

## Subject Description Form

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| <b>Subject Code</b>  | BME31112  |
| <b>Subject Title</b>   | <b>Biomedical Engineering Research and Design Studies II</b>  |
| <b>Credit Value</b>  | 4   |
| <b>Level</b>   | 3   |
| <b>Prerequisite</b>  | BME21111 Biomedical Engineering Research and Design Studies I   |
| <b>Objectives</b>  | <ul style="list-style-type: none"> <li>▪ To apply mechanical and electronic principles to biomedical engineering design.</li> <li>▪ To introduce various design mechanisms and manipulation techniques.</li> <li>▪ To introduce the use of computer software in design.</li> <li>▪ To provide opportunities for students to practice design process.</li> <li>▪ To develop team work skill in design.</li> </ul>  |
| <b>Intended Learning Outcomes</b>                                      | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Apply mechanical and electronic principles to biomedical engineering design;</li> <li>b. Demonstrate understanding of various mechanisms and machine element design;</li> <li>c. Use of computer software and tools in design;</li> <li>d. Define key concepts and be familiar with terminology in human information processing, physiological, and person–technology models for ergonomic design;</li> <li>e. Apply critical skills and knowledge to improve the ergonomic design of a product or system and report on this.</li> </ol>   |
| <b>Contribution to Programme Outcomes (Refer to Part I Section 10)</b> | <ul style="list-style-type: none"> <li>▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach, Practice, and Measure)</li> <li>▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Practice and Measure)</li> <li>▪ Programme Outcome 3: Demonstrate an ability to design a system, component, or process relevant to BME to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. (Practice and Measure)</li> </ul> |

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|   | <ul style="list-style-type: none"> <li>▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Teach, Practice, and Measure)</li> <li>▪ Programme Outcome 5: Demonstrate an ability to understand the impact of BME solutions in a global and societal context, especially the importance of health, safety, and environmental considerations to both workers and the general public. (Practice and Measure)</li> <li>▪ Programme Outcome 6: Demonstrate an ability to critically evaluate research and professional literature, and understand the principles and practice of conducting research in clinical and industrial environments relevant to BME. (Practice and Measure)</li> <li>▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach, Practice, and Measure)</li> <li>▪ Programme Outcome 8: Demonstrate an ability to use the computer/IT tools relevant to the BME discipline along with an understanding of their processes and limitations. (Teach, Practice, and Measure)</li> <li>▪ Programme Outcome 9: Demonstrate an ability to function in multi-disciplinary teams. (Practice and Measure)</li> <li>▪ Programme Outcome 10: Demonstrate an understanding of professional and ethical responsibility. (Practice and Measure)</li> <li>▪ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues, and other members of the community. (Practice and Measure)</li> <li>▪ Programme Outcome 12: Demonstrate an ability to recognize the need for, and to engage in life-long learning. (Practice and Measure)</li> <li>▪ Programme Outcome 13: Demonstrate an understanding of contemporary issues. (Teach, Practice, and Measure)</li> <li>▪ Programme Outcome 14: Demonstrate an understanding of entrepreneurship and leadership. (Practice and Measure)</li> </ul> |
| <p><b>Subject Synopsis/<br/>Indicative<br/>Syllabus</b></p> | <ul style="list-style-type: none"> <li>▪ Design methodology; design for standards; design communication; mechanism design; machine element design; computer-aided design and simulation; rapid prototyping; human factors and systems; ergonomics methods including ergonomic work analysis, task analysis, posture analysis, systems design, subjective assessment, behavioral and cognitive methods, interface design, and usability; and design examples in biomedical engineering.</li> <li>▪ Depending on the device/product selected by each project team, consideration will be given to mechanical and/or structural design, materials selection and tooling requirements, stress analysis, electrical design, sensors and actuator selection, computer interfacing, software engineering, signal processing, and facilities and resource planning.</li> </ul>   |

