Session 2, 2018
BIOM9420 Clinical Laboratory Science

COURSE DETAILS
Units of Credit 6
Contact hours Wednesday 3-6 pm
Lecture ChemSc M18
Tutorial/Laboratory Mathews 101
Mathews 102
Mathews 104
Mathews 227
Mathews 228

Course Coordinators
Dr Fengying Tang
Email: f.tang@unsw.edu.au
Office: LG, Samuels Building
Phone: (02) 9385 3911

Dr Kang Liang
Email: kang.liang@unsw.edu.au
Office: Chemical Science Building room 809
Phone: (02) 9385 4337

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

Lecturers
Dr Lauren Kark
email: lauren.kark@unsw.edu.au
office: Room 515B, Level 5, Samuels Building
phone: (02) 9385 0560

Dr Jelena Rnjak-Kovacina
email: j.rnjak-kovacina@unsw.edu.au
office: Room 507, Samuels Building
phone: (02) 9385 3920

Dr Michael Stevens
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: Lower ground, Samuels Building
phone: (02) 9385 3911

Dr Guozhen Liu
email: guozhen.liu@unsw.edu.au
office: Room 515, Samuels Building
phone: (02) 9385 0714

Demonstrators
Lucy Fu
Amy Jiang
Ha Na Kim

Kieran Lau
Zijun Zhang
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 equipment 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 a particular organ or 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, cardiac and musculoskeletal systems. An important component of the course is two practical sessions. The first focuses on the fundamentals of enzyme biochemistry and how this might be useful in generating a test for a particular disease and the second will build upon this knowledge to design, fabricate and test a diagnostic test strip for glucose.

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 principles of a variety of clinical testing systems</td>
<td>Quizzes Enzyme Activity Assessment Clinical Trial Report Final Exam</td>
<td>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.</td>
</tr>
<tr>
<td>Problem solving skills in the medical field.</td>
<td>Quizzes Clinical Trial Report Final Exam</td>
<td>Capacity for analytical and critical thinking and for creative problem solving. Skills for effective communication.</td>
</tr>
<tr>
<td>Teamwork skills and an understanding of an individual's strengths in a team environment.</td>
<td>Lab report Clinical Trial Report</td>
<td>Skills for collaborative and multi-disciplinary work.</td>
</tr>
<tr>
<td>Tools for independent and curiosity driven learning.</td>
<td>Enzyme Activity Assessment Clinical Trial Report</td>
<td>Information literacy. Capacity for analytical and critical thinking and for creative problem solving. An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context.</td>
</tr>
<tr>
<td>Communication skills in scientific presentation and writing.</td>
<td>Enzyme Activity Assessment Clinical Trial Report</td>
<td>Skills for effective communication.</td>
</tr>
</tbody>
</table>
TEACHING STRATEGIES
A combination of lectures, tutorials, laboratory classes and a site visit are used in this course to expose students to a range of teaching modes. These modes encompass a range of teaching styles, including passive and active participation.

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

<table>
<thead>
<tr>
<th>Private Study</th>
<th>Lectures</th>
<th>Activities (problem solving sessions, laboratory work)</th>
<th>Assessments (quizzes, final examination, major assignment and laboratory report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Review lecture material</td>
<td>• Find out what you must learn</td>
<td>• Hands-on work, to set studies in context</td>
<td>• Demonstrate your knowledge and skills</td>
</tr>
<tr>
<td>• Work through activities and do set assignments</td>
<td>• Follow worked examples</td>
<td>• Be guided by experts</td>
<td>• Demonstrate higher understanding and problem solving</td>
</tr>
<tr>
<td>• Reflect on class problems and assignments</td>
<td>• Hear announcements on course changes</td>
<td>• Practice solving set problems</td>
<td></td>
</tr>
<tr>
<td>• Download and work through materials from Moodle</td>
<td></td>
<td>• Ask questions</td>
<td></td>
</tr>
<tr>
<td>• Keep up with notices and find out marks via Moodle</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXPECTED LEARNING OUTCOMES
By the end of this course students will have gained a theoretical and practical understanding of:

Diagnostic Engineering
• Identify the range of fluids/tissues that can be analysed by clinical tests.
• Understand the requirements of an analytical test and reasons for variance in the results.
• Understand the different components of biosensors
• Understand the different types of biosensors
• Understand the different chemical reactions that allow the detection of glucose in biological fluids.

Clinical Biochemistry (enzyme laboratory, Sensi-GO Clinical Trial)
• Understand how enzymes can be used as diagnostic tools
• Understand how enzymes assist chemical reactions to take place.
• Understand Michaelis-Menten enzymes kinetics and use the equation to solve problems.
• Understand and apply Beers law to problem solving.
• Understand how ATP is generated and utilised in the body.
• Understand aerobic and anaerobic respiration and apply this knowledge to problem solving.

Haematology
• Identify the components of blood and understand their function and how changes in their levels are related to disease.
• Understand how monoclonal antibodies can be used in diagnostic tests.

Genetic Testing
• Understand where genetic information is stored.
• Identify the types of genetic testing and be able to give examples of these.
• Understand how genetic testing is performed.

Renal function
• Understand parameters used to measure kidney function.

Clinical Gait analysis
• Discuss techniques used to assess movement
• Describe the different types of data generated by motion analysis
• Interpret motion analysis data
• Identify the segments and joints involved in walking gait
• Describe the movement of these joints using anatomical terminology
• Identify and describe able-bodied joint kinematic curves
Cardiac monitoring
- Identify the main functions of the circulatory system
- Understand the electrical activity of the heart
- Understand techniques used to diagnose cardiac diseases.

