Nanyang Technological University
Division of Chemistry and Biological Chemistry

Course Title	**Honours Project 1**		
Course Code	**CM4080**		
Offered	Study Year 4, Sem 1 | Study Year 4, Sem 2		
Course Coordinator	So Cheuk Wai (Assoc Prof)	cwSo@ntu.edu.sg	6513 2730
Pre-requisites	CM3061 and CM3062 or by permission		
Mutually exclusive	CM4071, CM4072, CM4074, CM4075, CM4076, CM4077, CM4078, CM4079, CM4081, CM4900		
AU	10		
Contact hours	Final Year Project: 50		
Approved for delivery from	AY 2020/21 semester 1		
Last revised	24 Sep 2020, 09:29		

Course Aims

This 13-week research-based Final Year Project programme is offered as an optional course for all Chemistry and Biological Chemistry undergraduate students in their final year. This is a 10-AU course.

The purpose of this Final Year Project programme is to enable the application of knowledge and skills you have learned in the university in an authentic research environment. This is such that you can gain relevant exposures and develop research experiences and skills that will facilitate your career decision and future transition into your selected vocation. It allows you to develop research competencies that will enhance your employability and lifelong learning capabilities to support your career and life endeavours and your readiness for the future of work. The Final Year Project programme provides an opportunity to apply and integrate the knowledge you have gained through various subjects in your degree programme, and to demonstrate practical research skills through solving real life problems in related field.

Intended Learning Outcomes

Upon successfully completing this course, you should be able to:

1. Apply knowledge and skills relevantly and appropriately in the research laboratory. [Apply fundamental chemistry knowledge, logical reasoning, chemical laboratory and/or computational skills to analyse and solve problems in a research project]
2. Identify your own competency gaps at the research laboratory.
3. Evaluate and develop personal learning and development pathways towards bridging competency gaps identified in point (2) above. [Identify technical skills needed to solve problems in a research project]
4. Develop and apply strategies to solve problems effectively (involves critical thinking and creativity, generating questions, resourcing, application and reiteration). [To formulate research question, methodically develop approaches to tackle problems using scientific approach, collect, analyse data to make rigorous and objective deductions.]
5. Evaluate resources and develop insights to make informed judgements and recommendations. [Exhibit awareness of relevant knowledge through literature review and critically evaluate sources of scientific/non-scientific information.]

6. Discuss and Appraise significance, impact results and future plan of the research project.
7. Reflect on the culture at the research laboratory.
8. Reflect on personal and professional development needs within the research laboratory and set strategic goals for advancing along an intended career path.
9. Apply time and task management strategies effectively. [Spend adequate time on the project to ensure rigour and quality]
10. Apply effective written and oral communication skills in professional settings when communicating and connecting with research supervisor and colleagues. [Communicate (in writing and speaking) scientific and non-scientific ideas effectively to professional scientists and to the general public]
11. Assimilate into the work environment (people, team, hierarchy) and function effectively. [Communicate effectively with team members when working in a group and contribute as a valued team member when working in a group]
12. Tolerate ambiguity and handle anxiety.
13. Contribute proactively to the research laboratory.
14. Demonstrate responsibility, integrity and professionalism in the fulfilment of all research requirements. [Readily pick up new skills, particularly technology related ones, to tackle new problems.]
15. Demonstrate the persistence to learn, overcome and improve.
16. Use tools that enable and facilitate effective project/work/assignment undertaken at the research laboratory.

Course Content

In this Final Year Project programme, you (as a student) will experience independent supervised research work in a selected field of study. You will be supervised by the faculty from the Division of Chemistry and Biological Chemistry to achieve the intended learning outcomes listed above. The specific content is dependent on the selection field of study.

