Subject Description Form

Subject Code	BME21111
Subject Title	**Biomedical Engineering Research and Design Studies I**
Credit Value	3
Level	2
Prerequisite	Nil
Objectives	▪ To develop engineering design skills. ▪ To develop communication skills. ▪ To cultivate an innovative attitude. ▪ To develop teamwork skills in design. ▪ To have knowledge of contemporary issues related to Biomedical Engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Plan engineering design work including budget, resources, milestones, deliverables, and timeline; b. Present and communicate design processes and deliverables through design proposal writing and final report; c. Demonstrate understanding of the importance and process of research in health sciences; d. Perform literature search, critique, and review; and write a detailed and critical account of current knowledge of a selected topic; e. Correctly acknowledge sources of information and demonstrate ability to avoid plagiarism; f. Estimate errors and reliability in quantitative measurements; g. Demonstrate understanding of different statistical tests for data analysis and discuss the rationale for choosing which test to use for a given purpose or dataset; h. Demonstrate understanding of ethical issues and principles in health sciences research.
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) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach)

	▪ 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) ▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Teach and Practice) ▪ 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. (Teach) ▪ 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. (Teach and Practice) ▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach) ▪ 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 and Practice) ▪ Programme Outcome 9: Demonstrate an ability to function in multi- disciplinary teams. (Practice) ▪ Programme Outcome 10: Demonstrate an understanding of professional and ethical responsibility. (Teach) ▪ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues, and other members of the community. (Teach and Practice) ▪ Programme Outcome 12: Demonstrate an ability to recognize the need for, and to engage in life-long learning. (Teach and Practice) ▪ Programme Outcome 13: Demonstrate an understanding of contemporary issues. (Teach and Practice) ▪ Programme Outcome 14: Demonstrate an understanding of entrepreneurship and leadership. (Practice)
Subject Synopsis/ Indicative Syllabus	▪ Engineering design process including identification and formulation of BME design problems; explore and handle technical manuals of various types of equipment used in biomedical engineering; block diagrams for bioinstrumentation design; formulate flowcharts for software engineering; handle modern engineering tools for prototyping and design improvement. ▪ Research process including formulation of research problems; research in support of evidence-based health care; literature search and critique; research designs including experimental and non-experimental designs; research ethics including the use of human/animal subjects, health and safety issues; scientific writing including writing a literature review, research proposal, research report,

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<tr><td></td><td>citation of references, and plagiarism; principles of measurements; sampling; organization and presentation of data; descriptive statistics; samples and populations; measure of central tendency and dispersion; normal distribution; testing hypotheses (differences in means); analysis of variance; non-parametric analysis; correlation and linear regression; sample size calculation; reliability and validity.</td></tr>
<tr><td>Teaching and Learning Methodology</td><td>There will be lectures and tutorials dealing with engineering tools, research design, research methodology, and research proposal writing in order to prepare them for their group project. Students will be divided into groups and work together to carry out design group projects. Students will be divided into teams to propose, implement, evaluate, refine, document, and orally present a design solution for a biomedical engineering related challenge. Students will be tested by quiz, home assignments, project proposals, final report, and oral presentations.</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>f</td><td>g</td><td>h</td></tr>
<tr><td>Quiz</td><td>15%</td><td></td><td></td><td></td><td></td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Assignments</td><td>30%</td><td></td><td></td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Project</td><td>55%</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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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Students should work as a team and will be assessed through design proposal writing, assignments, quizzes, final report, and oral presentation.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<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>63 Hrs.</td></tr>
<tr><td>▪ Assignments and report</td><td>40 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>168 Hrs.</td></tr>
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Reading List and References	▪ King PH and Fries RC, *Design of Biomedical Devices and Systems*, CRC Press, 2009. ▪ Dieter G, *Engineering Design: A Materials and Processing Approach*, 3rd ed., McGraw-Hill, 2000. ▪ Otto K and Wood K, *Product Design*, Prentice Hall, 2001. ▪ Fries RC, *Handbook of Medical Device Design*, Marcel Dekker, 2001. ▪ Sanders MM and McCormick EJ, *Human Factors in Engineering and Design*, 7th ed., McGraw-Hill, 1993. ▪ Salvendy G, *Handbook of Human Factors and Ergonomics*, 3rd ed., John Wiley & Sons, 2006. ▪ Portney LG and Watkins MP, *Foundations of Clinical Research: Applications to Practice*, 3rd ed., Pearson/Prentice Hall, 2009. ▪ Polgar S and Thomas SA, *Introduction to Research in the Health Sciences*, 5th ed., Elsevier, 2008. ▪ Norman GR and Streiner DL, *Biostatistics: The Bare Essentials*, 3rd ed., B. C. Decker, 2008. ▪ Beauchamp TL and Childress JF, *Principles of Biomedical Ethics*, 6th ed., Oxford University Press, 2009. ▪ Day RA and Gastel B, *How to Write and Publish a Scientific Paper*, 6th ed., Greenwood Press, 2006. ▪ Motulsky H, *Intuitive Biostatistics*, Oxford University Press, 1995. ▪ Wong KL, *Methods in Research and Development of Biomedical Devices*, World Scientific, 2013.
Date of Last Major Revision	14 July 2014
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