Special Topics in Magnetic Nanoparticles

ECH 6937
Class Periods: T 8-10, 3:00PM – 6:00PM
Location: Chemical Engineering 231
Academic Term: Spring 2023

Instructor:
Carlos M. Rinaldi-Ramos
Carlos.rinaldi@ufl.edu
352-392-0881
Office Hours: Thursdays, 3:00-5:00PM, BMS J391 or Zoom (meeting room to be shared through CANVAS)

Teaching Assistants:
Not applicable.

Course Description
Fundamentals and biomedical applications of magnetic nanoparticles.

Course Pre-Requisites / Co-Requisites
Instructor approval.

Course Objectives
This course will introduce students to a wide range of interdisciplinary topics related to the behavior and applications of magnetic nanoparticles.

Materials and Supply Fees
None.

Required Textbooks and Software
None. Reading materials will be provided through CANVAS site.

Recommended Materials
Reading materials will be provided through CANVAS site.

Course Schedule

January 10:	Discuss syllabus and class expectations/grading Introduction to nanotechnology and nanoparticles Size effects in nanomaterials
January 17:	Useful geometric concepts and formulas Math of size distributions
January 19:	Review topic proposals due to Rinaldi-Ramos for approval.
January 24:	Characterization of nanoparticles - Electron microscopy; Diffraction and scattering techniques
January 26:	Review topic proposals due for peer review.
January 31:	Characterization of nanoparticles - Spectroscopy and Magnetometry
February 2:	Student peer review of proposals due.
February 7:	Colloidal stability - gravitational stability, centrifugation, settling, particle-particle interactions; DLVO theory
February 14:	Colloidal stability - van der Waals; electrostatic and magnetic interactions; steric repulsion
February 16:	Literature review outlines due.
February 21:	Colloidal stability - DLVO theory II; Particle aggregation; diffusion and reaction limited aggregation; rates of aggregation
February 23:	Student peer review of literature review outlines due.
February 28:	Compositions and properties of magnetic nanoparticles
March 7:	Superparamagnetism; Langevin and Brillouin functions; Magnetogranulometry
March 14:	Spring Break!

March 21: Magnetic relaxation - phenomenological description of relaxation; Brownian and Néel mechanisms; magnetic anisotropy
March 23: First draft of literature reviews due.
March 28: Dynamic magnetization in low fields - phenomenological derivation; orientation distribution solution; diffusion measurements
March 30: Student peer review of first draft of literature reviews due.
April 4: Dynamic magnetization in moderate to high fields - linear response theory, nonlinear phenomenological solution, simulations; energy conversion and thermodynamics; SAR and ILP
April 11: MRI contrast mechanism; MPI signal generation; x-space MPI point spread function, sensitivity, and resolution
April 13: Final draft of literature reviews due.
April 18 & 25: Student presentations

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is required and will be checked by the instructor at the start of the class period. Students may use a laptop or other electronic device suitable for note taking but should refrain from using electronic devices (including cell phones) for other purposes. Course grade will be assigned based on attendance and participation in class discussions (20%), assignments (40%), and preparation of a review article in a topic mutually agreed upon by the student and instructor (40%). Excused absences must be consistent with university policies in the Graduate Catalog and require appropriate documentation. Additional information can be found in Attendance Policies.

Grading Policy

The following is given as an example only.

Percent	***Grade***	***Grade Points***
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc). It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at

https://gatorevals.aa.ufl.edu/students/.

Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied:

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:
http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.