BIOM9420

Clinical Laboratory Science

Term Two // 2021

Graduate School of Biomedical Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Kang Liang	kang.liang@unsw.edu.au	Email confirmation prior face-to-face consultation	SEB E8	

School Contact Information

Student Services can be contacted via unsw.to/webforms.

Course Details

Credit Points 6

Summary of the Course

BIOM9420 outlines the fundamental science that underlies clinical laboratory tests. Students will explore how Biomedical Engineers have used these fundamentals to develop diagnostic devices for the laboratory and clinical environment. There is no assumed knowledge for this course. This course compliments other BIOM courses and certain thesis topics.

Course Aims

This course outlines the technologies, tests and operation of a variety of clinical laboratory testing systems (biochemistry, haematology and immunology) and how they apply to the diagnosis of diseases in a particular organ system. The students will also be exposed to the underlying principles involved in the measurement of certain physiological parameters from some of the complex organ systems including the urinary, pulmonary, cardiac and musculoskeletal systems. An important component of the course is to enable the student to think about how diagnostics can be generated to help the clinician diagnose disease by having an understanding of what is being measured and how to design a, build and test a diagnostic based on the fundamental science. Two activities in this course provide the student with this learning opportunity. One is an independent lab report that is a demonstration of how enzymes work and how by measuring their activity, we can obtain an indication of health or disease and then how we can use enzymes to generate reliable diagnostics; for example, diagnosing diabetes by measuring glucose in urine. The second activity is a group literature review on the different technologies used to measure glucose in body fluids for diabetes which includes a written review and a group video presentation.

OBJECTIVES

The objectives of this course align with program outcome attributes and assessment tasks as follows:

Course objectives	Assessment task	Program outcome attributes
Understanding of the underlying physiology of a variety of organ systems and the scientific principles used to design diagnostics of health and disease of that system.	Quiz Enzyme Activity Assessment Literature Review Report Group Presentation Final Exam	An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context. Capacity for analytical and critical thinking and for creative problem solving. Ability to engage independent and reflective learning. Information literacy. Skills for effective communication.
Develop problem solving skills to facilitate engineering solutions in the biomedical field.	Tutorial questions, Quiz Literature Review	Capacity for analytical and critical thinking and for creative problem solving. Skills for effective communication.

	Report Final Exam	
Teamwork and an understanding of an individual's roles in a team to produce a group literature review and video presentation.	Literature Review Report Group Presentation	Skills for collaborative and multi-disciplinary work.
Critical thinking and independent literature searching skills. Communication skills in scientific presentation and writing.	Literature Review Report	Skills for effective communication.

Course Learning Outcomes

1. Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
2. Apply problem-solving skills to a variety of case studies from the medical field
3. Demonstrate teamwork skills and reflect on individual strengths through collaborating with others in a team environment
4. Produce a scientific report that includes a literature review relevant to a clinical laboratory device or diagnostic tool

Teaching Strategies

A combination of recorded lectures played in a synchronous manner in a Teams live Event with the lecturer and course co-ordinators present to answer questions and help students engage; face-to-face and online Teams-facilitated tutorials that contain working groups of 5 – 6 students. Online modules in Moodle are used in this course to provide background and support the lecture material by providing slide shows, some with Q&A, and videos. This will expose students to a range of teaching modes encompassing a range of teaching styles, including passive and active participation.

Private Study	• Review lecture material • Work through online modules in Moodle • Work through activities and do set assignments • Reflect on class problems and assignments • Download and work through materials from Moodle • Keep up with notices and obtain marks via Moodle
Online Lectures	• Fundamental content is explained slide-by-slide • Hear announcements on course changes
Face-to-face and online Teams-facilitated tutorials (workshops, problem solving sessions, group	• Group conversation to provide context • Guidance provided on tasks required for assignments

activities)	• Be involved in the discussion - ask and answer questions using video
Assessments (quiz, enzyme activity assessment, group literature review report, group presentation and final examination)	• Demonstrate your knowledge, critical thought and problem solving skills • Demonstrate higher understanding of the fundamental science and its relevance to biomedical engineering

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Course Participation	10%	Not Applicable	1, 2, 3, 4
Mid-term Quiz	10%	At the end of tutorial on Week 7	1, 2
Enzyme Activity Assessment – “marble” practical	10%	Friday week 5	1, 2, 3
Literature Review	20%	Friday week 10	1, 2, 3, 4
Group video presentation	15%	Video due Monday Week 10	1, 2, 3
Final Exam (Online Final Quiz and Time-limited, open-book Exam)	35%	TBA	1, 2

Assessment Details

Assessment 1: Course Participation

Start date: Not Applicable

Details:

Course Participation (10%) *is to enable an assessment of the student’s engagement in the course tutorials and will be provided by the tutorial demonstrator.*

Assessment 2: Mid-term Quiz

Start date: Not Applicable

Details:

Mid term Quiz (10%) *is designed to reflect on the learning of the first few weeks and to encourage review of the course content up to the mid-term flexible week. It will also prepare students for the types of questions and how these are run on Moodle in preparation for the final exam.*

Assessment 3: Enzyme Activity Assessment – “marble” practical

Start date: Not Applicable

Details:

Enzyme Activity Assessment – "marble" practical (10%) *is a group and individual task to teach students how to graph, analyse and present experimental data using MATLAB using the standard scientific format for experimental reports. Requires successful completion of the on-ramp MATLAB course with completion certificate appended to the report together with the risk assessment supplied on Moodle.*

Assessment 4: Literature Review

Start date: Not Applicable

Details:

