

### MS4014 – Nanomaterials: fundamentals and applications

<b>Course Code</b>	MS4014				
<b>Course Title</b>	Nanomaterials: fundamentals and applications				
<b>Pre-requisites</b>	MS2018	Electronic and Magnetic Properties of Materials			
	MS3012	Micro-Nanoelectronic Processing			
	MS3013	Environmental Effects on Materials			
<b>Pre-requisite for</b>	NIL				
<b>No of AUs</b>	3				
<b>Contact Hours</b>	LECTURES	26	Tutorials	6	
<b>Course Aims</b>					
<p>This course aims to provide a comprehensive overview of nanomaterials in terms of the synthesis, characterization, properties, and applications. It will cover the fundamental scientific principles for the different synthesis techniques, assembly of nanostructured materials and, new physical and chemical properties at the nanoscale. Existing and emerging applications will also be discussed through case studies.</p>					
<b>Intended Learning Outcomes (ILO)</b>					
<p>By the end of this course, you (as a student) would be able to:</p> <ol style="list-style-type: none"> <li>1. apply the physics of the quantum confinement (by drawing the energy band diagram) to explain the origin of the property difference</li> <li>2. clearly state the difference of the optical and electrical properties between bulk materials and nanomaterials</li> <li>3. extend the concept to explain some daily observed phenomena or device applications</li> <li>4. describe the basic flow of the nanomaterials preparation process by drawing the flow chart of different synthesis approaches</li> <li>5. state how the synthesis parameters and kinetic factors would affect the morphology and physical properties of the nanoparticles</li> <li>6. design chemical synthesis routes to make complex nanostructures.</li> <li>7. describe the methods used to address the stability issue of nanoparticles and the underlying principles</li> <li>8. describe the important applications and properties of several typical nanomaterials and explain the mechanisms.</li> </ol>					

### **Course Content**

Introduction to nanomaterials, size effects, properties and applications of nanomaterials, synthesis methods, stabilization and assembly of nanomaterials, characterization of nanomaterials, and existing & emerging applications (case studies).

### **Reading and References**

1. Nanostructures and Nanomaterials -Synthesis, Properties and Applications, Cao Guozhong and Wang Ying, World Scientific Publishing, 2nd edition, 2011
2. Nanomaterials: An Introduction to Synthesis, Properties and Applications, Dieter Vollath, Wiley, 2008
3. Nanoscale Materials in Chemistry, edited by Kenneth J. Klabunde & Ryan M. Richards, John Wiley & Sons, 2nd edition, 2009.

### **Course Policies and Student Responsibilities**

(1) CA

All non-attendance must be supported by a medical certificate or other valid official documents.

### **Academic Integrity**

Good academic work depends on honesty and ethical behavior. Quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honor Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student of NTU, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at the University. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, and collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.