Pulmonary function
- Identify the anatomy of the pulmonary system
- Identify variables that affect pulmonary function tests
- Identify major classes of lung disease, give examples of diseases in each of these categories and understand how these diseases affect pulmonary function tests.
- Understand how pulmonary function test equipment obtains measurements.

Histology
- Identify different cellular organelles
- Identify different tissue types
- Understand how different histology dyes localise different tissue structures.

X-Ray, CT and MRI
- Understand how each imaging technique results in an image of the body and can be used to diagnose disease.
- Identify different types of medical images.

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

ASSESSMENT
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 70% of the Final Mark if class work is included and 100% if class work is not included. The class work is worth 30% of the Final Mark if included. A mark of at least 40% in the final examination is required before the class work is included in the final mark. The formal exam scripts will not be returned. Students who perform poorly in the quizzes and tutorials are recommended to discuss progress with the Course Convener during the semester. Note: The Course Convener reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Quizzes will consist of multiple choice questions and are designed to encourage learning throughout the semester and prepare students for the types of questions in the final exam. These quizzes are available on Moodle.

Enzyme Activity Assessment an individual task to teach students how to graph and analyse experimental data.

The Clinical Trial Protocol is a document prepared during class in groups to prepare for the Clinical Trial. A Clinical Trial Report is a group report designed to consolidate learning in the practical activity as well as independent literature search.

The Final Exam will be a closed book exam with a combination of multiple choice and short answer questions. The final exam will be held during the formal exam period. Materials allowed: University approved calculator.

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.
ASSIGNMENTS

1. Enzyme Activity Risk Assessment Quiz (1% of course assessment) due on: 8 August 2018
2. Quiz 1 (3% of course assessment) due on: 15 August 2018
3. Enzyme Activity Assessment (6% of course assessment) due on: 29 August 2018
4. Quiz 2 (3% of course assessment) due on: 12 September 2018
5. Clinical Trial Protocol (1% of course assessment) due on: 12 September 2018
6. Clinical Trial Risk Assessment Quiz (1% of course assessment) due on: 19 September 2018
7. Quiz 3 (3% of course assessment) due on: 10 October 2018
8. Clinical Trial Report (12% of course assessment) due on: 24 October 2018

Assignments must be submitted via moodle by the designated date and time. The Clinical Trial 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 make an appointment to discuss your situation as soon as possible.

Assessment marks will be available on Moodle as soon as they have been marked, which will usually be within 2 weeks of submission.
COURSE PROGRAM

A table of lecture and activity class topics for each week, indicating the location and name of lecturer involved.

SEMESTER 2, 2018

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Class Time</th>
<th>Moodle module</th>
<th>Assessment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25 July</td>
<td>3pm</td>
<td>Course Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 Aug</td>
<td>3pm</td>
<td>Clinical Trial Workshop I</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Chemical I. Clinical Biochemistry</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>8 Aug</td>
<td>3pm</td>
<td>Chemical II. Haematology (FT)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Enzyme Kinetics Activity (Tutorial Room)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td>Enzyme Risk Assessment Quiz (1%)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>15 Aug</td>
<td>3pm</td>
<td>Chemical III. Renal (KL)</td>
<td>Quiz 1 (3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Problem solving session I (Tutorial Room)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>22 Aug</td>
<td>3pm</td>
<td>Chemical IV. Genetics Testing (JRK)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Problem solving session II (Tutorial Room)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>29 Aug</td>
<td>3pm</td>
<td>Mechanical I. Pulmonary Function (JW)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Problem solving session III (Tutorial Room)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td>Enzyme Activity (6%)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>5 Sept</td>
<td>3pm</td>
<td>Problem solving session IV (Tutorial Room)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Mechanical II. Clinical Gait Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>12 Sept</td>
<td>3pm</td>
<td>Biosensors (GL)</td>
<td>Quiz 2 (3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Clinical Trial Workshop II (Tutorial Rooms)</td>
<td>Clinical Trial Experimental Protocol (1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5pm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>19 Sept</td>
<td>3pm</td>
<td>Clinical Trial (Tutorial Rooms)</td>
<td>Risk Assessment Quiz (1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MID SESSION BREAK

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Class Time</th>
<th>Moodle module</th>
<th>Assessment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3 Oct</td>
<td>3pm</td>
<td>Electrical I. Cardiac Monitoring (MS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Problem solving session V</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>10 Oct</td>
<td>3pm</td>
<td>Imaging, Histology, CT, MRI, and X-ray (Mohit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4pm</td>
<td>Problem solving session VI</td>
<td>Quiz 3(3%)</td>
</tr>
<tr>
<td>12</td>
<td>17 Oct</td>
<td>3pm</td>
<td>Problem solving session VII (Tutorial Rooms)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>24 Oct</td>
<td>3pm</td>
<td></td>
<td>Clinical Trial Report (12%)</td>
</tr>
</tbody>
</table>
RELEVANT RESOURCES
- Introduction to Biomedical Engineering (3rd edition) by John Enderle and Joseph Bronzino
- Additional materials provided on Moodle.
- Recommended Internet sites.

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 and incorporation of additional practical activities. Last year students in the class provided feedback including ‘Very interesting course and well organised’, ‘The activities were engaging, enjoyable, required critical thinking and were well integrated into the course’.

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

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/