Assessment

Component	Course ILOs tested	SPMS-CBC Graduate Attributes tested	Weighting	Team / Individual	Assessment Rubrics
Continuous Assessment					
Final Year Project					
Performance (CBC Faculty Supervisor)	1, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15	**1.** a, b, c **2.** a, b **3.** a, b **4.** a, b **5.** a, b, c	28	individual	See Appendix for rubric
Oral Presentation (CBC Faculty)	1, 2, 3, 4, 5, 10, 11, 16	**1.** a, b, c **2.** a, b **3.** a, b **4.** a, b **5.** a, b, c	36	individual	See Appendix for rubric
Written Report (CBC Faculty)	1, 2, 3, 4, 5, 10, 11, 16	**1.** a, b, c **2.** a, b **3.** a, b **4.** a, b **5.** a, b, c	36	individual	See Appendix for rubric
Total			**100%**		

These are the relevant SPMS-CBC Graduate Attributes.

1. Competence

a. Be well-versed in the foundational and advanced concepts of chemical science

b. Evaluate chemistry-related information critically and independently

c. Use complex reasoning to solve emergent chemical problems

2. Creativity

a. Synthesize and integrate multiple ideas across the curriculum

b. Propose innovative solutions to emergent chemistry-related problems based on their training in chemistry

3. Communication

a. Demonstrate clarity of thought, independent thinking, and sound scientific analysis and reasoning through written and oral reports to audiences with varying technical backgrounds

b. Effectively engage other professional chemists in collaborative endeavours

4. Character

a. Act in responsible ways

b. Uphold the high ethical standards that the society expects of professional chemists

5. Civic-mindedness

a. Be aware of the impact of chemistry on society

b. Apply chemistry to benefit mankind

c. Uphold the best chemical safety practices

Formative Feedback

Continuous feedback on progress and performance, along with the strength and weakness of personal and professional development toward the culture of research laboratory (ILO 7 and 8), can be expected from your supervisor.

Learning and Teaching Approach

Final Year Project (50 hours)	The Final Year Project programme is an experiential research programme done in a professional setting. You will be placed in a research laboratory and will undertake work assignments and research projects, where you learn to be responsible, independent, self-disciplined and self-motivated. You are expected to become better at managing your time, resources and emotions in this independent supervised research work. You would also acquire critical and logical thinking skills, and creative problem solving skills. You would gain confidence in your work and themselves, and develop fine oral and written communication skills. The CBC Faculty Supervisor will be the key person working with and interacting with you on a day-to-day basis.

Reading and References

Reading materials are dependent on the selected field of study and specific to each project. Faculty Supervisor will recommend reading materials, and you will conduct a comprehensive literature review as well.

Course Policies and Student Responsibilities

Your Faculty Supervisor for the Final Year Project programme will be allocated to you after the placement process is completed. The Final Year Project programme is managed and administered by your school's course coordinator.

The Final Year Project programme concerns research work in a professional setting. As with good academic work, good research work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of research and 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. Refer to this link for details: http://www.ntu.edu.sg/ai/Pages/shared-values-honour-code.aspx

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
So Cheuk Wai (Assoc Prof)	SPMS-CBC-06-17	6513 2730	cwSo@ntu.edu.sg

Planned Schedule

Topic	Course ILO	Readings/ Activities
In this Final Year Project programme, you (as a student) will experience independent supervised research work in a selected field of study. You will be supervised by the faculty from the Division of Chemistry and Biological Chemistry to achieve the intended learning outcomes listed above. The specific content is dependent on the selection field of study.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	The weekly schedule will be discussed and agreed on between you and your Faculty Supervisors.

Appendix 1: Assessment Rubrics

Rubric for Final Year Project: Performance (CBC Faculty Supervisor) (28%)

Criteria for the assessment of student performance in the research laboratory:

ILOs	Focus	Criteria
1,6	Knowledge and Skills [Scientific approach to problem solving]	Able to apply knowledge and skills (whether prior or newly learned) appropriately in the research laboratory and/or projects/tasks. [Able to put together analytical, laboratory and/or computational skills to solve quantitative problems.]
4	Problem-solving	Able to solve problems systematically and effectively.

