

| Course ID: | Course Title: | Winter 2021 |
|------------|--|------------------------------------|
| CHE335 | Introduction to Nanoscience and Nanotechnology | Prerequisite: CHE251 Credits: 3 |

| Class Information | | Instructor Information | | Important Dates | |
|---------------------|-------------|------------------------|-----------------------|---|---------------|
| Days: | W/F | Instructor: | Liza Abraham PhD | First day of classes: | M., Jan 11 |
| Time: | 3:15-4:30 | Email: | labraham@ambrose.edu | Last day to add/drop, or change to audit: | Sun, Jan 24 |
| Room: | | Phone: | 403-410-2000 ext.6921 | Last day to request revised exam: | Mon, Mar 8 |
| Lab/ Tutorial: | 3 of hrs/wk | Office: | A2160 | Last day to withdraw from course: | Fri, Mar 19 |
| | | Office Hours: | Open-door Policy | Last day to apply for coursework extension: | Fri, March 29 |
| Final Exam in class | Apr 19-26 | | | Last day of classes: | Fri, Apr 16 |

Course Description

An introduction to the fundamental concepts and applications within the developing field of nanoscience and technology. The underlying principles of nanoscale science, the unique properties of nanosized particles, and the modern applications of nanoscience will be explored. Instruction will consist of lectures, supplementary readings, in-class activities, course-based research projects, and presentations.

Textbooks

No prescribed textbook for this course; notes will be provided.

Attendance:

- Class participation is extremely important to your learning in this course. If you miss any class please make sure to complete the notes from your peers.
- You are not allowed to use the phone as your calculator; you must use a calculator to do all your work.
- In respect to the professor and to your fellow students, we ask that you:
 - a) Turn your phone off during class and that you don't use it for texting during lecture or lab;
 - b) Not have conversations with the people beside you during the lecture – it is very distracting to the people around you;
 - c) Use your laptops for lecture material and assignments only – that you are not using the internet or Facebook during class time;
 - d) Arrive to lecture on time
 - e) Don't listen to music in class. These will help to maximize the learning experience for you and your fellow students (and will keep your professor in a good mood).

Course Schedule (tentative)

| Week of | Lecture | Assignments/Projects |
|----------|--|---|
| Jan 10 | Fundamentals of Nanoscience and Technology Silver and Gold Nanoparticles-Synthesis and Characterization Chemical and biological methods (green Chemistry) Characterization by UV-Vis, XRD, Dynamic Light Scattering, FTIR, XPS, SEM, TEM, AFM, LSPR | |
| Jan 17 | Nanomaterials for Environmental Remediation/Water Purification/ Catalysis | |
| Jan 24 | Nanomaterials for Water Purification - Metal – and Metal Oxide based Nanomaterials | |
| Jan 31 | Nanomaterials for Water Purification-Fe nanoparticles | |
| Feb 7 | Nanomaterials for Water Purification-TiO ₂ nanoparticle | Project 1: Class Presentations Design of a water purification system based on nanotechnology |
| Feb 14 | Mon Feb 15 No Classes | |
| Feb 21 | Nanomaterials for Water Purification-TiO ₂ nanoparticle | |
| Feb 28 | Nanomaterials for Water Purification-carbon based nanomaterials | |
| March 7 | Nanomaterials for Water Purification-polymer based nanomaterials | |
| March 14 | Nanocarriers for drug delivery-Polymeric/Hydrogel nanoparticles/ | Project 2 Class Presentations Design of a nanotechnology sensor |
| March 21 | Nanocarriers for drug delivery- Lipid/Metal and inorganic nanoparticles | |
| March 28 | Nanocarriers for drug delivery -nanoshells, quantum dots Ambrose Research Conference | |
| April 4 | Design of a Multifunctional Nanoparticle | Project 3 3 : Class Presentations Application of nanotechnology in COVID-19 |

