



整合奈米課程成為工學院奈米科技學程

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摘要

奈米科技是近期研究微小尺寸的重要課題。此新的研究課題對於學工程的學生是一大挑戰。學生需應用工程、數學及科學的知識及理論才能從事微零件、微設備及微系統的設計及製造。因此奈米科技是跨領域的科學，它牽涉到物理、數學、材料及工程的領域。老師們的挑戰是如何提供跨領域的課程給學生，以讓學生瞭解此新的科技。宜蘭大學工學院乃提出奈米科技學程以讓學生有機會學習此新的科技。

關鍵詞: 奈米科技、跨領域、學程、宜蘭大學



Integrated Nanotechnology Courses to be a Curriculum of College of Engineering

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ABSTRACT

Nanotechnology is recently popular research topics in the development of small-scale field. The new fields will provide challenge to the engineering students they must have the ability to apply knowledge of engineering, mathematics and sciences to design and manufacture of nano-components, nano-devices, and nano-systems. Nanotechnology is interdisciplinary and it involves physics, mathematics, materials, and many engineering fields. Our challenge is to provide an interdisciplinary education to student with a broad understanding of basic sciences. All staffs in college of engineering joint together to develop the nanotechnology curriculum at I-Lan University in Taiwan.

Keyword: Nanotechnology , interdisciplinary, curriculum, I-Lan University

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Introduction

Nanotechnology is a unique interdisciplinary field which includes the design, analysis, and manufacture of nano-size devices and systems [1].

Nanotechnology, the terminology and concept born in 1959 and was founded by the American Physicist Richard P. Feynman. But the term 'Nanotechnology' was first used in 1974 by Japanese scientist Professor Norio Taniguchi at the Tokyo Science University. However it was introduced to the world in 1986 by K. Eric Prexler, an American Engineer and the founder of Foresight Nanotech Institute.

Application of nano-carbon tube

The nano-carbon tube has some special electronic, mechanical, and chemical characters, therefore new application elements and materials can be produced from it.

(a) electronic and opto-electronic part

Nanocarbon tube has the characters of electricity conducting, semiconducting, and nano-size and can be made to be the nano-electron opto-electronic part. They are applied in the single electron crystal, nano-biology, quantum line to get good results. Next, the nano-carbon tube shows the specific field emission effect that the lower emission voltage and get large density of electron, they can be applied in the emission displayer. This new plan displayer has a higher light, lower electricity consumed, and a large observation angle. It also has the fast reflection speed. That will become the next generation display part.

(b) Energy saving part

Because the surface area ratio of the nano-carbon tube is large, it can become a good absorption material. If a large amount of hydrogen can be absorbed in the wall of the nano-carbon tube, then it can become a good hydrogen stored material for the fuel cell.

(c) Composite Material

Nano-carbon tube has the high mechanical strength, lower mass density, very soft and easily extended, higher ratio of length and diameter. It can become the reinforced materials for the high polymer, porcelain, and metal. It can also be developed to be multi-functional composite material that can be used in automobile and aerospace industry.

(d) nano-meter instrument and sensor

The parallel nano-carbon tube excited by the current will have the action as the open and

close of two chopsticks due to the electro-static force. It become the smallest nano tweezer in the world and may become the nano-instrument to adjust the nano-mechanical part. If the nano-carbon tube absorbed some air, the electric-resistance will change very much. The sensitivity of the resistance is hundreds times of traditional metal oxide.

Nanotechnological curricular in college of Engineering

National I-Lan University is the only national institute of highest education in Lanyang Plain. NIU marked the highlight of this qualified promotion to expedite high-level research and teaching capability for generations of new era [2-4]. To foster passionate, enthusiastic and ongoing expansion of knowledge to scholarship, internationalization of NIU with a world-wide perspective has been a higher prospect.

Nanotechnological issues in Mechanical Engineering curricular

Knowledge is the basic principles in Mechanical engineering is required to clearly understand the nanoscale issues and develop insight toward the nanotechnological engineering issues that we face today. Therefore the basic courses are offered in nthe area of mechanical engineering and nanotechnological fields. Understanding the design and analysis of mechanical and electro-mechanical system is offered. The nanotechnological engineering is an emerging issue for the nano-scale carbon tube or other nano-engineering device. The high-tech industries such as computer, IC and TFT LCD manufacturing depend on precision manufacturing equipments. To help our national raise its technology standard and production capability, our department trains students in both theories and applications in traditional mechanical and electro-mechanical engineering, and extend the modern technologies such as micro and nano technological courses.

Nanotechnological issues in Department of Civil Engineering

As modern technologies advances, civil engineers must keep up with new trends. The department education program starts in ecology(nature), mathematics, mechanics, management (tools), and nanotechnology(green building), to establish the design, construction, and management of engineering. Computer applications, Internet technologies, laser assisted survey, global positioning system, remote sensing, geographic information system along with natural environment and ecological engineering are all accounted for in the training courses for modern civil engineers. By applying new technologies such as nanotechnologies to traditional civil engineering works, future civil engineers, as what we would expect of our

students, would become sustainable engineers. Civil engineering is no longer filled with “old” stuff. With new thoughts and new technologies, it now surfs the waves of the future.

