NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

# COURSE CONTENT

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| **Academic Year** | 2024/2025 | **Semester** | 1 & 2 |
| **Course Coordinator** | Asst Prof. Ling Tong | | |
| **Course Code** | BG4801 | | |
| **Course Title** | Final Year Project | | |
| **Pre-requisites** | Year 4 status | | |
| **No of AUs** | 8 | | |
| **Contact Hours** | Practicals: 288 hrs | | |
| **Proposal Date** | *8/11/2019* | | |

## Course Aims

The purpose of final year projects is to provide you an opportunity to apply the knowledge you have learnt, your intellectual abilities and practical skills to solving real, or close to real life bioengineering problems. These problems may take the form of an investigation or the development of engineering hardware, software or both. The objectives of the project are:

1. To offer you opportunities to demonstrate their competence in laboratory work.
2. To provide various lab platforms for integrating the knowledge gained in various subjects of the degree course.
3. To allow the exercise of the undergraduates' personal qualities such as maturity, initiative and creativity.
4. To apply communication skills, both oral and written, to communicate results, concepts and ideas.
5. To solve problems of a non-routine nature

## Intended Learning Outcomes (ILO)

Throughout this one-year project, you are expected, with guidance from their supervisors, to perform experiments and obtain data yourself. Literature review, which provides you with a broader perspective of the work you are engaged in, is an essential part of the project. The projects are also organized with a view to develop your ability to communicate, both verbally and in writing. The verbal skill is developed through constant meetings and discussions with supervisors and assessed via an oral presentation towards the end of the projects. The writing skill is developed through report writing. These reports form the major part of the final assessment. Throughout the FYP exercise, you are trained, when necessary, how to use hardware, software and IT effectively in order for a successful completion of the project. You also have to learn to how to optimize the outcomes under various constraints. Your progress is continuously monitored throughout the project duration. It is through these rigorous approaches and procedures that it is ensured that in end of the exercise, you are able to:

1. plan and implement an investigative or developmental project given general objectives and guidelines
2. use some laboratory / workshop equipment proficiently to process and characterize materials
3. analyze data to produce useful information and to draw conclusions by systematic deduction
4. work and study independently on bioengineering projects
5. communicate results, concepts, analyses and ideas in both written and oral forms

## Course Content

N/A

## Assessment (includes both continuous and summative assessment)

| Component | Course LO Tested | Related Programme LO or Graduate Attributes | Weighting | Team /Individual | Assessment rubrics |
|---|---|---|---|---|---|
| Continuous Assessment* | 1, 2, 3, 4, 5 | | 100% | Individual | |
| a) Supervisor | 1, 2, 3, 4, 5 | EAB SLO* a, b, c, d, e, f, g, h, i, j, l | 30% | Individual | Refer to Appendix 1 |
| b) Panel* for reports | 3, 5 | EAB SLO* a, b, j, l, j | 30% | Individual | Refer to Appendix 2 |
| c) Moderators for reports and posters | 3, 4, 5 | EAB SLO* a, b, j, l, j | 40% | Individual | Refer to Appendix 2, 3 |
| Total | | | 100% | | |

*The FYP panel will consist of at least three faculty members.

## Mapping of Course ILOs to EAB Graduate Attributes

| Course Intended Learning Outcomes | Cat | EAB's 12 Graduate Attributes* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (i) | (j) | (k) | (l) |
| | Core | ● | ● | ● | ● | ● | ◐ | ◐ | ◐ | ● | ● | | š |
| plan and implement an investigative or developmental project given general objectives and guidelines | | | | | | | | | | a, b, c, d, f, g, l | | | |
| use some laboratory / workshop equipment proficiently to process and characterize materials | | | | | | | | | | d, e, i | | | |
| analyze data to produce useful information and to draw conclusions by systematic deduction | | | | | | | | | | a, b, c, d, h | | | |
| work and study independently on bioengineering projects | | | | | | | | | | a, c, h, i | | | |
| communicate results, concepts, analyses and ideas in both written and oral forms | | | | | | | | | | a, b, j, l | | | |

Legend:
- ● Fully consistent (contributes to more than 75% of Intended Learning Outcomes)
- ◐ Partially consistent (contributes to about 50% of Intended Learning Outcomes)
- š Weakly consistent (contributes to about 25% of Intended Learning Outcomes)
- Blank Not related to Student Learning Outcomes

## Formative feedback

Formative feedback will be given verbally and/or in writing to you over the 2 semesters.