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| April 11 | | |
| Final Exam | Apr 19-26 | |
| In-Class | | |

Grade Summary:

The available letters for course grades are as follows:

| <u>Letter Grade</u> | <u>Description</u> |
|---------------------|--------------------|
| A+ | |
| A | Excellent |
| A- | |
| B+ | |
| B | Good |
| B- | |
| C+ | |
| C | Satisfactory |
| C- | |
| D+ | |
| D | Minimal Pass |
| F | Failure |

In determining the overall grade in the course, the following weights will be used:

| | | | | | |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| A+ | A | A- | B+ | B | B- |
| 95% - 100% | 87% - 94.99% | 82% - 86.99% | 77% - 81.99% | 72% -76.99% | 66% - 71.99% |
| C+ | C | C- | D+ | D | F |
| 62% - 65.99% | 58% - 61.99% | 54% - 57.99% | 50% - 53.99% | 45% - 49.99% | < 44.99% |

Assessments:

Project 1-20%

Project 2-20%

Project 3-20%

Final Exam-40%

Project 1 (20%):

Use *nanotechnology* to design a system to produce *clean water* for developing nations

Work in groups of two to research about the ordinary impurities in water. Research to find the methods that are available to remove them. Design a new system that will be able to purify the water. Present the findings to the whole class. Each PPT presentation should take approximately 15-20 minutes, plus 5 minutes for questions and discussion. A minimum of ten peer-reviewed publications from any database (e.g. PubMed).

This project is designed so that the students can work together during the class time. The objective is to develop a water filtration system that can be used in households in a developing country. Your design must be simple, efficient and cost-effective. Please try to apply nanomaterials whenever possible

Increased amounts of untreated sewage, combined with agricultural runoff and industrial discharge, have degraded water quality and contaminated water resources around the world. Globally, 80% of wastewater flows back into the ecosystem without being treated or reused, contributing to a situation where around 1.8 billion people use a source of drinking water contaminated with feces, putting them at risk of contracting cholera, dysentery, typhoid and polio. Mainly in low-income areas of cities and towns within developing countries, a large proportion of wastewater is discharged directly into the closest surface water drain or informal drainage channel, sometime without or with very little treatment. In addition to household effluent and human waste, urban-based hospitals and industries such as small-scale mining and motor garages, often dump highly toxic chemicals and medical waste into the wastewater system.

Research Outline

- List the common impurities present in water
- Categorize them based on their chemical/biological properties (example: heavy metals)
- List of materials that can be used to remove the impurities (Try your best to use nanomaterials)
- Design a filter (with layers) that could be used to obtain clean water
- Make sure your system is not complex or expensive but affordable and work efficiently
- Keywords: adsorbents, polymers, nanotechnology

The grading will be based on

- Content (50%) - Your group must demonstrate an in depth understanding of the topic, and accurately utilize researched information.

- Team work (25%) - I will be meeting with each group in breakout rooms. This will be an opportunity for me to witness the evidence of group work.

_____ Participation in developing ideas and planning project

_____ Willingness to discuss the ideas of others

_____ Cooperation with other group members

_____ Interest and enthusiasm in project

_____ Participation in leading/facilitating discussion

_____ Ease and familiarity with discussion material

The team must work well together to achieve the above objectives.

- PPT presentation (25%)- The design of the PPT must be excellent, attractive, neat, and enabling smooth flow of information. You must cite all appropriate information correctly and use images to make the presentation “come alive”. Use ACS referencing style for citations.

Reference:

<https://pubs.acs.org/doi/pdf/10.1021/bk-2006-STYG.ch014>

<https://libguides.murdoch.edu.au/ACS/sample>

Project 2 (20%): Design a nanotechnology sensor

Class Presentations: Week of March 14

This is a group work. Find a review paper on nanomaterials sensors to prepare your presentations. Each presentation should take approximately 15 minutes, plus 5 minutes for questions and discussion.