Nanotechnological issues in Department of Chemical and Materials Engineering

To meet the needs in new emerging sciences and technologies of the 21st century, prudent and incentive decisions have been made to merge Chemical Engineering and Materials Engineering (C&ME) as the core perspective of the department. The department offers access to university courses of the new era for C&ME professionals not only in education but for enrichment as well. Emphasis of core courses is placed on their fundamentals and flexibility to adopt recent development in professional fields as well as meet the requirements for advanced academic disciplines. The framework of elective courses also reflects vast diversity of materials, biotechnology, nanotechnology, alternative energy, pollution, system engineering, process control and instrumental analysis.

Nanotechnological issues in Department of Environmental Engineering

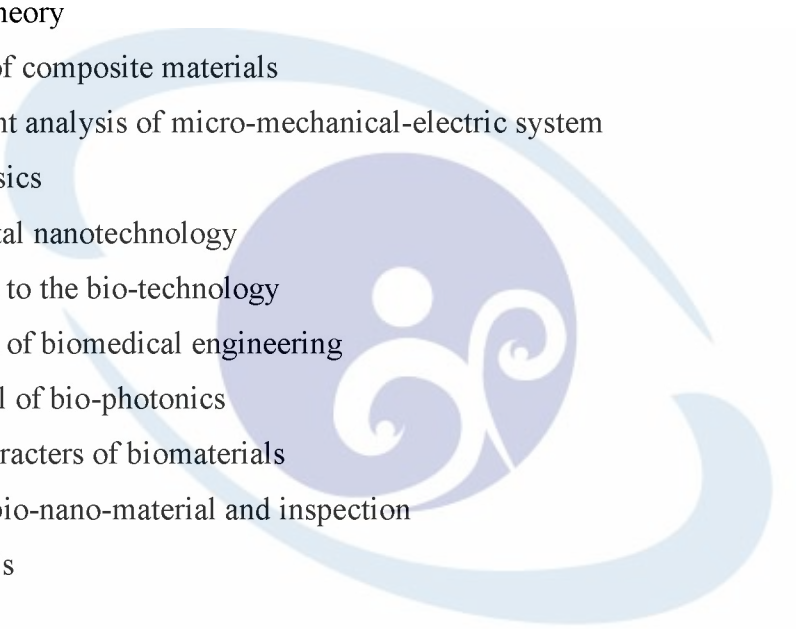
There is but one earth. No matter how great humankind’s technological advancement and economic development, we will always be dependent upon our environment and the resources it provides to exist and develop. Hence, the use of engineering technology to control pollutants and maintain the quality of the environment will become more of a focal point in our world of the future. The courses are divided into three areas of environmental engineering technology, environmental quality management, and renewable energy and resources. The fields of renewable energy and resources will offer waste management and resources recovery, renewable energy and material recovery, microbial fuel cell, environmental nanotechnology.

The courses in the college of Engineering offered by four departments are listed in the following:

Basic courses:

1. Physics
2. Introduction to nanotechnological Engineering
3. Introduction to nanotechnology
4. Introduction to nano-material
5. Introduction to environmental nanotechnology

Elective courses:

1. produce of nano-materials and inspection technology
 2. Theory and application of surface-active agent
 3. Semi-conductor materials
 4. Science of colloid
 5. Optical spectrum chemical analysis
 6. Industry catalyst
 7. Physical chemistry
 8. Micro-mechanical-electric theory
 9. Introduction of semi-conductor manufacture process
 10. nano-meter measurement technology
 11. nano-wear theory
 12. Mechanics of composite materials
 13. finite element analysis of micro-mechanical-electric system
 14. modern physics
 15. environmental nanotechnology
 16. Introduction to the bio-technology
 17. Introduction of biomedical engineering
 18. Fundamental of bio-photonics
 19. physical characters of biomaterials
 20. Produce of bio-nano-material and inspection
 21. Bio-materials
 22. Case study
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The students in the college of engineering can get 20 or 20 more credits from the listed course, they will get the certification of nano-technology curriculum.

The nanotechnology development in the national developing program, the industry need many engineers devoted their capabilities to establish the new technology. The new processing and application of nanotechnology need more students work in the field. The basic knowledge of the students must be known in their study program, then they can directly involve into the nanotechnology job after they graduate from the school. The new technology contains many new sciences and it is difficult to let a single department offer all the related courses. Therefore, all the faculties in the college of engineering they are studied in the nanotechnology have to offer the interdisciplinary curriculum to the students and may not limit the students in the college of engineering. Due to the success of the nanotechnology curriculum, the college

of engineering in I-Lan University will follow this procedure to develop the new and update curriculum that can give the students the different discipline. The new curriculum can increase the students understand the new and emerging technology and can off the opportunity to the students to contact the new technology.

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