| <b>Teaching and Learning Methodology</b>                               | <p>This subject will last for 2 semesters and provide an opportunity for the students to practice design process through experiencing the development of a practical solution for a challenging biomedical engineering-related problems. There will be lectures and tutorials dealing with fundamental design approaches and design examples in biomedical engineering field. Students will be divided into groups and work together to carry out group projects. Each group will be supervised by one or more lecturers. Students are required to carry out design projects and class discussions and presentations. All design experiences must have some biological component. Students' knowledge will be tested by quiz, home assignments, reports, and presentation conducted during the course.</p>                                 |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
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| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="444 642 1437 995"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="7">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>Continuous assessment</td> <td>100%</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="7"></td> </tr> </tbody> </table> <p><i>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</i></p> <p>Students should work as a team and will be assessed through project reports, mid-assessment and oral presentation.</p> |  |   |   |   |   |  |  |  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |         |                         |         |                             |  |              | a        | b             | c       | d                          | e        |  |  | Continuous assessment | 100% | √ | √ | √ | √ | √ |  |  | Total | 100% |  |  |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
|  |  | a  | b | c | d | e |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| Continuous assessment  | 100%   | √  | √ | √ | √ | √ |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| Total  | 100%   |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| <b>Student Study Effort Expected</b>                                   | <table border="1" data-bbox="435 1234 1453 1698"> <tr> <td>Class contact:</td> <td></td> </tr> <tr> <td>▪ Lectures</td> <td>39 Hrs.</td> </tr> <tr> <td>▪ Training laboratories</td> <td>26 Hrs.</td> </tr> <tr> <td>Other student study effort:</td> <td></td> </tr> <tr> <td>▪ Self-study</td> <td>107 Hrs.</td> </tr> <tr> <td>▪ Assignments</td> <td>80 Hrs.</td> </tr> <tr> <td>Total student study effort</td> <td>252 Hrs.</td> </tr> </table>  |  |   |   |   |   |  |  |  | Class contact:                    |             | ▪ Lectures   | 39 Hrs. | ▪ Training laboratories | 26 Hrs. | Other student study effort: |  | ▪ Self-study | 107 Hrs. | ▪ Assignments | 80 Hrs. | Total student study effort | 252 Hrs. |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| Class contact:   |  |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| ▪ Lectures   | 39 Hrs.  |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| ▪ Training laboratories  | 26 Hrs.  |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| Other student study effort:  |  |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| ▪ Self-study   | 107 Hrs.   |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| ▪ Assignments  | 80 Hrs.  |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |
| Total student study effort   | 252 Hrs.   |  |   |   |   |   |  |  |  |                                   |             |  |         |                         |         |                             |  |              |          |               |         |                            |          |  |  |                       |      |   |   |   |   |   |  |  |       |      |  |  |  |  |  |  |  |

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| <b>Reading List and References</b> | <ul style="list-style-type: none"> <li>▪ Zenios S, Makower J, Yock P, Biodesign, Cambridge University Press, 2010.</li> <li>▪ Dieter G, Engineering Design: A Materials and Processing Approach, McGraw-Hill, 3rd Ed., 2000.</li> <li>▪ Otto K and Wood K, Product Design, Prentice Hall, 2001.</li> <li>▪ Jensen C, Engineering Drawing and Design, Mcsmillam/McGraw-Hill, 7th Ed., 2008.</li> <li>▪ Juvinall A, Fundamentals of Machine Component Design, Wiley, 4th Ed., 2006.</li> <li>▪ Norton RL, Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, McGraw-Hill, 4th Ed., 2008.</li> <li>▪ Fries RC, Handbook of Medical Device Design, Marcel Dekker, 2001.</li> <li>▪ King PH and Fries RC, Design of Biomedical Devices and Systems, CRC Press, 2009.</li> <li>▪ Salvendy G, Handbook of Human Factors and Ergonomics, John Wiley &amp; Sons, 3rd Ed., 2006.</li> </ul> |
| <b>Date of Last Major Revision</b> | 14 July 2014  |
| <b>Date of Last Minor Revision</b> | 01 September 2015   |