UNSW Course Outline

BIOM9420 Clinical Laboratory Science - 2024

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General Course Information

Course Code : BIOM9420
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : Graduate School of Biomedical Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate, Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

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. You 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 you 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, build and test a diagnostic based on the fundamental science. Two activities in this course provide you with this learning opportunity. One is an independent lab report that is a demonstration of how enzymes work and by measuring their activity, you can obtain an indication of health or disease and then how you 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.

Course Aims

The course is integral to understanding the fundamental science behind clinical laboratory tests, marking its importance in bridging theoretical knowledge with practical diagnostic applications. Situated within the broader context of the Biomedical Engineering program, it complements other courses and certain thesis topics, ensuring a comprehensive education pathway for students. Its aims are to explore the intersection of biomedical engineering with clinical diagnostics, emphasising the development of diagnostic devices for both laboratory and clinical settings. Through engaging with technologies, tests, and operations of various clinical laboratory testing systems, such as biochemistry, haematology, and immunology, students are prepared to contribute significantly to the diagnosis of diseases across various organ systems. The intention behind BIOM9420 is to cultivate an understanding of the principles involved in measuring physiological parameters and designing diagnostics, fostering problem-solving skills, teamwork, critical thinking, and communication abilities among students.

The course aims to:

- Provide an appreciation 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.
- Develop problem solving skills to facilitate engineering solutions in the biomedical field
- Develop teamwork and an understanding of an individual’s roles in a team to produce a group literature review and video presentation.
- Develop critical thinking and independent literature searching skills.
- Improve communication skills in scientific presentation and writing.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
CLO2 : Apply problem-solving skills to a variety of case studies in the medical field
CLO3 : Demonstrate teamwork skills and reflect upon their own strengths and weaknesses while collaborating with others in a team environment
CLO4 : Produce a scientific report that includes a literature review relevant to a clinical laboratory device or diagnostic tool

Course Learning Outcomes	Assessment Item
CLO1 : Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems	• Practical Activities • Mid-Term Quiz • Final Exam • Group Project
CLO2 : Apply problem-solving skills to a variety of case studies in the medical field	• Practical Activities • Mid-Term Quiz • Final Exam • Group Project
CLO3 : Demonstrate teamwork skills and reflect upon their own strengths and weaknesses while collaborating with others in a team environment	• Practical Activities • Group Project
CLO4 : Produce a scientific report that includes a literature review relevant to a clinical laboratory device or diagnostic tool	• Practical Activities • Group Project

Learning and Teaching Technologies

Moodle - Learning Management System

Other Professional Outcomes

EXPECTED LEARNING OUTCOMES

On completion of this course, the student should:

- Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
- Apply problem-solving skills to a variety of case studies from the medical field.
- Demonstrate teamwork skills and reflect on individual strengths through collaborating with others in a team environment.

- Produce a scientific report and a literature review relevant to a clinical laboratory device or diagnostic.

These learning outcomes will be achieved through maximal participation in area of the structured teaching strategies provided in class time (on-line lectures and activities) as well as student-centred and self-directed learning (private study and completion of assessment tasks)

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Practical Activities Assessment Format: Individual	20%	
Mid-Term Quiz Assessment Format: Individual	15%	
Final Exam Assessment Format: Individual	40%	
Group Project Assessment Format: Group	25%	

Assessment Details

Practical Activities

Assessment Overview

There will be two practical activities:

1. The Enzyme Activity (10%)
2. Rapid Antigen Test Design (10%)

The Enzyme Activity practical (10%) is a group activity and individual report to teach you how to graph, analyse and present experimental data using MATLAB using the standard scientific format for experimental reports. This assessment requires successful completion of the on-ramp MATLAB course with completion certificate appended to the report together with the risk assessment supplied on Moodle.

The Rapid antigen test strip design report (10%) is a group activity and individual report designed to enhance students understanding in relevant topics and apply the knowledge in timely clinical and diagnostic settings.

Course Learning Outcomes

- CLO1 : Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
- CLO2 : Apply problem-solving skills to a variety of case studies in the medical field
- CLO3 : Demonstrate teamwork skills and reflect upon their own strengths and weaknesses while collaborating with others in a team environment
- CLO4 : Produce a scientific report that includes a literature review relevant to a clinical laboratory device or diagnostic tool

Mid-Term Quiz

Assessment Overview

Mid-term Quiz (15%) 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.

Course Learning Outcomes

- CLO1 : Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
- CLO2 : Apply problem-solving skills to a variety of case studies in the medical field

Final Exam

Assessment Overview

A mark of at least 50% in the final examination is required before the class work is included in the final mark. The final exam will be composed of two sections and completed at home in a time-limited, open-book environment. The first section will be an on-line Moodle Quiz containing randomised sets of multiple-choice, short answer questions. The second section will contain 4-7 medium-long answer questions, which can be scanned and returned via Turn-it-in for marking. Students who feel that they are not performing in the quizzes and assignments are recommended to discuss progress with the Course Convenor. The final exam will be held during the formal exam period. Note: The Course Convenor reserves the right to adjust the final scores by scaling as discussed and approved by the Head of School.

