

SYLLABUS: EMA6938 – Magnetic Biomaterials | Fall 2014

1. **Course Description:** (3 Credit Hours) The course will consist of classroom lectures on fundamental concepts in magnetism and magnetic micro- and nano-materials and their applications in biomedicine. As part of the course, students will prepare and present an NIH-type proposal on one of the course topics.

2. **Course Objectives:**

- To provide the students with an overview of fundamental concepts in magnetism and magnetic materials.
- To present an overview of biomedical applications of both synthetic and endogenous magnetic micro- and nano-materials.
- To provide students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

3. **Prerequisites:** Undergraduate Physics and Chemistry

4. Instructor: **Dr. Jon Dobson**

a. Office location: **MAE 311 or BMJ 393**

c. E-mail address: **jdobson@ufl.edu**

d. Office hours: **TBA**

5. Meeting Times and Location: **M-W-F Period 5, 1:45 - 12:35 pm**

MCCB 3124

6. Textbook Required – **None required**

a. Title:

b. Author:

c. Year and edition:

d. ISBN:

Suggested Reading:

- *The Feynman Lectures on Physics (Vol. 2), R. Feynman, Addison-Wesley. ISBN: 0-201-02117-X-P*
- *Magnetism: Principles & Applications, D. Craik, Wiley. ISBN: 0-471-95417-9*
- *Magnetic Nanoparticles: From Fabrication to Clinical Application, NTK Thanh (Ed.), CRC Press. ISBN: 978-1-4398-6932-1*
- *Rock Magnetism: Fundamentals and Frontiers, DJ Dunlop & Ö Özdemir, Cambridge Studies in Magnetism. ISBN: 978-0521325141*

7. **On the Web:** Students may be directed to resources on the web for information related to the course and for access to scientific papers. Please use Sakai.

8. **Conduct, Attendance and Expectations:** Proper behavior in class is always important and leads to a relaxed and productive educational environment. Thus, eating, drinking, texting, reading of newspapers, working on homework for this or other courses, or other activities that are not part of the class are not allowed. Students who do not comply with

these requirements or who behave disorderly or disrespectfully may be asked to leave the classroom. Leaving your cell phone on, leaving early or arriving late can be VERY distracting. All electronic devices (PDAs, cell-phones, etc.) should be turned off or in silent mode. If your cell phone rings during class it will be confiscated for the remainder of the class period. While not directly enforced, attendance is strongly suggested since class participation and in-class presentations count for 40% of the final grade. Students will prepare, present and defend an original research proposal that will count for 30% of their final grade.

9. Grading and Grading Scale: Your final grade will be allocated based on the following distribution:

In class presentations:	30%	Three In-Class exams:	20% each
Class participation:	10%		

A = 95% - 100%; **A-** = 90% - 94%; **B+** = 87% - 89%; **B** = 83% - 86%; **B-** = 80% - 82%;
C+ = 77% - 79%; **C** = 73% - 76%; **C-** = 70% - 72%; **D+** = 67% - 69%; **D** = 63% - 66%;
D- = 60% - 62%; **E** < 60%.

In order to graduate, graduate students must have an overall GPA of 3.00 or better (B or better) and a 3.00 truncated GPA in their major (and in the minor, if a minor is declared) at graduation. Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

<http://gradcatalog.ufl.edu/content.php?catoid=4&navoid=907#grades>

10. Homework/Class Presentations/Class Participation: Following the lecture portion of the course, students will prepare (outside classroom time) and present (during class) a research proposal. The proposal will follow the NIH style and contain the following sections: (i) Hypothesis, (ii) Aims and Objectives, (iii) Background (including: Rationale for the work; Introductory material outlining the problem and past work, An introduction to magnetism and magnetic materials), (iv) Research Plan (including: Significance, Innovation, Approach, Possible problems and how they will be addressed), (v) Expected Outcomes; (vi) References Cited. Page limits will be provided.

11. **Course Outline:** Below is the *tentative* schedule of topics, activities and exams.

TOPICS COVERED (Provisional)

Date	Lecture	Lecture Topic	Notes
Mon 08/25	1	Introduction & course overview	
Wed 08/27	2	Fundamental concepts in electricity and magnetism: A review	
Fri 08/29	3	Magnetic Fields	
Mon 09/01		LABOR DAY	
Wed 09/03	4	Vector fields & Maxwell's equations	
Fri 09/05	5	Magnetic coils & high-field permanent magnets	
Mon 09/08	6	Magnetic moment	
Wed 09/10	7	Quantum mechanics & Bohr magneton	
Fri 09/12	8	Magnetism in matter	
Mon 09/15	9	Magnetism in Matter / EXAM REVIEW	
Wed 09/17	10	EXAM 1	
Fri 09/19	11	Micromagnetic Devices	Dr. Arnold (ECE)
Mon 09/22	12	Anisotropy and superparamagnetism	
Wed 09/24	13	Anisotropy and superparamagnetism	
Fri 09/26	14	Magnetic characterization	
Mon 09/29	15	Biogenic magnetic materials	
Wed 10/01	16	Biogenic magnetic materials	
Fri 10/03	17	Intro to MNP synthesis & functionalization	
Mon 10/06	18	MNP synthesis & functionalization	Dr. Andrew (MSE)
Wed 10/08	19	EXAM REVIEW	
Fri 10/10	20	EXAM 2	
Mon 10/13	21	Targeted drug & gene delivery	
Wed 10/15	22	Targeted drug & gene delivery	
Fri 10/17		HOMECOMING	
Mon 10/20	23	Magnetic Biomarker Harvesting & Magnetic Cell Sorting	
Wed 10/22	24	Multiferroics	Dr. Andrew (MSE)
Fri 10/24	25	Magnetic control of biomolecules	Adam Monsalve
Mon 10/27	26	IEEE Magnetis Society Distinguished Lecture	Dr. Tim St. Pierre
Wed 10/29	27	Magnetic MRI contrast agents	
Fri 10/31	28	Magnetic particle imaging	
Mon 11/03	29	Magnetically activated receptor signaling (MARS)	
Wed 11/05	30	MARS / Magnetic fluid hyperthermia (MFH)	
Fri 11/07	31	MFH / EXAM REVIEW	
Mon 11/10	32	EXAM 3	
Wed 11/12	33	Literature evaluation & presentations	
Fri 11/14	34	Literature evaluation & presentations	
Mon 11/17	35	Literature evaluation & presentations	
Wed 11/19	36	Literature evaluation & presentations	
Fri 11/21	37	Literature evaluation & presentations	
Mon 11/24	38	Literature evaluation & presentations	
Wed 11/26		THANKSGIVING	
Fri 11/28		THANKSGIVING	
Mon 12/01	39	Literature evaluation & presentations	
Wed 12/03	40	Literature evaluation & presentations	
Fri 12/05	41	Literature evaluation & presentations	
Mon 12/08	42	Literature evaluation & presentations	
Wed 12/10	43	Literature evaluation & presentations	

No Final Exam

12. Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

13. **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 (<http://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.

Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

See <http://www.dso.ufl.edu/sccr/procedures/honorcode.php>

14. **Accommodation for Students with Disabilities** – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

15. **UF Counseling Services** –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, <http://www.counseling.ufl.edu/cwc/Default.aspx>, counseling services and mental health services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.
- University Police Department 392-1111

16. **Software Use** – All faculty, staff and student 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.

17. Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.