Literature Review (20%) *is completed as a group task designed to provide an opportunity for team-work and independent literature searching on different complementary topic areas relevant to the measurement of glucose in a clinical setting.*

Assessment 5: Group video presentation

Start date: Not Applicable

Details:

Group video presentation (15%) *is a group report designed to consolidate learning in the assessments and tutorials and bring it all together in a team environment to produce a cohesive and balanced short video presentation.*

Assessment 6: Final Exam (Online Final Quiz and Time-limited, open-book Exam)

Start date: Not Applicable

Details: Final Exam is composed of two parts: Part 1: Online Final Quiz similar to Mid-term Quiz (10%). Part 2: Time-limited, open-book Exam (25%)

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
O Week: 25 May - 28 May		
Week 1: 31 May - 4 June	Lecture	**Diagnostic Engineering 1** **Course introduction** *Biomedical Engineering and Diagnostics*
	Online Activity	1. MATLAB introduction – Onramp course 2. Background to group major report - Glucose Biosensors
	Tutorial	**Workshop 1** – Complete MATLAB Onramp course
	Assessment	Append MATLAB Course Completion Certificate to the Enzyme activity report in week 5
Week 2: 7 June - 11 June	Lecture	**Diagnostic Engineering 2** *Blood Diagnostics* *Antibody-based Diagnostics*
	Online Activity	1. Ovulation test strip design 2. Cell & DNA background for week 3 3. Cell cycle video 4. Exercise on cell cycle 5. Review Enzyme Kinetics Activity Risk Assessment & Quiz 6. Introduction to diagnostics - enzymes
	Tutorial	**Workshop 2** – Group discussion on sources of scientific literature. Compare reviews, journals & scientific reports Write an abstract
Week 3: 14 June - 18 June	Lecture	**Diagnostic Engineering 3** *DNA, Genetics & PCR Diagnostics*
	Online Activity	1. PCR virtual lab 2. Chromosomal disorders

		3. Single gene Inheritance 4. Genetic testing
	Tutorial	**Workshop 3** – Enzyme Kinetics Activity - Moodle “Marble” practical
Week 4: 21 June - 25 June	Lecture	**Diagnostic Engineering 4** *Kidney Function*
	Online Activity	1. Urinary system 2. Glomerular filtration 3. Diagnosis of type 2 diabetes
	Tutorial	**Workshop 4** – Group discussion on how to write a literature review
Week 5: 28 June - 2 July	Lecture	**Diagnostic Engineering 5** *Cardiac Monitoring*
	Online Activity	1. Worked example - cardiac output 2. Worked example - dilution 3. Worked example - ECG
	Tutorial	**Workshop 5** – Cardiac Monitoring exercise
	Assessment	**Enzyme Kinetics Activity Report** Due Friday week 5
Week 7: 12 July - 16 July	Lecture	**Diagnostic Engineering 7** *Lung Function*
	Online Activity	1. 3D lung model 2. Spirometry and Peak Flow Test
	Tutorial	Quiz 1 – on-line (open book)
	Assessment	**Quiz 1** Due at end of tutorial time
Week 8: 19 July - 23 July	Lecture	**Diagnostic Engineering 8** *Imaging Modalities*
	Online Activity	1. Imaging tutorial questions
	Tutorial	**Workshop 8** – Group discussion & presentation on imaging tutorial question

		Group video and major report Q&A
Week 9: 26 July - 30 July	Lecture	**Diagnostic Engineering 9** *Clinical Gait Analysis*
	Online Activity	1. Gait Video
	Tutorial	**Workshop 9** – Group discussion and report back on gait function exercise
Week 10: 2 August - 6 August	Lecture	**Review of content**
	Tutorial	**Group video presentations**
	Assessment	**Major Group Report** Due Friday week 10

Resources

Recommended Resources

Course Evaluation and Development

Submission of Assessment Tasks

Laboratory reports and major assignments will require a Non Plagiarism Declaration Cover Sheet.

Late submissions will be penalised 10% of the mark for each calendar day late. If you foresee a problem in meeting the nominated submission date please contact the Course Convenor to make an appointment to discuss your situation as soon as possible.

Academic Honesty and Plagiarism

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise will have their names entered on a plagiarism register and will be liable to disciplinary action, including exclusion from enrolment.

It is expected that all students must at all times submit their own work for assessment. Submitting the work or ideas of someone else without clearly acknowledging the source of borrowed material or ideas is plagiarism.

All assessments which you hand in must have a Non Plagiarism Declaration Cover Sheet. This is for both individual and group work. Attach it to your assignment before submitting it to the Course Coordinator or at the School Office.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:
https://student.unsw.edu.au/plagiarism

Academic Information

COURSE EVALUATION AND DEVELOPMENT
Student feedback has helped to shape and develop this course, including feedback obtained from on-line evaluations as part of UNSW's as part of UNSW's myExperience process. You are highly encouraged to complete such an on-line evaluation toward the end of Term. Feedback and suggestions provided will be important in improving the course for future students.

DATES TO NOTE
Refer to MyUNSW for Important Dates, available at:
https://my.unsw.edu.au/student/resources/KeyDates.html

ACADEMIC ADVICE
For information about:

- Notes on assessments and plagiarism,
- Special Considerations,
- School Student Ethics Officer, and
- BESS

refer to the School website available at
http://www.engineering.unsw.edu.au/biomedical-engineering/

Supplementary Examinations:

Supplementary Examinations for Term 2 2021 will be held on Monday 6th September – Friday 10th September (inclusive) should you be required to sit one.

Image Credit

Synergies in Sound 2016

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.