Course Learning Outcomes

- CLO1 : Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
- CLO2 : Apply problem-solving skills to a variety of case studies in the medical field

Group Project

Assessment Overview

The Group Project consists of a Literature Review (15%) and a Group Presentation (10%).

The Literature Review (15%) 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.

Group video presentation (10%) is a group submission 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.

Course Learning Outcomes

- CLO1 : Identify the underlying scientific and engineering principles of a variety of clinical testing and/or diagnostic systems
- CLO2 : Apply problem-solving skills to a variety of case studies in the medical field
- CLO3 : Demonstrate teamwork skills and reflect upon their own strengths and weaknesses while collaborating with others in a team environment
- CLO4 : Produce a scientific report that includes a literature review relevant to a clinical laboratory device or diagnostic tool

General Assessment Information

Assignments must be submitted via Moodle by the designated date and time. The Report must contain a Non Plagiarism Declaration Cover Sheet

Late submissions will be penalised 5% of the mark for each calendar day late, capped at five days (120 hours), after which a student cannot submit and assessment, and no permitted variation. If you foresee a problem in meeting the nominated submission date, please contact the Course Convenor to discuss your situation as soon as possible.

Assessment marks will be available on Moodle as soon as possible after marking, which will normally be within 2 weeks of submission.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Diagnostic Engineering 1 Course introduction
	Online Activity	1. MATLAB introduction – Onramp course 2. Background to group major report - Biosensors
	Tutorial	Workshop 1 – Complete MATLAB Onramp course
Week 2 : 3 June - 9 June	Lecture	Diagnostic Engineering 2 Blood Diagnostics Antibody-based Diagnostics
	Online Activity	• Cell & DNA background for week 3 • Cell cycle video • Exercise on cell cycle • Review Enzyme Kinetics Activity Risk Assessment & Quiz • Introduction to diagnostics - enzymes
	Tutorial	Workshop 2 – Group discussion on sources of scientific literature. Compare reviews, journals & scientific reports Write an abstract
Week 3 : 10 June - 16 June	Lecture	Diagnostic Engineering 3 DNA, Genetics & PCR Diagnostics
	Online Activity	• PCR virtual lab • Chromosomal disorders • Single gene Inheritance • Genetic testing
	Tutorial	Workshop 3 – Enzyme Kinetics Activity - Moodle “Marble” practical
Week 4 : 17 June - 23 June	Lecture	Diagnostic Engineering 4 Cardiac Monitoring
	Online Activity	• Worked example - cardiac output • Worked example - dilution • Worked example - ECG
	Tutorial	Workshop 4 – Cardiac Monitoring exercise
Week 5 : 24 June - 30 June	Lecture	Diagnostic Engineering 5 Kidney Function
	Online Activity	• Urinary system • Glomerular filtration • Diagnosis of type 2 diabetes
	Tutorial	Workshop 5 – Rapid antigen test strip design Group discussion on how to write a literature review
Week 7 : 8 July - 14 July	Lecture	Diagnostic Engineering 7 Clinical Gait Analysis (online module, no F2F lecture)
	Online Activity	• Gait video practice
	Tutorial	Quiz 1 – on-line (open book) Gait function exercise
Week 8 : 15 July - 21 July	Lecture	Diagnostic Engineering 8 Imaging Modalities
	Online Activity	• Imaging tutorial questions
	Tutorial	Workshop 8 – Group discussion & presentation on imaging tutorial question Group video and major report Q&A
Week 9 : 22 July - 28 July	Lecture	Diagnostic Engineering 9 Lung Function
	Online Activity	• 3D lung model • Spirometry and Peak Flow Test
	Tutorial	Workshop 9 –

		Self-directed work on group presentation and major report
Week 10 : 29 July - 4 August	Tutorial	Group video presentations

Attendance Requirements

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

General Schedule Information

Course Resources

Recommended Resources

RELEVANT RESOURCES – Useful Books

- Introduction to Biomedical Engineering (3rd edition) by John Enderle and Joseph Bronzino Publisher: Elsevier/Academic Press, 2011, ISBN: 9780123749796

Digital available - https://unswbookshop.vitalsource.com/products/-v9780080961217

- An Introduction to Clinical Laboratory Science by Connie Mahon, Linda A. Smith and Cheryl Burns. Publisher: Elsevier Health Sciences, 1988, ISBN10 0721649904

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 myExperience process.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Kang Liang		SEB E8		Email confirmation prior face-to-face consultation	No	Yes
Lecturer	Jared Campbell					No	No
	Tianruo Guo					No	No
	Mohit Shivdasani					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit / Submit rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

Note: This course outline sets out the description of classes at the date the Course Outline is

published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/ Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School Contact Information

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