Creating a nanotechnology-based sensor

- What are nanomaterial sensors?
- What are the components of a nanosensors design?
- What are the classes of nanomaterials that are used in nanosensors? Explain each class with details
- What are the recognition elements that have been implemented in the nanosensors? Explain with details
- What are the major signal transduction methods employed in nanosensors? Explain with details
- What are the common analytes that can be detected by nanosensors?
- Select a paper that describes the application of nanosensors and provide a summary (include images)

Reference:

- <https://cen.acs.org/analytical-chemistry/chemical-sensing/New-device-uses-carbon-nanotubes/97/web/2019/08>
- <https://uwaterloo.ca/capstone-design/node/3>

The grading will be based on

- Content (50%) - Your group must demonstrate an in depth understanding of the topic, and accurately utilize researched information.
- Team work (25%) - I will be meeting with each group in breakout rooms. This will be an opportunity for me to witness the evidence of group work.

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The team must work well together to achieve the above objectives.

- PPT presentation (25%)- The design of the PPT must be excellent, attractive, neat, and enabling smooth flow of information. You must cite all appropriate information correctly and use images to make the presentation “come alive”. Use ACS referencing style for citations.

Project 3: **Application of nanotechnology in COVID-19 (20%)**

Work in groups of two. Each PPT presentation should take approximately 15-20 minutes, plus 5 minutes for questions and discussion. Make sure to use a minimum of five scholarly sources.

Rubric for Group Research Work Presentations:

| Criteria | Weight | Excellent | Adequate | Needs Improvement |
|----------|--------|---|---|--|
| Teamwork | 25 | The team worked well together to achieve objectives. Each member contributed in a valuable way to the project. All data | The team worked well together most of the time, with only a few communication breakdown occurrences or failure to collaborate | The team did not collaborate or communicate well. Some members would work independently, without regard to objectives or |

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| | | sources indicated a high level of mutual respect and collaboration | when appropriate. Members were mostly respectful of each other. | priorities. A lack of respect and regard was frequently noted. |
| Subject Knowledge (25 Points) | 25 | The deliverable demonstrated knowledge of the course content by integrating major and minor concepts into the response. The deliverable also demonstrated evidence of extensive research effort and a depth of thinking about the topic | The deliverable demonstrated knowledge of the course content by integrating major concepts into the response. The deliverable also demonstrated evidence of limited research effort and/or initial of thinking about the topic. | The deliverable did not demonstrate knowledge of the course content, evidence of the research effort or depth of thinking about the topic. |
| Research Design | 25 | The design considerations were well supported by the literature. Considerations Were able to answer questions from the instructors and the peers | The design considerations were mostly supported by the literature. Were able to answer most of the questions. | The design considerations were not supported by the literature Unable to answer most of the questions. |
| | | | | |

Because of the nature of the Alpha 4.00 system, there can be no uniform

University-wide conversion scale. The relationship between raw scores (e.g. percentages) and the resultant letter grade will depend on the nature of the course and the instructor's assessment of the level of each class, compared to similar classes taught previously.

Please note that final grades will be available on student registration system. Printed grade sheets are not mailed out.

Ambrose University Academic Policies:

Communication

All students have received an Ambrose e-mail account upon registration. It is the student's responsibility to check this account regularly as the Ambrose email system will be the professor's instrument for notifying students of important matters (cancelled class sessions, extensions, requested appointments, etc.) between class sessions. If students do not wish to use their Ambrose accounts, they will need to forward all messages from the Ambrose account to another personal account.

Registration

During the **Registration Revision Period** students may enter a course without permission, change the designation of any class from credit to audit and /or voluntary withdraw from a course without financial or academic penalty or record. Courses should be added or dropped on the student portal by the deadline date; please consult the List of Important Dates. After that date, the original status remains and the student is responsible for related fees.

