A-	3.70	90-92%	C-	1.70	70-72%
• Mid Term	: 25%	B+	3.30	87-89%	D+	1.30	67-69%
• Final Exam	: 40%	B	3.00	83-86%	D	1.00	60-66%
• Assignment/Presentation	: 10%	B-	2.70	80-82%	F	0.00	59 or below
• Participation	: 10%	C+	2.30	77-79%			Failing

#### 5. Other Rules

- This course is designed for BS students and its prerequisite are CHEM 250, CHEM 261 & CHEM 270.
- It is recommended to attend at least 80% classes and in-time submission of assigned work is highly desirable.
- The similarity with the internet content and any other source/person will be highly discouraged while doing the assignment and quizzes. The use of these practices will put a negative impression (deduction of marks). Moreover, try to explain the things in your own words/way.

- A student has the option to take make up test for missed exams if he or she has genuine reasons.

## 6. Logistics

We will interact and discuss the things through F2F classroom teaching during the class and discussion timings. Moreover, students are welcome to share the problems and queries from 14:00 to 16:00 on Tuesday in S-141. However, the key dates regarding lectures, exams, announcements, and assignments are provided below.

## 7. Exams/Assignments

The tasks pertaining to this section are given below:

Task Description	Due Date
Quiz 1: This task will include the topics cover in first FIVE weeks.	March 17, 2023
Mid Term Exam: This task will include the topics cover during first FIVE weeks and 6 <sup>th</sup> to 9 <sup>th</sup> week.	April 14, 2023
Quiz 2: This task will include the topics cover during 10 <sup>th</sup> to 14 <sup>th</sup> week	May 19, 2023
Assignment topics will be assigned.	May 26, 2023
Final Exam: This will include the syllabus covered during the whole semester.	June 12- Jun 21, 2023

## 8. Lesson Plans

DATE/WEEK	TOPICS
Feb 13-17, 2023 1 <sup>st</sup> Week	Introduction to energy: understanding of the word energy, units of energy, basic concepts of kinetic energy, potential energy, radiant energy, nuclear energy, electrical energy, thermal energy, wind energy, tidal energy, biogas energy, hydrogen energy and solar energy.
Feb 20-24, 2023 2 <sup>nd</sup> Week	
Feb 27- March 3, 2023 3 <sup>rd</sup> Week	Energy & chemical changes, energy & climate, and the scale of the energy challenge.
March 6 - 10, 2023 4 <sup>th</sup> Week	Sources of energy and energy generation methods; coal power generation method
March 13 - 17, 2023 5 <sup>th</sup> Week	Thermal, nuclear, geothermal, and hydro power generation methods
March 17, 2022	Quiz 1
March 20 - 24, 2023 6 <sup>th</sup> Week	Fuel cells: basic terminologies, types of fuel cells and their working.
March 27 - 31, 2023 7 <sup>th</sup> Week	Advantages and disadvantages of fuel cells over conventional means of power production.
April 03-14, 2023 8 <sup>th</sup> & 9 <sup>th</sup> Week	Operating principle and chemical reactions of different types of fuel cells and their comparative advantages and disadvantages. <b>(Easter Break)</b>
April 14, 2023	Mid-Term Exam

<p>April 17-28, 2023 10<sup>th</sup> &amp; 11<sup>th</sup> Week</p>	<p>Solar Cells: nature of solar radiation and its use as a source of energy, photovoltaic effect, PV cells (1<sup>st</sup> &amp; 2<sup>nd</sup> generation SC) and effect of light on silicon crystals. <b>(Spring Break)</b></p>
<p>May 01-05, 2023 12<sup>th</sup> Week</p>	<p>Working principle and construction of different (3<sup>rd</sup> generation) solar cells such as dye-sensitized, perovskite and organic solar cells</p>
<p>May 08-12, 2023 13<sup>th</sup> Week</p>	<p>Solar cell efficiency and factor affecting the efficiency of solar cell.</p>
<p>May 15-19, 2023 14<sup>th</sup> Week</p>	<p>Photocatalytic and electrochemical splitting of water for hydrogen generation</p>
<p><b>May 19, 2023</b></p>	<p><b>Quiz 2</b></p>
<p>May 22-26, 2023 15<sup>th</sup> Week</p>	<p>Synthesis and fabrication of nanostructured materials for their potential use in energy production.</p>
<p>May 29- Jun 02, 2023 16<sup>th</sup> Week</p>	
<p>Jun 05- Jun 09, 2023 17<sup>th</sup> Week</p>	<p>A research article will be assigned to a student with a set of (03 to 05) questions. The student will be expected to answer the questions after careful reading of the article and answers will be returned by <b>Jun 09,2023</b>.</p>
<p><b>June 12- Jun 21, 2023</b></p>	<p><b>Final Examination</b></p>