INTRODUCTION:

Final year MLS students are required to complete a research project in MLSCI 409 or MLSCI 491. The majority of the project work will be completed in the second term for MLSCI 409 (3-credit) but the project proposal and estimation of supplies and equipment needs (if applicable) must be completed in the first term. Students registered in MLSCI 491 (6-credit) will complete the project proposal and begin work in the first term. The work will be completed in the second term.

GENERAL OBJECTIVES:

The general objectives of the project are:

1. to gain experience in the research process by planning and conducting a technical project. (CSMLS competencies 1.01, 1.02, 1.03, 1.04, 1.05, 1.06, 1.07, 1.08, 1.09, 1.10, 1.11, 1.12, 1.13, 1.14 as required; 2.01, 2.02, 2.03, 2.05, 2.06, 2.07, 2.08, 2.09, 2.10 as required; 3.01, 3.02, 3.04, 3.05, 3.06, 3.07, 3.08, 3.09, 3.10, 3.11, 3.12 as required; 4.01, 4.02, 4.03, 4.04, 4.05, 4.06, 4.07, 4.08, 4.09, 4.10, 4.11, 4.12, 4.13, 4.14, 4.17, 4.18, 4.19, 4.20, 4.21, 4.22 as required; 6.01, 6.02, 6.03, 6.04, 6.05, 6.06, 6.07, 6.08, 6.09, 6.10 as required; 9.03)

2. to develop the ability to use critical thinking in analyzing data and in formulating conclusions based on empirical evidence. (CSMLS competencies 7.01, 7.02, 7.05, 9.04)

3. to develop problem solving skills in dealing with scientific problems. (CSMLS competencies 8.01, 8.02, 8.03, 9.03)

4. to develop the ability to write a scientific paper using a standard format. (CSMLS competencies 9.04, 10.01, 10.02)

5. to present your findings to an audience of peers and others. (CSMLS competencies 10.01, 10.02)

The research project will involve one or more of the following processes:

1. to assess, develop or improve an established or new analytical method or clinical process based on relevant and recent scientific and medical literature. This will involve appropriate data analysis and statistical evaluation. It may also involve a comparative study with a reference method.

2. to apply techniques to the clinical investigation of patients.
PROJECT TOPICS:

Project topics will be assigned in the following manner:

1. upon the initiation of a student, a supervisor may submit a mutually acceptable project topic with the name of the student already assigned.

2. other project topics will be assigned from a list of submitted topics. On Friday, September 2, 2016 at 0900, students will choose a topic from the circulated list. Students should be prepared with six choices. Submit choices to 5-411 ECHA (MLS office).

Students should meet with their supervisors as soon as possible to discuss the project and to obtain a list of initial references. The references obtained from the supervisors should be considered as a starting point to the literature review. Additional reference books and review articles should be identified that contain pertinent information to the topic and project proposal.

PROJECT PROPOSAL:

The project proposal should be typed (double-spaced, size 12 Times new roman font) using one side of each page with 1" margins on all sides. Students will attend a 50-minute seminar covering the guidelines for writing a project proposal. This seminar is scheduled for Friday September 23 at 1200 h. Prior to writing the project proposal, students are encouraged to discuss with their supervisors the purpose of the project.

Other pertinent issues:
- meet with supervisor to talk about project
- view procedures so you understand what you will be doing
- read methods for the laboratory
- plan out blocks of time in which you can accomplish
- if it is reasonable and applicable, do an experimental run prior to writing proposal

NOTE: project proposals include a literature review. The purpose of this is to justify your research project and to demonstrate gaps in the literature that your research will help fill.

Generally you must have a good idea of what you will be doing before you can write a meaningful proposal. A diagram of the study design to help you focus your ideas.

The project proposal is due to the supervisors no later than Friday, October 28, 2016. A 5% per day penalty may be assessed for proposals received after the deadline.

Within one week of completion, students should meet with their supervisors to discuss the project proposal. Supplies if necessary should then be ordered through the supervisors' departments ensuring that they arrive by the first week of January for the three-credit project. Supplies should be available for the students to begin the six-credit project the beginning of November.

