ENG697AN-SEC01 Syllabus (Spring 2020)

Instructor:
Jun Yao Life Science Laboratory, S419 juny@umass.edu

Class Meeting Time: T/Th, 2:30-3:45 PM

Location: Hasbrouck Laboratory, room 228

Main References:

Lecture notes and additional references will be provided (progressively along course schedule), and will be made available for download from course website (Moodle).

Course Overview:

This course will provide an introduction and survey of contemporary topics in nanoscience and nanotechnology. Topics include: bottom-up versus top-down paradigms; synthesis and fabrication of zero-, one- and two-dimensional materials; physical properties of nanostructures, including electronic and optical properties; hierarchical organization in two and three dimensions; functional devices, circuits and nanosystems; applications with an emphasis on research in energy conversion and the interface between nanoscience and biology.

The course will include lectures on major course topics as well as critical review and discussion of selected papers from current literature in each of the topical areas.

Grading Policy:

Class Discussion:	25%	(participation in discussion/review of current research literature)
Midterm:	35%	(15-min literature presentation)
Final:	40%	(~3-5 page research proposal based on area of interest from course)

Lecture Outline:

I. Nanoscience and Nanotechnology

II. Bottom-Up vs. Top-Down Paradigms
   A. Basic Definitions
   B. Top-Down Approaches
   C. Bottom-Up Approaches
   D. Hybrid

III. Nanomaterials: Synthesis & Structure
   A. General Issues
   B. 0D Systems
   C. 1D Systems
   D. 2D Systems
   E. 3D and Hierarchical Structures

IV. Nanoelectronic Devices & Integrated Nanosystems
   A. Basic Definitions & 'Fabrication'
   B. Nanotransistors and other nanodevices
   C. Architectures, Assembly and Circuits for Nanocomputing

V. Nano-enabled Energy Conversion and Storage
   A. Introduction to Solar Cells
   B. Photovoltaics
   C. Solar-driven fuels
   D. Batteries
   E. Fuel cells (chemical and biological), Electro-mechanical conversion, Other

VI. Nano-Biology Frontier
   A. Detection and Sensing
   B. Imaging, Drug Delivery & Nanotoxicology
   C. Nanoelectronic Biology Tools
   D. Cyborg Tissue & More

Collaboration Policy Statement:

Discussion and the exchange of ideas are essential to academic work. For assignments in this course, you are encouraged to consult with your classmates on the choice of paper topics and to share sources. You may find it useful to discuss your chosen topic with your peers, particularly if you are working on the same topic as a classmate. However, you should ensure that any written work you submit for evaluation is the result of your own research and writing and that it reflects your own approach to the topic.

You must also adhere to standard citation practices in this discipline and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. If you received any help with your writing (feedback on drafts, etc), then you must also acknowledge this assistance.