Students intending to withdraw from a course after the Registration Revision Period must apply to the Office of the Registrar by submitting a "Request to Withdraw from a Course" form or by sending an email to the Registrar's Office by the **Withdrawal Deadline**; please consult the List of Important Dates on the my.ambrose.edu website. Students will not receive a tuition refund for courses from which they withdraw after the Registration Revision period. A grade of "W" will appear on their transcript.

Students wishing to withdraw from a course, but who fail to do so by the applicable date, will receive the grade earned in accordance with the course syllabus. A student obliged to withdraw from a course after the Withdrawal Deadline because of health or other reasons may apply to the Registrar for special consideration.

Exam Scheduling

Students, who find a conflict in their exam schedule must submit a Revised Examination Request form to the Registrar's Office by the deadline date; please consult the List of Important Dates. Requests will be considered for the following reasons only: 1) the scheduled final examination slot conflicts with another exam; 2) the student has three final exams within three consecutive exam time blocks; 3) the scheduled final exam slot conflicts with an exam at another institution; 4) extenuating circumstances. Travel is not considered a valid excuse for re-scheduling or missing a final exam.

Electronic Etiquette

Students are expected to treat their instructor, guest speakers, and fellow students with respect. It is disruptive to the learning goals of a course or seminar and disrespectful to fellow students and the instructor to use electronics for purposes unrelated to the course during a class session. Turn off all cell phones and other electronic devices during class. Laptops should be used for class-related purposes only. Do not use iPods, MP3 players, or headphones. Do not text, read, or send personal emails, go on Facebook or other social networks, search the internet, or play computer games during class. Some professors will not allow the use of any electronic devices in class. The professor has the right to disallow the student to use a

laptop in future lectures and/or to ask a student to withdraw from the session if s/he does not comply with this policy. Repeat offenders will be directed to the Dean. If you are expecting communication due to an emergency, please speak with the professor before the class begins.

Academic Policies

It is the responsibility of all students to become familiar with and adhere to academic policies as stated in the Academic Calendar. Personal information (information about an individual that may be used to identify that individual) may be required as part of taking this class. Any information collected will only be used and disclosed for the purpose for which the collection was intended. For further information contact the Privacy Compliance Officer at privacy@ambrose.edu.

Extensions

Although extensions to coursework in the semester are at the discretion of the instructor, students may not turn in coursework for evaluation after the last day of the scheduled final examination period unless they have received permission for a course Extension from the Registrar's Office. Requests for course extensions or alternative examination time must be submitted to the Registrar's Office by the deadline date; please consult the List of Important Dates. Course extensions are only granted for serious issues that arise "due to circumstances beyond the student's control."

Appeal of Grade

An appeal for change of grade on any course work must be made to the course instructor within one week of receiving notification of the grade. An appeal for change of final grade must be submitted to the Registrar's Office in writing and providing the basis for appeal within 30 days of receiving notification of the final grade, providing the basis for appeal. A review fee of \$50.00 must accompany the appeal. If the appeal is sustained, the fee will be refunded.

Academic Integrity

We are committed to fostering personal integrity and will not overlook breaches of integrity such as plagiarism and cheating. Academic dishonesty is taken seriously at Ambrose University as it undermines our academic standards and affects the integrity of each member of our learning community. Any attempt to obtain credit for academic work through fraudulent, deceptive, or dishonest means is academic dishonesty. Plagiarism involves presenting someone else's ideas, words, or work as one's own. Plagiarism is fraud and theft, but plagiarism can also occur by accident when a student fails or forgets to acknowledge to another person's ideas or words. Plagiarism and cheating can result in a failing grade for an assignment, for the course, or immediate dismissal from the university. Students are expected to be familiar with the policies in the current Academic Calendar that deal with plagiarism, cheating, and the penalties and procedures for dealing with these matters. All cases of academic dishonesty are reported to the Academic Dean and become part of the student's permanent record.

Note: Students are strongly advised to retain this syllabus for their records.