COURSE DETAILS

Units of Credit

On-line hours  Wednesday 11:00 – 16:00
Lecture - Teams  Wednesday 11:00 – 12:00
Tutorial / e-Lab  Teams channels 12:00 – 14:00 or 14:00 – 16:00

Course Coordinators

Dr Kang Liang
Email: kang.liang@unsw.edu.au
Office: Room 320, Science and Engineering Building
Phone: (02) 9385 4337

Prof John Whitelock
Email: j.whitelock@unsw.edu.au
Office: Room 510 Level 5, Samuels Building
Phone: (02) 9385 3948

Guest Lecturers

Dr Michael Stevens – Diagnostic Engineering
email: michael.stevens@unsw.edu.au
office: Lower ground, Samuels Building
phone: (02) 9385 3911

Dr Mohit Naresh Shivdasani
email: m.shivdasani@unsw.edu.au
office: Room 515B, Level 5, Samuels Building
phone: (02) 9385 0561

Demonstrators

Ha Na Kim
Amy Jiang
Kieran Lau
Zijun Zhang
Habib Joukhdar
INFORMATION ABOUT THE COURSE

This course outlines the fundamental science that underlies clinical laboratory tests. Students are 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.

HANDBOOK 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. 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, 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:

<table>
<thead>
<tr>
<th>Course objectives</th>
<th>Assessment task</th>
<th>Program outcome attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding of the underlying physiology of a variety of organ systems and the</td>
<td>Quiz, Enzyme Activity Assessment,</td>
<td>An in-depth engagement with the relevant disciplinary knowledge in</td>
</tr>
<tr>
<td>scientific principles used to design diagnostics of health and disease of that</td>
<td>Literature Review Report, Group</td>
<td>its interdisciplinary context.</td>
</tr>
<tr>
<td>system.</td>
<td>Presentation, Final Exam</td>
<td>Capacity for analytical and critical thinking and for creative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>problem solving.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ability to engage independent and reflective learning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information literacy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skills for effective communication.</td>
</tr>
<tr>
<td>Develop problem solving skills to facilitate engineering solutions in the</td>
<td>Tutorial questions, Quiz, Literature</td>
<td>Capacity for analytical and critical thinking and for creative</td>
</tr>
<tr>
<td>biomedical field.</td>
<td>Review Report, Final Exam</td>
<td>problem solving.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skills for effective communication.</td>
</tr>
<tr>
<td>Teamwork and an understanding of an individual’s roles in a team to produce a</td>
<td>Literature Review Report, Group</td>
<td>Skills for collaborative and multi-disciplinary work.</td>
</tr>
<tr>
<td>group literature review and video presentation.</td>
<td>Presentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical thinking and independent literature searching skills.</td>
<td>Literature Review Report</td>
<td>Skills for effective communication.</td>
</tr>
<tr>
<td>Communication skills in scientific presentation and writing.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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; 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  

| Tutorials facilitated through Teams (workshops, problem solving sessions, group activities) | • Group conversation to provide context  
| • Guidance provided on tasks required for assignments  
| • 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  

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

The assessment tasks for BIOM9420 Clinical Laboratory Science have been designed to measure your achievement of the learning outcomes.

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Examination is worth 35% of the final mark. A mark of at least 40% 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 3 – 4 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 Participation (10%)** is to enable an assessment of the student’s engagement in the course tutorials and will be provided by the tutor.

