

### **Subject Description Form**

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| <b>Subject Code</b>                                                   | BME5133                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Subject Title</b>                                                  | Modern Rehabilitation Engineering and Robotics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Credit Value</b>                                                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Level</b>                                                          | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Responsible staff &amp; Department/School</b>                      | Dr Xiaoling HU (BME)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Pre-requisite / Co-requisite/ Exclusion</b>                        | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Objectives</b>                                                     | This subject aims to provide students a good background on advanced engineering solutions and automation in applications for persons who suffer from physical or sensory impairments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Intended Learning Outcomes</b>                                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>Apply fundamental knowledge of engineering in rehabilitation</li> <li>Apply analytical skills to assess and evaluate the need of the end-user</li> <li>Conduct patient/technology evaluation via the use of modern instrumentation</li> <li>Develop self-learning initiatives and integrate learned knowledge for problem solving</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Contribution to Programme Outcomes (Refer to Part I Section 2)</b> | <p>Programme Learning Outcome (a): Acquire and apply advanced levels of knowledge and skills in BME discipline. (Teach, Practice, and Measure)</p> <p>Programme Learning Outcome (b): Apply critical analysis and problem-solving skills for evidence-based practice in BME discipline. (Teach, Practice, and Measure)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Subject Synopsis/ Indicative Syllabus</b>                          | <p>This subject is on the rehabilitation with modern engineering solutions for people with sensorimotor disabilities, underpinned with the advances in neuroscience, engineering, and clinical practice. It is multi-disciplinary in nature. Team approach is the preferred clinical approach in the provision of rehabilitation engineering devices, e.g., robots, in long-term automatic services. This subject is appropriate for professionals concerned with rehabilitation.</p> <p>The contents of this subject covers:</p> <ul style="list-style-type: none"> <li>- Quantitative neural coding techniques</li> <li>- Human-machine interface and robotic design</li> <li>- Sensory aids for hearing and visual impairments</li> <li>- Assistive technology in balance</li> <li>- Prosthetics and orthotics technology</li> <li>- Evaluation and training technology</li> <li>- Emerging technologies</li> </ul> |

|                                                                 |                                                                                                                                                                                                                              |                                    |                                                   |   |          |   |  |  |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------|---|----------|---|--|--|
|                                                                 |                                                                                                                                                                                                                              |                                    |                                                   |   |          |   |  |  |
| Teaching/Learning Methodology                                   | Lecture, laboratories and/or presentations                                                                                                                                                                                   |                                    |                                                   |   |          |   |  |  |
|                                                                 | Teaching/learning methodology                                                                                                                                                                                                | Intended subject learning outcomes |                                                   |   |          |   |  |  |
|                                                                 |                                                                                                                                                                                                                              | a                                  | b                                                 | c | d        |   |  |  |
|                                                                 | 1. Lectures                                                                                                                                                                                                                  | √                                  | √                                                 | √ | √        |   |  |  |
|                                                                 | 2. Labs                                                                                                                                                                                                                      |                                    | √                                                 | √ |          |   |  |  |
|                                                                 | 3. Group Project                                                                                                                                                                                                             | √                                  | √                                                 | √ |          |   |  |  |
| Assessment Methods in Alignment with Intended Learning Outcomes | Specific assessment methods/tasks                                                                                                                                                                                            | % weighting                        | Intended subject learning outcomes to be assessed |   |          |   |  |  |
|                                                                 |                                                                                                                                                                                                                              |                                    | a                                                 | b | c        | d |  |  |
|                                                                 | 1. Assignments                                                                                                                                                                                                               | 30%                                | √                                                 |   |          | √ |  |  |
|                                                                 | 2. Lab report                                                                                                                                                                                                                | 10%                                |                                                   | √ | √        |   |  |  |
|                                                                 | 3. Group project presentations                                                                                                                                                                                               | 30%                                | √                                                 | √ | √        | √ |  |  |
|                                                                 | 4. Quiz                                                                                                                                                                                                                      | 30%                                | √                                                 | √ | √        |   |  |  |
|                                                                 | Total                                                                                                                                                                                                                        | 100 %                              |                                                   |   |          |   |  |  |
|                                                                 | Different assignments and lab experience and/or presentations were used to guide the students towards the learning objectives of this course. Students are expected to demonstrate their learned knowledge through the quiz. |                                    |                                                   |   |          |   |  |  |
| Student Study Effort Expected                                   | Class contact:                                                                                                                                                                                                               |                                    |                                                   |   |          |   |  |  |
|                                                                 | ▪ Lectures/Tutorial/Seminar                                                                                                                                                                                                  |                                    |                                                   |   | 33 Hrs.  |   |  |  |
|                                                                 | ▪ Laboratories                                                                                                                                                                                                               |                                    |                                                   |   | 6 Hrs.   |   |  |  |
|                                                                 | Other student study effort:                                                                                                                                                                                                  |                                    |                                                   |   |          |   |  |  |
|                                                                 | ▪ Self-study                                                                                                                                                                                                                 |                                    |                                                   |   | 38 Hrs.  |   |  |  |
|                                                                 | ▪ Assignments and laboratory reports                                                                                                                                                                                         |                                    |                                                   |   | 40 Hrs.  |   |  |  |
|                                                                 | Total student study effort                                                                                                                                                                                                   |                                    |                                                   |   | 117 Hrs. |   |  |  |

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| <b>Reading List and References</b> | <ul style="list-style-type: none"> <li>▪ Intelligent Biomechatronics in Neurorehabilitation, Elsevier, U.K., ISBN: 9780128149423, 2019</li> <li>▪ Daniel J. DiLorenzo, Joseph D. Bronzino, Neuroengineering, 2007.</li> <li>▪ Bruce F. Katz, Neuroengineering the Future: Virtual Minds and the Creation of Immortality, 2008.</li> <li>▪ IOP Publishing, Journal of Neural Engineering, (2004- present).</li> <li>▪ BioMed Central, Journal of NeuroEngineering and Rehabilitation, (2004- present).</li> <li>▪ IEEE, IEEE Transactions on Neural Systems and Rehabilitation Engineering, (1994-present)</li> </ul> |
| <b>Date of Last Major Revision</b> | 3 June 2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Date of Last Minor Revision</b> | 20 August 2025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |