Subject Description Form

Subject Code	BME32128
Subject Title	**Micro and Nano Technologies for Biomedicine and Biotechnology**
Credit Value	3
Level	3
Prerequisite	Nil
Objectives	The application of microfabrication technology for the development of devices in medical diagnostics and therapeutics, commonly known as bio-microelectromechanical systems (BioMEMS), is a rapidly growing area in biomedical engineering. This subject covers the fundamentals of microfabrication techniques, micro-sensors and -actuators, as well as microfluidics. Design, fabrication, and operation issues in applications of micro-total analysis systems, drug delivery systems, devices and instrumentation for diagnostics and treatment of human disease will be presented. Particular emphasis will be given to clinical significance of these microscale technologies.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply scaling laws and advantages offered by miniaturization; b. Discuss the basic microfabrication techniques for silicon, glass, and polymer devices; c. Analyze design, fabrication, and operation of MEMS-based sensors, actuator, and fluidic devices; d. Integrate interdisciplinary principles of basic sciences, medical sciences, and engineering to understand biomedical microsystems for diagnosis and treatment of human diseases; e. Apply the principles to design novel microsystems for better health care.
Contribution to Programme Outcomes (Refer to Part I Section 10)	▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach and Practice) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach and Practice) ▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Teach and Practice)

<table>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Introductory overview; lithography; materials choices (silicon, glass, and polymer) for microfabrication; thin-film deposition; dry-bulk etching; wet etching; wafer bonding; packaging; microsensors; microactuators; microfluidics; micro-total analysis systems (e.g., genomics and proteomics); drug delivery systems; implantable systems; biocompatibility and regulatory issues.</td></tr>
<tr><td>Teaching and Learning Methodology</td><td>Students will learn the fundamentals of microfabrication and their biomedical applications in lectures. Laboratory demonstrations will provide students with experiences on the practical microfabrication techniques.</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="8">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><td></td><td></td></tr>
<tr><td>Continuous assessment</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Final exam</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="8"></td></tr>
</table>
Note: To pass this subject, students must obtain grade D or above in both continuous assessment and final examination.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Continuous assessment will include 4 homework assignments and 1 quiz. Individual assignments will be designed to testify outcomes a, b, c, d and e, respectively. One quiz will be designed to testify outcomes a, b and c. A final exam will be designed to testify outcomes a, b c, d and e.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>36 Hrs.</td></tr>
<tr><td>▪ Laboratory</td><td>3 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Preparation for homework</td><td>42 Hrs.</td></tr>
<tr><td>▪ Preparation for exam</td><td>45 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>126 Hrs.</td></tr>
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Reading List and References	▪ Madou, M., Fundamentals of Microfabrication: The Science of Miniaturization, 3rd edition, CRC, 2010.
Date of Last Major Revision	14 July 2014
Date of Last Minor Revision	27 Jan 2015