**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.

**Enzyme Activity Assessment – “marble” practical (10%)** is an 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.

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

**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.

**Final Exam (Online Final Quiz and Time-limited, open-book Exam) (35%)**

The marks assigned and dates of submission of each assessment task are set out below. Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are provided in detail on Moodle.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Due</th>
<th>Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Participation</td>
<td>On-going</td>
<td>10%</td>
</tr>
<tr>
<td>Enzyme Activity Risk Assessment</td>
<td>Friday, week 5</td>
<td></td>
</tr>
<tr>
<td>Enzyme Activity Assessment (With satisfactory on enzyme activity risk assessment and MATLAB Onramp Course)</td>
<td>Friday, week 5</td>
<td>10%</td>
</tr>
<tr>
<td>Quiz (open book)</td>
<td>Tutorial on-line in Teams and Moodle, week 7</td>
<td>10%</td>
</tr>
<tr>
<td>Group video presentations (5 mins max)</td>
<td>Tutorial on-line in Teams Week 10</td>
<td>15%</td>
</tr>
<tr>
<td>Major Group Report</td>
<td>Submit via Moodle, Friday, week 10</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>TBC</td>
<td>35%</td>
</tr>
</tbody>
</table>

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 10% of the mark for each calendar day late, or part thereof. 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.
# COURSE PROGRAM

A table of lecture and activity class topics for each week.

## SEMESTER 2, 2020

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Live Event Lecture</th>
<th>Online Resources</th>
<th>Live Event Tutorial</th>
<th>Assessment Due</th>
</tr>
</thead>
</table>
| 1    | 1 Jun | Diagnostic Engineering 1  
Course introduction  
Biomedical Engineering and Diagnostics | 1. MATLAB introduction – Onramp course  
2. Background to group major report - Glucose Biosensors | Workshop 1 – Complete MATLAB Onramp course |  
|      |       |                    |                  |                     | Append MATLAB Course Completion Certificate to the Enzyme activity report in week 5 |
| 2    | 8 Jun | Diagnostic Engineering 2  
Blood Diagnostics  
Antibody-based Diagnostics | 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 | Workshop 2 – Group discussion on sources of scientific literature. Compare reviews, journals & scientific reports. Write an abstract |  
| 3    | 15 Jun| Diagnostic Engineering 3  
DNA, Genetics & PCR Diagnostics | 1. PCR virtual lab  
2. Chromosomal disorders  
3. Single gene Inheritance  
4. Genetic testing | Workshop 3 – Enzyme Kinetics Activity - Moodle “Marble” practical |  
| 4    | 22 Jun| Diagnostic Engineering 4  
Kidney Function | 1. Urinary system  
2. Glomerular filtration  
3. Diagnosis of type 2 diabetes | Workshop 4 – Group discussion on how to write a literature review |  
| 5    | 20 Jul| Diagnostic Engineering 5  
Cardiac Monitoring | 1. Worked example - cardiac output  
2. Worked example - dilution  
3. Worked example - ECG | Workshop 5 – Cardiac Monitoring exercise | Enzyme Kinetics Activity Report  
Due Friday week 5 |
| 6    |       | Flexible Week | Group video and major report Q&A |  
| 7    | 13 Jul| Diagnostic Engineering 7 | 1. 3D lung model | Quiz 1 – on-line (open book) | Quiz 1  
Due at end of tutorial time |
Lung Function

2. Spirometry and Peak Flow Test

<table>
<thead>
<tr>
<th>No.</th>
<th>Date</th>
<th>Topic</th>
<th>Workshop Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>27 Jul</td>
<td>Diagnostic Engineering 8 Imaging Modalities</td>
<td>Workshop 8 – Group discussion &amp; presentation on imaging tutorial question Group video and major report Q&amp;A</td>
</tr>
<tr>
<td>9</td>
<td>29 Jun</td>
<td>Diagnostic Engineering 9 Clinical Gait Analysis</td>
<td>Workshop 9 – Group discussion and report back on gait function exercise</td>
</tr>
<tr>
<td>10</td>
<td>12 Aug</td>
<td>Review of content</td>
<td>Group video presentations Major Group Report Due Friday week 10</td>
</tr>
</tbody>
</table>

RELEVANT RESOURCES – Useful Books
- 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 online evaluations as part of UNSW’s myExperience process. Changes to the course have included revision to the course content by refocusing on the lecture content and balancing this content across the sciences and maths. This course is now designed to run online in distance mode.

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

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.

Assessments must have a Non Plagiarism Declaration Cover Sheet. This is for both individual and group work.

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 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/