Subject Description Form

Subject Code	BME5127
Subject Title	Nanobiotechnology
Credit Value	3
Level	5
Pre-requisite / Co-requisite/ Exclusion	General Physics, Chemistry, and Biology
Objectives	Nanobiotechnology is a rapidly growing field that deals with the application of biofunctionalized nanomaterials/nanostructures for biomedical diagnostics/imaging, drug delivery, implants, nanoscale devices, and many others. This subject commences with the fundamentals (i.e., synthesis, characterization, and unique properties) of the nanostructured materials, followed by their conjugation with biomolecules and specific applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand and discuss the fundamentals of biofunctionalized nanostructured materials; b. Apply the unique properties of these bio-nanomaterials for novel biomedical applications; c. Analyze the performance of these nanoscale technologies as compared to their macro- or micro-scale counterparts; d. Integrate knowledge of chemistry, biology, and engineering to design nano-enabled devices/systems; e. Appraise the value of nanobiotechnology in scientific, economic, social, and environmental contexts; f. Identify promising areas/future directions in the nanobiotechnology field.
Contribution to Programme Outcomes (Refer to Part I Section 2)	Programme Learning Outcome (a): Acquire and apply advanced levels of knowledge and skills in BME discipline. (Teach and Measure) Programme Learning Outcome (b): Apply critical analysis and problem-solving skills for evidence-based practice in BME discipline. (Teach and Measure) Programme Learning Outcome (c): Demonstrate a higher level of professional competence to cope with the rapid changes in practice in BME discipline. (Teach and Measure)
Subject Synopsis/ Indicative Syllabus	Introductory overview; preparation, characterization, and properties of nanostructured materials (e.g., metal nanoparticle, quantum dot, carbon nanotube, polymeric nanocarrier, and silica nanoparticle); biofunctionalization of nanomaterials (e.g., cell, nucleic acid, and protein); applications of biofunctionalized nanomaterials (e.g., diagnostics and screening technologies, drug delivery); nanofabrication/nanopatterning techniques and applications; DNA nanostructures; toxicity, health, and environmental issues.
Teaching/Learning Methodology	Students will learn the concepts and applications of nanobiotechnology in lectures. Lab demonstrations will allow students to have real experience on the some of the lab skills in the field of nanobiotechnology. Students are required to investigate emerging nanobiotechnology areas in an individual project and a group project.

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<table>
<tr><td rowspan="2">Teaching/learning methodology</td><td colspan="6">Intended subject learning outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Lectures</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Lab demonstrations</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
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<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</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Group project</td><td>30%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Quizzes</td><td>40%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Lab reports</td><td>30%</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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For group project, students have to give an oral presentation on the state-of-the-art nanotechnologies for different applications. All the assessments are aligned to the intended learning outcomes.
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<tr><td>Student Study Effort Expected</td><td>
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<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>30 Hrs.</td></tr>
<tr><td>▪ Lab demonstrations</td><td>9 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Individual project</td><td>20 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>58 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>117 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>

Nanomaterials in Bionanotechnology Fundamentals and Applications (9781003139744), Singh, R.P., Singh, K.R.B., CRC Press, 2021
Nanoengineered Biomaterials for Regenerative Medicine (9780128133569), Mozafari, M., Rajadas, J., Kaplan, D., Elsevier, 2018
Advances in Biomaterials for Biomedical Applications (9789811033278), Editors: Tripathi, A., Melo, J.S., Springer, 2017
Bionanomaterials (9783319620275), Editors: Piotto, S., Rossi, F., Concilio, S., Reverchon, E., Cattaneo, G, Springer, 2016

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<tr><td>Date of Last Major Revision</td><td>26 Apr 2021</td></tr>
<tr><td>Date of Last Minor Revision</td><td>19 Aug 2022</td></tr>
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