<table>
<tr><td>Course Code and Title</td><td colspan="2">MS7210: Processing of Inorganic Materials</td></tr>
<tr><td>Instructor</td><td colspan="2">Dr Long Yi</td></tr>
<tr><td rowspan="3">Details of Course</td><td colspan="2">Rationale for introducing this course

The processing techniques used to manufacture materials and components is a very broad activity encompassing materials science, mechanical engineering, chemistry and economics. Commercial processing is now accomplished by automated and computer controlled equipment yet the engineers must understand the basic principles to program and control the parameters. This course is to develop the scientific base and fundamental nature of some common processes.</td></tr>
<tr><td colspan="2">Aims and objectives

The aim of this course is to provide students with the basic understanding of manufacturing processes, and the relationships between process design and fundamental concepts in transport phenomena, and properties.

At the end of this course the students will be able to
1. Explain the relationships between basic concepts and design of the processing route.
2. Apply basic concepts to predict the material behaviour during processing.
3. Predict the structure and properties of the end products
4. List the advantages and limitations of each process.
5. Choose the best process for a particular component, device or material.</td></tr>
<tr><td colspan="2">Course Syllabus (Refer to page 2)

Module 1 : Processes for Particulate Materials and bulk materials
Module 2: Vacuum Processes
Module 3: Solution Processes</td></tr>
<tr><td>Assessment</td><td>Components are assessed Individually</td><td></td></tr>
<tr><td></td><td>1 x Continuous Assessment
1 x Oral Presentation
1 x Review Paper</td><td>50%
25%
25%</td></tr>
<tr><td></td><td>Total:</td><td>100 %</td></tr>
<tr><td>To be offered with effect from
(state Academic Year and Semester)</td><td colspan="2">AY2018/19 Semester 2</td></tr>
<tr><td>Any Duplication of Course</td><td colspan="2">NIL</td></tr>
<tr><td>Cross Listing (if applicable)</td><td colspan="2">N/A</td></tr>
<tr><td>Prerequisites (if applicable)</td><td colspan="2">N/A</td></tr>
<tr><td>Preclusions (if applicable)</td><td colspan="2">N/A</td></tr>
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Mode of Teaching & Learning (Lectures, regular tests, Q&A, problem-based learning)	Lectures, MCQ, tutorials, assessments	
Basic Reading List • **Compulsory Reading** • **Supplementary Reading**	**Supplementary Reading** 1. Ohring, M. (2002). *The materials science of thin films*. (2nd ed). San Diego, CA : Academic Press 2. Smith, D.L. (1995). *Thin-film deposition, principles and practice*. Boston : McGraw-Hill 3. Mitzi, D. B. (Editor) (2009). *Solution Processing of Inorganic Materials*. Hoboken, New Jersey : Wiley 4. Barsoum, M. X. (2002). Fundamentals of Ceramics, CRC Press	
Maximum Class Size	*30*	
Hours of Contact/Academic Units	39 hours/ 3 AUs	
Workload Per Week (The workload for a 3-AU course must add up to 39 hours of contact hours)	Lecture hours per week Tutorial hours per week	*3 hours*
	Total hours	*39 hours*

Course Syllabus
The following topics will be covered:

MODULE 1 : PROCESSES FOR PARTICULATE MATERIALS AND BULK MATERIALS
1.1: Powder synthesis
Methods for powder production and blending. Particle shape and size distribution. Properties of powders.
1.2: Compaction of Powders
Various densities. Pressing. Isostatic pressing. Metal injection moulding. Sintering and mechanisms. Processing ceramics, cermet and composite. Properties of sintered products.

MODULE 2: VACUUM PROCESSES
2.1: Vacuum
Introduction to vacuum technology, systems, pumps and gauges. Units of pressure. Deposition chambers, target and substrate preparation.
2.2: ~~P~~hysical vapor deposition
Physical vapour deposition processes and sputtering. Polycrystalline and epitaxial film production. Effects of substrates
2.3: Chemical vapor deposition
Films and nanostructures from gas precursors. Atomic layer deposition. Nanoscale control of film chemistry.
2.4: Growth progress and Microstructure control
Zone structure model, amorphous and crystallinity control, pore control and defects evolutions.

MODULE 3: SOLUTION PROCESSES
3.1: Basic Principles
Precursor solutions, reaction rates, ligand additives for size and shape control.
3.2: Sol Gel
The principal of Sol gel and the related process. Morphology control, Chemical reaction of sol gel, the advantages and disadvantages of sol gels.
3.3: Chemical Solution Deposition — Basic Principles
Basics of sol-gel, chelate and related processes. Film formation: spin coating, dip coating and spray coating. Spray pyrolysis. Examples of chemical synthesis. Examples of chalcogenide semiconductor synthesis.