

On-site Research Seminar Syllabus

1. Overview

Title	Nanotechnology & Electric Vehicles technologies		
Mode	Online lectures and mentor sessions		
Targeted Students	students undertaking a STEM subject, e.g. Engineering, Science, Computer Science, Materials		
Prerequisites	College Students	Required course/Knowledge	Basic understanding of scientific principles. I will teach the rest
		Recommended Materials for preparing for the course	
	High School Students	Required course/Knowledge	Basic science competence, with some knowledge of Physics and Chemistry. I will teach the rest according to their knowledge.
		Recommended Materials for preparing for the course	None

2. Program Introduction and Objectives

Course Description	<p>We will take a look at Nanotechnology in everyday use, gain an understanding of the basic underpinning principles and see where this exciting field is heading. We will start by looking at the origins of nanotechnology, deep in the mists of time when science thought it had all the answers, and then it became clear from one discovery after another that this was not the case. From Quantum mechanics to relativity, science was shaken at its roots over a century ago, and this led to the interest in all things small. We will then look at what nanotechnology really is, and how and why the properties of nanometer-sized objects are fundamentally different to larger things, and how we can take advantage of this. We will then delve into looking at electric vehicles and battery technologies, with an emphasis on Tesla's new Silicon-nanowire anode technology. We will also look at the energy issues facing our planet. Students will have a final group project (groups of 3) which they will present on as a group, but write an individual report on their own findings. They will also have a short assignment every week.</p>
Software/Tools (if any)	N/A

3. Program Schedule

	Lecture	Mentor Session (lab/case study, etc.)	Assignment
Topic	Overview of Electric vehicles & where Nanotechnology is useful		-The group projects will be revealed and outlined at the end of the session. -A series of short questions for students to answer
Detail	We will look at EV development, why they are needed, the challenges and how Nanotechnology is being used to tackle them. We will investigate the energy density of different materials as power sources and see why hydrocarbons have been dominant for so long.	History of Electric Vehicles Structure of Electric Vehicles Tesla 's new tabless battery and Roadrunner production line	
Topic	What is Nanotech?		A series of short questions for students to answer
Detail	In this session, we will explore what Nanotech is, where it came from, what it is all about and where it is applied. We will also introduce some of the concepts of Quantum Mechanics	What is Nanotech? What is the application? How to make use of Nanotech? Risk Assessment Wave-particle duality The photoelectric effect De Broglie Waves	
Topic	Nanotech & Battery technologies		A series of short questions for students to answer
Detail	Specifically in this session, we will develop our understanding of battery technologies – how batteries work, the basic chemistry inside, how lithium ions improve things and how to enhance battery capacity and lifetime	Why is battery important? Brief history of batteries Basic chemistry Battery types and characteristics	
Topic	Electric vehicles		A series of short questions for students to answer
Detail	We will look at the whole system around an electric vehicle, beyond just the battery, and the challenges around electric aircraft.	Why Silicon to replace the graphite as an anode ? Why silicon nanowires? Why silicon nanowires? Some Math on Tesla's New Batteries	
Topic	Final Project Discussion Session		
Detail	We will spend our time looking at the projects the students have chosen, as an opportunity to answer questions from earlier in the course, and to help them find and understand the appropriate material	Help the students to prepare the final projects.	
Topic	Final Project Discussion Session		
Detail	This will be a continuation of the previous session	This will be a continuation of the previous session	
Final Oral Presentation and Written Reporting			

4. Final Oral and Written Project

There will be a group project.

Students are required to meet the following objectives before attending the session in Week 5:

Have completed all weekly assignments.

Have chosen a topic for the final presentation and report.

Have a clear idea of who will do what in each group, and assign a leader.

Students are required to meet the following objectives before attending the session in Week 6:

Have a draft of the presentation and have clear questions about what they need to put into it

Have some thoughts about what sources of information to use

4.1 Final Oral Presentation

Oral Project Theme:

1. The need for electrification – fundamental reasons, and limitations
2. Electric vehicles – what about aircraft? Will we ever have an all-electric jumbo jet? Thoughts on alternatives to batteries?
3. Nanotechnology – what does it have to offer the field of electric vehicles?
4. Challenges with the ultimate energy density with batteries

Oral Project Requirements:

Each group should present for 10 minutes with 5 minutes for questions/discussion. Each member of the group should present an equal amount of information.

Presentations should include figures as well as text, and all should be referenced.

4.2 Written Project Requirements: 2,000 words page report.