## Learning and Teaching approach

| Approach | How does this approach support students in achieving the learning outcomes? |
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| Introduction of Project | You will need to understand the relevant background of the problem, and the motivation of the project. |

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| Literature Review | You need to read up on the related subjects and review what has been achieved critically. The process enables you to work out a suitable scope of the project and be able to support all the decisions taken during the work. |
| Methodology | This requires you to analyse all factors in the problem and formulate a workable method or approach for the solution, noting dependency of constraints. |
| Result Analysis and Discussion | You will develop the skills to present the results, obtained from simulation/experiments, in a professional way before students can interpret and discuss the results and draw conclusions. |
| Conclusion and Recommendation of Future Work | This requires you to review the value of the work completed and the limitations. You will need a higher-level critical thinking to recommend meaningful future work. |

**Reading and References**

1) John M. Swales & Christine B. Feak, Academic Writing for Graduate Students, 3rd Edition Essential Tasks and Skills

**Course Policies and Student Responsibilities**

The intent of this course is to give you experience as an independent researcher, where you will propose experiments to achieve research goals, and mostly solve issues that arise.

All BIE students are to carry out their Final Year Projects under the supervision of a CCEB faculty, in their laboratory (https://www.ntu.edu.sg/cceb/about-us/faculty-and-staff/bioengineering https://www.ntu.edu.sg/cceb/about-us/faculty-and-staff/chemical-engineering)

Students may complete their FYP outside of CCEB (within Singapore)

- with an external supervisor and a CCEB supervisor, with prior approval by school
- via FYP-URECA programme

*Details can be found in the FYP handbook circulated by the Undergraduate Office, prior to FYP registration.*

Lab safety is crucial for the smooth running of your research. You need to maintain high standards in ethical research approaches.

**Academic Integrity**

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

**Course Instructors**

| Instructor | Office Location | Phone | Email |
|---|---|---|---|
| Ling Tong | N1.3-B3-13 | 6316 8879 | tong.ling@ntu.edu.sg |

**Planned Weekly Schedule**

| Week | Topic | Course LO | Readings/ Activities |
|---|---|---|---|
| 1 | Project briefing | 1-2 | Varies depending upon selected field of research: chosen based on your research with guidance and supervision of your professor. |
| 2~7 | Project planning | 1-3 | |
| 5~25 | Project execution | 1-4 | |
| 13 | Interim report and assessment | 3-5 | |
| 23 | Final report | 3-5 | |
| 26 | Oral presentation and final assessment | 5 | |

## Appendix 1: Assessment Criteria for Supervisor

| Criteria | Does Not Meet Expectation (<40%) | Below Expectation (40% to 49%) | Meet Expectation (50%-79%) | Exceed Expectation (>80%) |
|---|---|---|---|---|
| **Project Plan/ strategy (includes scientific ability, independence)** | No project schedule provided | Project activities were poorly identified and not arranged practically in a project schedule with timeline | Project activities were identified but some were not arranged practically in a project schedule with timeline | Project activities were clearly identified and arranged practically in a project schedule with timeline |
| | Problem, aim and objectives were not identified and presented | Problem not clearly identified/inaccurate and explanation is too brief , aim and objectives were vague and not addressing research problem | Problem was identified and addressed in a satisfactory manner, aim and objectives were stated and presented the research problem in a satisfactory manner | Problem was clearly addressed, aim and objectives were clearly stated and strongly related to research problem |
| **General initiative (includes attendance, participation)** | The student did not understand the project and did not show any self-initiative at all | The student did not understand some parts of the project and did not show self-initiative in handling and planning of the tasks for the project | The student understood most parts of the project and showed some self-initiative in handling and planning of the tasks for the project | The student understood the project well and showed self-initiative in handling and planning of the tasks for the project |
| | The student did not demonstrate any form of commitment in the work (e.g never meet deadline, less than 2 discussion meetings with supervisor per semester, etc) | The student was not committed and did not perform most tasks in the project (e.g seldom met deadline, only 3-5 discussion meetings with supervisor per semester) | The student was committed and performed the tasks in the project in a satisfactory manner (e.g usually met deadline, 6-9 discussion meetings with supervisor per semester) | The student was very committed and diligent in performing the tasks in the project (e.g consistently met deadline, more than 10 discussion meetings with supervisor per semester) |
| **Ability to extend ideas and expand on** | The student was partially able to follow existing protocols. | The student was mostly able to follow existing protocols. | The student was fully able to follow existing protocols. | The student was fully able to follow existing protocols |

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| **suggestion (includes ability to follow protocols)** | The work was entirely adapted for previous works | Most work was adapted from previous works, did not demonstrate creativity and critical thinking | Some work was adapted from previous work and/or demonstrated creativity and critical thinking in a satisfactory manner | The concept of the work is original/ novel and/or demonstrated creativity and critical thinking. |
| **Sense of responsibility in making decisions** | The student couldn't define current constraints in order to choose a correct path. | The student knew some constraints in order to choose a correct path. | The student knew most constraints in order to choose a correct path. | The student was able to figure out all constraints in order to choose a correct path. |
| | The student was stuck in one way of doing things. | The student was trying to look for other's views and ways of thinking, but was stuck in one way of doing things. | The student looked for other's views and ways of thinking, and partially implemented those into the decision. | The student was fully open to other's views and ways of thinking rather than being stuck in one way of doing things. |
| | The student didn't understand the realistic outcomes to which different approaches will lead. | The student partially understood realistic outcomes to which different approaches will lead. | The student mostly understood realistic outcomes to which different approaches will lead. | The student fully understood the realistic outcomes to which different approaches will lead. |

## Appendix 2: Assessment Criteria for Final Report

| Criteria | Unsatisfactory: <40% | Borderline: 40% to 49% | Satisfactory: 50% to 69% | Very good: 70% to 89% | Exemplary: >90% |
|---|---|---|---|---|---|
| **Title page** | Absent | Evidence of one | Evidence of two | Evidence of three | Title, your name, Submission date, neatly finished with no error |
| **Abstract** | Absent | Incomplete or unfocused | States the paper's purpose | Clearly states the paper's purpose | Clearly and concisely states the paper's purpose within the word limit |
| **Introduction** | Absent | There is no clear introduction or main topic and the structure of the paper is missing | The introduction states the main topic but doesn't adequately preview the structure of the paper | The introduction states the main topic and previews the structure of the paper | The introduction is engaging, states the main topic and previews the structure of the paper |
| **Body** | Absent | Each paragraph fails to develop the main idea | Each paragraph lacks supporting detail sentences | Each paragraph has sufficient detail sentences that develop main idea | Each paragraph has thoughtful supporting detail sentences that develop main idea |
| **Organization-structural development of the idea** | NA | No evidence of structure or organization | Logical organization, but organization of ideas not fully developed | Paragraph development present but not perfected | Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs |
| **Conclusion** | Absent | Incomplete and/or unfocused | The conclusion doesn't adequately restate the thesis | The conclusion restates the thesis | The conclusion is engaging, clearly stating a future direction of the main topic |
| **Mechanics** | NA | Numerous and distracting errors in punctuation, capitalization and spelling | Many errors in punctuation, capitalization and spelling | Almost no errors in punctuation, capitalization and spelling | No errors in punctuation, capitalization and spelling |
| **Citation (Figures, tables)** | NA | Absent | Few cited works, both text and visual, are done in the correct format | Some cited works, both text and visual, are done in the correct format. | All cited works, both text and visual, are done in the correct format with no errors |

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| | | | | Inconsistencies evident | |
| **Bibliography** | Absent | Done in the correct format with many errors. Includes 3 major references | Done in the correct format with some errors. Includes 4 major references | Done in the correct format with few errors. Includes 5 major references | Done in the correct format with no errors. Includes more than 5 major references |

## Appendix 3: Assessment Criteria for Poster Presentation

| Criteria | Does Not Meet Expectation (<40%) | Below Expectation (40% to 49%) | Meet Expectation (50%-79%) | Exceed Expectation (>80%) |
|---|---|---|---|---|
| **Presentation skills** | Presentation does not sufficiently present the topic. | Presentation describes the topic. | Presentation describes the topic. | Presentation thoroughly and concisely presents the topic. |
| | Lack of data to support the positions made / presented data irrelevant to topic. | Poster inadequately used, or figures unable to support the presented position. | Use of poster or additional props emphasises the importance of the topic, with appropriate supporting facts. | Use of poster or additional props greatly emphasises the importance of the topic, with appropriate supporting facts. |
| **Visual Presentation** | Not very visually appealing; cluttered; colors and patterns hinder readability | Somewhat cluttered; colors and patterns detract from readability | Overall visually appealing; not cluttered; colors and patterns support readability | Overall visually appealing; not cluttered; colors and patterns enhance readability |
| | Font sizes/ variations inconsistent/ distracting | Font sizes/variations somewhat inconsistent/distracting | Adequate use of font sizes/ variations to facilitate the organization and readability | Uses font sizes/ variations which facilitate the organization and readability |
| **Content** | Graphics (e.g., tables, figures, etc.) do not enhance the text. | Graphics (e.g., tables, figures, etc.) adequately enhance the text. | Graphics (e.g. tables, figures, etc.) enhance the text. | Graphics (e.g., tables, figures, etc.) are engaging and enhance the text. |
| | Content arrangement is somewhat confusing and does not adequately assist the viewer in understanding | Content arrangement is somewhat confusing and does not adequately assist the viewer in understanding | Content is arranged so that the viewer can understand order without narration | Content is clearly arranged so that the viewer can understand order without narration |

| | | | | |
|---|---|---|---|---|
| | order without narration | order without narration | | |
| **Documentation of Sources** | Does not cite sources. | Cites some data obtained from other sources. Citation style is either inconsistent or incorrect. | Cites most data obtained from other sources. "Nature" citation style is mostly accurate | Cites all data obtained from other sources. "Nature" citation style is mostly accurate |
| **Q&A** | Doesn't not handle questions | Some questions are managed | Most questions are sufficiently managed | Most questions are well managed |

**Appendix 2: The EAB (Engineering Accreditation Board) Accreditation SLOs (Student Learning Outcomes)**

a) **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems
b) **Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
d) **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
f) **The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change