INVESTIGATION AND WORKBOOK:

Students in the six-credit project should begin work the beginning of November, and complete in March. Students in the three-credit project should plan to begin the technical work during the first week of January and to complete it during the third week of March. Students are encouraged to work relatively unassisted but should contact their supervisors when problems arise as well as once a week to discuss progress. Students are to arrange a mutually convenient time with their supervisors for these meetings. When problems arise, students are encouraged to think of and perhaps try out a few solutions so that the resolution of the problem can be discussed with their supervisors.
Supervisors are encouraged to assess their students' work critically twice during the project period.

Approximately 70 hours of technical work for three credits and 140 hours for six credits is suggested but will vary depending on the nature of the project. A workbook is required to keep a permanent record of the investigative work. The book should be legible, complete, self-explanatory, and include the following:

- approximate time involved in technical work (excluding non-productive times such as incubation periods)
- reagent preparation procedures and methods used (reference may be made to the project proposal)
- procedural modification (intentional as well as accidental)
- instrument type, model, setting, etc.
- incubation time and temperature
- reagent type, lot number, etc.
- specimen type, identification number, date collected, etc.
- all data (including that which initially seems meaningless)
- comments as to reliability of results, difficulties encountered, interpretation
- for data analysis projects your databook has to capture your work flow – I should be able to pick up your data book and completely replicate the work that you did.
- Meetings with supervisors

SCIENTIFIC PAPER:

To write a scientific paper requires time and effort in organizing and analyzing the data. It is suggested that the Introduction and Materials and Methods sections be drafted well ahead of the Results, Discussion and Conclusion sections. Also, sufficient time should be allowed to write the paper after completion of the technical work, since the paper itself is worth 35% of the course mark.

The scientific paper, reflecting a concise and critical appraisal of the project, should be typed (double-spaced) using one side of each page with 1” margins on all sides. Students will attend a 1-hour seminar covering the guidelines for writing a technical report. The seminar is scheduled for Thursday, March 2, 2017 at 1230 h. The scientific paper and workbook are due to the supervisor no later than Monday, April 3, 2017. A penalty of 5% per day may be assessed for papers received after this date. On Monday April 3, 2017 also submit the paper electronically to Lisa Purdy.

Students must e-mail a SEPARATE copy of the abstract along with the project title to Lisa for inclusion on the student project page.

By Monday, April 17, 2017, the workbook and scientific paper should be returned to Lisa Purdy in order that marks and final grades can be processed in time for convocation.

Students may pick up their project papers from Lisa after the first week of May. Workbooks will be returned to the supervisors unless other arrangements have been made.

PRESENTATION:

Students are required to give a formal 10-15 minute presentation of their project work, as well as attend all presentations. Unexcused absence from the presentations will result in 5% reduction of the final grade per day missed. Project supervisors are invited to attend these presentations which will be scheduled Thursday and Friday April 6 and 7 from 1300 to 1700h.

The project presentation should include the following:

1. the purpose and main objectives of the project
2. a brief outline of the experimental design and methodology
3. the **major** results
4. the **major** conclusions
5. anything interesting or learned while doing the project work

For further guidelines a seminar on scientific presentations will be given on Thursday March 9, 2017 1230-1400h. The project presentation will be graded based on presentation guidelines - see attached.

*All components of the project are compulsory. Students receive a grade of IN - incomplete - if any are omitted and risk receiving an F1.*

**PARTICIPATION:**
The seminars are designed to help you navigate this course. Attendance is mandatory. Any unexcused absence will result in a 5% reduction of the final grade per seminar missed.

**Tips for initial discussion with supervisors:**
- Ask what the expectations are for work hours per week
- Often a student or technologist helps supervise so ask who your direct report is.
- Ask about the work alone policy if you will be there after hours
- Do you need to discuss security and confidentiality of information? Is ethical approval necessary?
- Ask how often they would like you to communicate, and by what route and what should you report on?
- Ask about data books – and what the supervisor would like to see in the book, be specific