Subject Description Form

Subject Code	BME41118
Subject Title	**Capstone Project**
Credit Value	6
Level	4
Prerequisite	BME31147 Biomedical Engineering Innovation for the Community
Objectives	This is a subject on independent critical studies. It will provide an opportunity for each student to carry out an independent project on a topic relevant to Biomedical Engineering. The process will demand each student to integrate a number of different subject matters to which he/she has been previously exposed in the programme. Students should have formulated a meaningful research question in Year 3 and, in Year 4, be ready to gain personal experience in attempting to find some appropriate answers to their own questions, given a definite amount of time and resources.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the importance and principles of research inbiomedical disciplines as well as related ethical issues; b. Perform literature search, critique, review, and write a detailedand critical account of current knowledge of a selected topic;and correctly acknowledge sources of information and avoidplagiarism; c. Integrate the subjects learned and plan engineeringdesign work including budget, resources,milestones, deliverables, and timeline; d. Reflect the ability to apply the knowledge learned before tothe independent study; e. Understand the principles of statistics and performappropriate statistical analysis of data gathered during theprogress of the project; f. Write a report to present and discuss the results to the team ofproject supervisors and to their own fellow students; g. Deliver an oral presentation of the project and to provide appropriate answers to the questions.

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. (Practice and Measure) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Practice and Measure) ▪ 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) ▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Practice and Measure) ▪ 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) ▪ 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) ▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Practice and Measure) ▪ 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) ▪ Programme Outcome 10: Demonstrate an understanding of professional and ethical responsibility. (Practice and Measure) ▪ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues and other members of the community. (Practice and Measure) ▪ Programme Outcome 12: Demonstrate an ability to recognize theneed for, and to engage in life-long learning. (Practice and Measure) ▪ Programme Outcome 13: Demonstrate an understanding of contemporary issues. (Practice and Measure)
Subject Synopsis / Indicative Syllabus	The project can be a topic either on design or on research. Possible project areas include: ▪ Bioinstrumentation ▪ Biomaterials ▪ Biomechanics ▪ Prosthetics and Orthotics ▪ Rehabilitation Engineering / Assistive Technology

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- Other Biomedical Engineering relevant topics

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<tr><td>Teaching and Learning Methodology</td><td>

- Lectures – Principles in general research methodology, statistics and proposal writing will be taught
- Tutorial & Independent Project Study – Student can work on a single project or team up with other students to form a group. Each student in the group will be working on a related project area but with different objective(s) / foci. Each student will be guided by a project supervisor who would meet with the student on a weekly basis. The project supervisor will monitor the progress of the student, point out relevant references and resources to the student, and if necessary, assist the student to focus and keep him/her on track. The methods that each student may employ to complete his/her project would of course vary from project to project. It could be empirical data collection, involving physical experiments or interviews with some forms of questionnaires. It could also be some form of theoretical analysis or design some clinical evaluation devices and even construction of prototypes.

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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="7">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></tr>
<tr><td>1. Proposal</td><td>10%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Written proposal / report</td><td>45%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>3. Oral presentation</td><td>45%</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="5"></td><td></td><td></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The students will be assessed on their general understanding of the subject matter and the background literature, the clarity of their objectives, the appropriateness of the methodology, the validity of the data collected, and the relevance of the conclusions to their data; or for a design project, the innovativeness, practicality as well as the cost-effectiveness of the design. Assessments will also be made on the process of project execution (interim and final) in both the written reports and the oral presentations.

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<tr><td>Student Study Effort Expected</td><td>

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<tr><td>Class contact:</td><td></td></tr>
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- Lecture

</td><td>13 Hrs.</td></tr>
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- Tutorial

</td><td>26 Hrs.</td></tr>
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- Data collection and data analysis

</td><td>117 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
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	▪ Literature review and report writing	78 Hrs.
	Total student study effort	234 Hrs.
Reading List and References	▪ King PH and Fries RC, *Design of Biomedical Devices and Systems*, CRC Press, 4th ed., 2019. ▪ Fries RC, *Handbook of Medical Device Design*, Boca Raton, FL: CRC Press; 2019. ▪ Salvendy G, *Handbook of Human Factors and Ergonomics*, 4th ed., John Wiley & Sons, 2012. ▪ Portney LG and Watkins MP, *Foundations of Clinical Research: Applications to Practice*, 3rd ed., Pearson/Prentice Hall, 2015. ▪ Polgar S and Thomas SA, *Introduction to Research in the Health Sciences*, 7th ed., Elsevier, 2020. ▪ Norman GR and Streiner DL, *Biostatistics: The Bare Essentials*, 4th ed., B. C. Decker, 2014. ▪ Beauchamp TL and Childress JF, *Principles of Biomedical Ethics*, 8th ed., Oxford University Press, 2019. ▪ Day RA and Gastel B, *How to Write and Publish a Scientific Paper*, 8th ed., Greenwood Press, 2016. ▪ Motulsky H, *Intuitive biostatistics: a nonmathematical guide to statistical thinking*, 4th ed., New York: Oxford University Press, 2018. ▪ Wong KL, *Methods in Research and Development of Biomedical Devices*, World Scientific, 2013. ▪ Journal papers from the BME discipline.	
Date of Last Major Revision	5 August 2022	
Date of Last Minor Revision	11 January 2023	