Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP618
Subject Title	Science and Technology of Micro- and Nano- systems
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	To introduce knowledge in the field of micro- and nano- technologies to research students from different disciplines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) obtain a concept on the scope and recent development of the science and technology of micro- and nano-systems; b) gain the physical knowledge underlying the operation principles and design of micro- and nano-systems; c) gain the technical knowledge required for computer-aided design, fabrication, analysis and characterization of nano-structured materials, micro- and nano-scale devices; d) learn some typical or potentially applicable micro- and nano-systems at the frontier of the development of the field; e) gain hands-on experience on characterization and fabrication of some micro- and nano-systems.
Subject Synopsis/ Indicative Syllabus	• Overview of the science and technology of micro- and nano-systems • Physics in micro- and nano-systems includes mechanics for micro- and nano-systems, fluid dynamics for micro- and nano- systems, heat conduction in micro- and nano- systems and quantum phenomena in nano-systems. • Micro- and nano-fabrication: principles and techniques includes basic micro- and nano-fabrication techniques, MEMS fabrication techniques, packaging, measurement techniques and computer-aided design. • Applications and devices includes design of microaccelerometers and pressure sensors, microfluidic systems, biochemistry and medical applications, MEMS for information technology and nanoelectronics etc.
Teaching/Learning Methodology	In order to stimulate and motivate the students' interest in the study of material science and related topics, Four experiments will be offered for the students to gain experience on nanoindentation, atomic force microscopy, carbon nanotubes fabrication and operation of some MEMS

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<tr><td></td><td>devices. These proposed practical examples will demonstrate the importance of material science in our everyday life.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>2. Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Students should have a) a basic understanding on the development of the science and technology of micro- and nano- systems, b) gained knowledge in the operation principle and design of micro- and nano- systems, c) gained knowledge to use CAD to design and fabricate the nano-systems, d) learned problems related to the micro- and nano- technologies and e) obtained hand-on experience in micro- and nano- technologies – these are the intended learning outcomes.
Assignments will strengthen the students’ basic knowledge and the analytical skill to solve the problems related to micro- and nano- technologies. Tests will review their understanding of the course and examination will accelerate their knowledge’s understanding and improve their manipulation on problem solving. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes (i.e., items a, b, c, d & e).
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures/Seminar</td><td>27 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>81 Hrs.</td></tr>
<tr><td>▪ Laboratory</td><td>12 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>120 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>

T.R. Hsu, MEMS & microsystems design and manufacture, Boston, McGraw Hill, 2002.
S.E. Lyshevski, Nano- and microelectromechanical systems, Boca Raton, CRC Press, 2001.
R. Waser (ed.), Nanoelectronics and information technology, Aachen, Wiley-VCH, 2003.
B. Bhushan, Springer handbook of nanotechnology, Berlin, Springer-Verlag, 2004.
J.A. Pelesko and D.H. Bernstein, Modeling MEMS and NEMS, Boca Raton, Chapman &Hall/CRC, 2003.
V.K. Varadan, Microstereolithography and other fabrication techniques for 3D MEMS, Chichester, Wiley, 2001.

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	• H. Fujita, Micromachines as tools for nanotechnology, Berlin, Springer, 2003. • W.A. Goddard, Handbook of nanoscience, engineering, and technology, Baca Raton, CRC Press, 2003. • W. Menz, Microsytem technology, Weinheim, Wiley-VCH, 2001. • G.M. Rebeiz, RF MEMS: theory, design, and technology, Hoboken, Wiley, 2003. • V.K. Varadan, RF MEMS and their applications, Chichester, John Wiley, 2003. • M.J. Madou, Fundamentals of microfabrication : the science of miniaturization, Boca Raton, CRC Press, 2002.