Course ID:	Course Title:	Winter 2022
CHE335	Introduction to Nanoscience and Nanotechnology	**Prerequisite: CHE251** **Credits: 3**

Class Information		Instructor Information		Important Dates	
Days:	W	**Instructor:**	Liza Abraham PhD	**First day of classes:**	M., Jan 10
Time:	3:15-6:15 pm	**Email:**	labraham@ambrose.edu	**Last day to add/drop, or change to audit:**	Sun, Jan 23
Room:	L2084, A2145	**Phone:**	403-410-2000 ext.6921	**Last day to request revised exam:**	Mon, Mar 7
Lab/ Tutorial:		**Office:**	A2160	**Last day to withdraw from course:**	Fri, Mar 18
		Office Hours:	Open-door Policy	**Last day to apply for coursework extension:**	Fri, March 28
Final Exam	No Final Exam			**Last day of classes:**	Fri, Apr 14

Course Description

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

Expected Learning Outcomes

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

- Identify and articulate examples of nanomateril solutions to water purification
- Identify and articulate examples of medical problems amenable to nanomedicine solutions
- Compare and contrast existing nanomaterial designs and their ability to perform specific function
- Develop independent skills for scientific inquiry through course-based research and able to communicate the outcome
- Enhance leadership, team and communication skills through the high school outreach experience
- Critically evaluate information, accurately utilize the researched information along with effective presentation skills

Textbooks

There is no textbook because this course draws widely from peer-reviewed literature and investigates cutting-edge work in the field of nanomedicine. Weekly materials will be provided within Moodle. Additionally, you will search your library resources and the web as part of your assignments.

Course Schedule (tentative)

Week of	Lecture
Jan 12	Fundamentals of Nanoscience and Technology Synthesis & Characterization of Nanoparticles-UV-Vis, XRD, Dynamic Light Scattering, FTIR, XPS, SEM, TEM, AFM, LSPR Application of Nanomaterials in Environmental Remediation (a) removal of organic contaminants by nano zero-valent iron (b) antimicrobial Activity of nZVI & Ag nanoparticles (c) nano-silica–AgNPs composite material as an antifouling adsorbent (d) carbon nanotubes as membranes for water filtration (e) graphene oxide as adsorbent for organics (f) magnetic Fe_3O_4 @ SiO_2/GO nanocomposite for removal of heavy metal ions (g) sodium alginate –chitosan polymer-based nanomaterials High School Outreach- Introducing Nanoscience (a) Preparation of Ag mirror (b) Prepation of Silver nanoparticles (c) Characterization-UV (d) Preparation of AgNPS-alginate beads (e) Presentation to Rundle College Students
Jan. 19-Mar. 16	Research Activity- **Environmental and Biomedical Applications of Saponin** (a) Extraction of Saponinn (b) Chromatography of Saponin (c) Characterization of Saponin (d) Testing for saponins (e) Surfactant chemistry of saponin (h) Heavy metal remoal-Environmental a pplication (i) Saponin-chitosan-alginate bead for heavy metal removal (j) Antimicrobial Activity (k) Results and Discussion (l) Recommendations (m) Conclusions (n) Presentations Feb 23 Reading Break - No Classes Term Test 1-March 16
March 23	Nanomedicine ○ Biological Barriers for Drug Delivery

	○ Targeted Drug Delivery- Passive, Stimuli Responsive, pH, Redox, Temperature MMPs sensitive, Active or Ligand ○ Polymeric Micelles ○ Nanoliposomes-Conventional, Stealth, Ligand-targeted, Theranostic ○ Lipid Nanoparticles ○ Inorganic Nanoparticles ○ Molecular Imaging and Diagnosis-MRI, PET, PET/MRI nanoparticles Quantum Dots as imaging agents ○ Photodynamic Therapy ○ Magnetic Hypothermia Therapy ○ Regenerative nanomedicine ○ Nanotechnology-based stem cell differentiation
March 30	March 30-Ambrose Research Conference Presentations Topic-Engineering precision nanoparticles for drug delivery
April 6	○ Bionanosensors-Project-Nanotechnology-based sensors (student presentations). Include the following components- components, classes of nanomaterials, recognition elements , major, signal transduction methods, common analytes detected by nanosensors ○ Select a paper that describes the application of nanosensors and provide a summary; Example: "New device uses carbon nanotubes to detect marijuana in human breath" https://cen.acs.org/analytical-chemistry/chemical-sensing/New-device-uses-carbon-nanotubes/97/web/2019/08
April 13	April 13-Term Test 2

Grade Summary:

The available letters for course grades are as follows:

Letter Grade	Description
A+ A A-	Excellent
B+ B B-	Good
C+ C C-	Satisfactory
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:

Term Test 1- 20%

Term Test 2- 15%

Course-Based Undergraduate Research -40%

ARC Presentation- "Engineering precision nanoparticles for drug delivery"-5%

Projects-10%

High School Outreach-10%

Course-Based Undergraduate Research (CUR)

Upon successful completion of this research project, the students will demonstarte

• The ability to integrate skills and knowledge from core chemistry courses and apply them in CURE;

• A basic understanding of the scientific literature in the chosen area of research;

• The ability to design a hypothesis and plan and execute appropriate experimental procedures;

• The ability to interpret the results and rationalize them in the context of the hypothesis;

• The ability to share the results and their implications in a professional way via written or oral scientific communication.

Research Project Evaluation Methods

Component:	Description:	Weight:
Research Question	In this proposal, your group will summarize the relevant scientific literature, identify a research question, and design methods.	**15%**
Research Performance Evaluation	Your team will participate actively in research-based learning. Throughout the term, certain number of hours are dedicated to carry out experiments. You will collect data, process data, and analyze results. The instructor will base this portion of the	**35%**

	student's grade on direct observation of laboratory work, as well as the groups ability to work collaborately.	
Research Progress Oral Presentation	Throughout the term, the team will give several 10-minute oral presentations on the project. These presentations will outline the project's research objectives and the progress made to date. The Instructor will base this portion of the student's grade on overall performance throughout the term.	**20%**
Research Report	The team will submit a formal written report by the due date. The research report should contain an abstract, introduction, experimental section, results and discussion, conclusion, and references.	**30%**

Ambrose Research Conference Poster Presention

The students need to create a scientific poster based on the results they have obtained from the course-based undergraduate research. The grading will be based on teamwork, content, ability to answer questions, design, and visual appeal.

Project

Nanotechnology-based sensors. Create a PPT presentation with the following components- classes of nanomaterials, recognition elements , major signal transduction methods, and analytes. Select a paper that describes the application of nanosensors and provide a summary. This is a group work. Each presentation should take approximately 15 minutes, plus 5 minutes for questions and discussion. The grading will be based on content, and team work. 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.

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 devises 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.