# Subject Description Form

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| **Subject Code** | BME31114 |
| **Subject Title** | **Biomedical Instrumentation and Sensors** |
| **Credit Value** | 3 |
| **Level** | 3 |
| **Prerequisite** | BME31121 Fundamentals of Biomedical Instrumentation II |
| **Objectives** | This subject aims to provide students with fundamental concepts of biomedical instrumentation and to develop students' ability to analyze the signals and solve problems. It also aims to explain the principles of and ways in which to build the instrumentation, including different kinds of sensors. |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to:<br>a. Describe and explain the principles of various biomedical devices and sensors, appreciate their advantages and limitations for BME investigation;<br>b. Describe and design the instrumentation for amplifying the bioelectrical signals, and to conduct experimental investigations on living systems;<br>c. Demonstrate an ability to use appropriately and safely the techniques, sensors, and selected modern engineering tools necessary (such as LabVIEW and MATLAB) for bioengineering practice and in experimental investigation.<br>d. Apply analytical skills for the interpretation of experimental data. |
| **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)<br>▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach, Practice and Measure)<br>▪ 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. (Teach and Practice)<br>▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach, Practice and Measure)<br>▪ 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. (Practice and Measure)<br>▪ Programme Outcome 9: Demonstrate an ability to function in multi-disciplinary teams. (Practice)<br>▪ Programme Outcome 11: Demonstrate an ability to communicate |

<table>
<tr><td></td><td>effectively and advise clients, professional colleagues, and other members of the community. (Practice)</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Handle various types of equipment used in health care; principles of the design of amplifier for measuring bioelectrical signals; various biomedical devices; design building block for the bioinstrumentation device; and related safety issues.<br><br>Handle the measurements of force transducer, blood flow, displacement, temperature, respiratory equipment; therapeutic and prosthetic devices.</td></tr>
<tr><td>Teaching and Learning Methodology</td><td>Students will learn in lectures the principles of various components used in different biomedical instrumentation and sensors. Students will write a report on how to solve a practical healthcare problem using latest technologies in bioinstrumentation and sensors. Students will learn additional example problems in laboratory sessions to facilitate students learning. Students will also practice real examples of bioinstrumentation and sensors in laboratory.</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></td><td></td><td></td><td></td></tr>
<tr><td>Practical examination</td><td>20%</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Lab reports</td><td>20%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Lab preparation and performance</td><td>20%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Quiz</td><td>40%</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>
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<br>Note: To pass this subject, students must obtain grade D or above in every tasks listed in the table above.<br><br>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:<br><br>Continuous assessment during lab sessions ensures that the student can acquire the needed skills to conduct experimental investigation. Lab reports are used to assess the student's ability to analyze and report experimental findings. To ensure each individual student has acquired the required technical skills, a lab skill test and quiz are arranged at the end of the learning sessions.</td></tr>
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| **Student Study Effort Expected** | Class contact: | |
| | ▪ Lectures | 26 Hrs. |
| | ▪ Labs & Practical | 13 Hrs. |
| | Other student study effort: | |
| | ▪ Self-study | 59 Hrs. |
| | ▪ Lab preparation and report writing | 28 Hrs. |
| | Total student study effort | 126 Hrs. |
| **Reading List and References** | ▪ Webster JG (Editor). Medical Instrumentation Application and Design, 4th/3rd ed., John Wiley & Sons,2010/1998.<br>▪ Webster JG (Editor), Bioinstrumentation, John Wiley & Sons, 2004.<br>▪ Christe BL. Introduction to Biomedical Instrumentation: The Technology of Patient Care, Cambridge University Press, 2009.<br>▪ Chatterjee S. Biomedical Instrumentation Systems, Delmar Cengage Learning, 2010.<br>▪ Carr JJ and Brown JM. Introduction to Biomedical Equipment Technology, 4th ed., Prentice Hall, 2001.<br>▪ Akay M (Editor), Wiley Encyclopedia of Biomedical Engineering, Wiley, 2006.<br>▪ Harsanyi G. Sensors in Biomedical Applications: Fundamentals, Technology and Applications, Technomic Publishing Co., 2000. | |
| **Date of Last Major Revision** | 10 April 2018 | |
| **Date of Last Minor Revision** | 14 September 2018 | |