5	Resourcefulness [Awareness of relevant knowledge, skills needed]	Able to source for relevant information to make informed judgement, decisions and/or recommendations. [Able to handle information critically and propose systematic approaches to handling problems.]
9	Time and Task Management	Able to plan, organise, manage and complete assignments effectively and in a timely manner.
10	Written and Oral Communication	Able to communicate effectively and appropriately in writing and verbally
11	Team Work	Able to function effectively with other colleagues in the research laboratory.
12	Adaptability	Able to function effectively under ambiguity and/or change.
13	Initiative	Able to remain consistently pro-active towards contributing to the work and/or research laboratory.
14	Responsibility	Consistently demonstrates commitment, responsibility, integrity, professionalism and ethical behaviour at the research laboratory.
15	Persistence to Learn and Improve [Particularly technological tools.]	Consistently demonstrates persistence and grit to overcome challenges, to learn and improve continuously at the research laboratory.
16	Fluency with Tools	Able to use tools, whether software or hardware tools, (and learn new ones where necessary) proficiently to accomplish tasks and assignments.

Rubric for Final Year Project: Oral Presentation (CBC Faculty) (36%)

Your **slideshow** presentation in a professional setting will be assessed at the end of your Final Year Project programme by the Faculty Examiners using the following criteria:

Category	**Scoring Criteria**
Organization	The presentation is appropriate for the topic and audience.
	Information is presented in a logical sequence.
	Presentation appropriately cites references used.
Content	Introduction is captures attention; the problem is well defined and establishes a framework for the rest of the presentation.
	Technical terms are well-defined in language appropriate for the target audience.
	Presentation contains accurate information.
	Material included is relevant to the overall message/purpose.
	Appropriate amount of material is prepared and points made reflect well their relative importance.
	There is an obvious conclusion summarizing the presentation.
Presentation	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).
	Speaker uses a clear and audible voice.
	Delivery is poised, controlled, and smooth.
	Good language skills and pronunciation.
	Visual aids are well prepared, informative, effective, and not distracting.

	Length of presentation is within the assigned time limits.
	Content is presented in a clear and concise way.
Q & A	Able to answer questions in a way that reflects a good understanding of the project.

Rubric for Final Year Project: Written Report (CBC Faculty) (36%)

Your written report in a professional setting will be assessed at the end of your Final Year Project programme by the Faculty Supervisor and Examiners using the following criteria:

Category	**Scoring Criteria**
Organization	Content is organized and presented in a clear, coherent and logical sequence.
	Correct use of referencing throughout, formatted in the correct scientific specification.
	Proper literature review was done and references were properly cited.
	Appropriate use of figures, tables and graphs to communicate data and information.
Content	Clear description of project's objectives, motivations, interpretation and explanation of research approach, process and findings.
	Technical terms are well-defined in language appropriate for the subject area.
	Report contains accurate information.
	Material included is relevant to the overall message/purpose.
	Appropriate amount of material is prepared, and points made reflect well their relative importance.
	Shows clear understanding of key concepts/theories, and interpretation of wider context issues.
	Strong links made between problem statement, claims made, tools used and results.
	Discussion and conclusions tie well with the problem statement and results obtained.
Difficulty / Originality	Is the project a new initiative, or is it similar to a previous or ongoing project?
	Does the project involve very sophisticated theory or does it require heavy and challenging code development?
	Has the student developed original models or o riginal results, novel and creative application of existing techniques/discovery of new principles?
	Clarity and distinct originality of thought, with clear link to major topics from research materials, as well as important linked topics.
Effort	The project involves substantial work and intellectual demand befitting of a university final year project.

Appendix 2: Intended Affective Outcomes

As a result of this course, it is expected you will develop the following "big picture" attributes:

Competency: Graduates should be well-versed in the foundational and advanced concepts of chemical science, be able to evaluate chemistry-related information critically and independently, and be able to use complex reasoning to solve emergent chemical problems.

Creativity: Graduates should be able to synthesize and integrate multiple ideas across the curriculum, and propose innovative solutions to emergent chemistry-related problems based on their training in chemistry.

Communication: Graduates should be able to demonstrate clarity of thought, independent thinking, and sound scientific analysis and reasoning through written and oral reports to audiences with varying technical backgrounds. They should also be able to effectively engage other professional chemists in collaborative endeavours.

Character: Graduates should be able to act in responsible ways and uphold the high ethical standards that the society expects of professional chemists.

Civic-mindedness: Graduates should be aware of the impact of chemistry on society, and how chemistry can be applied to benefit mankind. They should also be aware of and uphold the best chemical safety practices.