ALES 291 / MATH 120

MATHEMATICS FOR THE LIFE SCIENCES

In Winter 2014, MATH 120, *Mathematics for the Life Sciences*, is being offered at Yukon College concurrent with the University of Alberta's ALES 291, *Mathematics for the Life Sciences*, as part of the Northern Environmental and Conservation Sciences, B.Sc. Program. All students registered in MATH 120 or ALES 291 must adhere to requirements outlined in this course syllabus. University of Alberta students must also be aware of, and adhere to, the University's Code of Student Behaviour, referenced in the outline; Yukon College students must be aware of, and adhere to, Yukon College's Academic Regulations, also referenced in the outline.

INSTRUCTOR:	Dr. Tim Topper, Ph.D.
OFFICE HOURS:	You are encouraged to drop by any time. If you want to ensure you will see me you should arrange a meeting ahead of time.
OFFICE LOCATION:	C2211 (Inside the library, southeast corner)
TELEPHONE/E-MAIL:	(867) 668-8775 / ttopper@yukoncollege.yk.ca
DAYS & TIMES:	Tuesdays, Wednesdays & Thursdays 12:00 pm – 1:30 pm, room A2202

COURSE DESCRIPTION:

This course provides a survey of calculus and finite mathematics focussing on the concepts and modelling techniques used in the natural sciences. To this end it covers common families of functions (polynomial, logarithmic and exponential) and their derivatives and integrals, linear programming, simple and conditional probability and Bayes theorem, and network analysis. The topics are illustrated using problems drawn from the natural sciences.

STUDENT LEARNING OUTCOMES AND COMPETENCIES:

Upon successful completion of this course students will be able to do the following:

- Take everyday situations, translate them into mathematical representations (equations, graphs, tables, or network diagrams), manipulate these representations, and interpret the results in terms of the original situation.

- Categorize quantities' variations as being polynomial, exponential, logarithmic or 'other'.
- Find the derivatives and integrals of polynomial, exponential and logarithmic functions and solve problems requiring their application.
- Solve linear programming problems graphically and using the simplex method.
- Apply Bayes theorem.
- Solve a variety of networking problems, e.g. critical path, shortest route, maximal flow, using both graphical and matrix representations.

COURSE FORMAT (3-0-1.5):

Class time will be roughly divided 2:1 between lectures and tutorials.

The course content is covered through lectures and tutorials. <u>Students with a sound mathematical background can expect to spend between one and three hours in preparation and study for every hour spent in class.</u>

COURSE PREREQUISITES AND/OR CO-REQUISITES:

Pre-Calculus 12 or Foundations of Mathematics 12 or MATH 060. For students taking the course as ALES 291, registration in Yukon College/University of Alberta BSc in Environmental and Conservation Sciences degree program is also required.

REQUIRED TEXTBOOKS/MATERIALS:

A variety of online resources will be used in place of a printed textbook. Students will require a scientific calculator, but it must **not** include graphing capabilities.

UNIVERSITY OF ALBERTA ACADEMIC INTEGRITY AND CODE OF STUDENT BEHAVIOUR

Plagiarism and Cheating

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students must be familiar with standards regarding academic honesty and uphold policies of the University. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students at the University of Alberta are subject to the Code of Student Behaviour, as outlined in the 2013/2014 University Calendar. Students should familiarize themselves with the current version of the code and ensure they do not participate in any inappropriate behaviour as defined by it. Key components of the code specific to this course include the following statements:

- Plagiarism: no student shall submit the words, ideas, images or data of another person as the student's own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study.

- Cheating: no student shall represent another's substantial editorial or compositional assistance on an assignment as the student's own work.

The most recent version of the Code of Student Behaviour can be found on line on the University of Alberta web site.

Students should speak with the course instructor about any questions or concerns about the code. Students should be particularly aware of the code as it pertains to internet and library research, use of previous class notes, reclamation plans of former students and interviews or discussions with others.

YUKON COLLEGE ACADEMIC STANDARDS AND REGULATIONS

Yukon College students are expected to be familiar with academic standards and regulations as outlined in Yukon College's Academic Regulations, at
http://www.yukoncollege.yk.ca/downloads/Academic_Regulations_2004.pdf.

Plagiarism

Plagiarism involves representing the words of someone else as your own, without citing the source from which the material is taken. If the words of others are directly quoted or paraphrased, they must be documented according to standard procedures (such as APA, MLA, CSE, etc.). The resubmission of a paper for which you have previously received credit is considered a form of plagiarism. Plagiarism is academic dishonesty, a serious academic offence, and will result in you receiving a mark of zero (F) on the assignment or the course. In certain cases, it can also result in dismissal from the College.

PROFESSIONALISM AND CLASSROOM RULES OF ENGAGEMENT

Students are expected to attend all lectures and labs, be engaged and courteous in all course activities, and to be on time for class. Please do not use cellular phones during class. Laptops are permitted for note taking and in-class work; however, please do not use laptops in class for non-class-related activities. While in computer labs, students are expected to refrain from using the computers to engage in non-class-related activities (e.g. Facebook, etc.).

COURSE REQUIREMENTS/EVALUATION:

Homework

Mathematics can only be learned by doing it. To this end problems will be assigned in most classes and solutions to them will be made available. Students should be certain to do these problems promptly or they risk being unable to understand the material in the next class.

Quizzes (30%)

There will be brief quizzes *most* weeks. Many questions on the quizzes will be drawn from the assigned problems, thus completing the homework should lead to good quiz results. *Missed quizzes cannot be made up*, but the lowest quiz result will be discarded. Quiz results are worth 30% of the final mark in the course.

Assignments (30%)

There will be *weekly* assignments over the course of the term worth 30% of the final mark. *Late assignments are not accepted,* but the lowest assignment mark will be discarded. Where the homework problems are intended to assist the student in *learning* new material and are not marked, the assignments are meant to reinforce and *extend* the student's understanding of material that has already been *learned* (i.e. they're harder).

Final Examination (40%)

A final examination which will cover the entire course, and be worth 40% of the final mark, will be held at the end of the term. The examination date will be announced as soon as it is set by the School of Science.

Students taking the course as ALES 291 must ensure that they are familiar with the University of Alberta's Academic Regulations governing missed and deferred final exams (http://www.registrar.ualberta.ca/calendar/Regulations-and-Information/Academic-Regulation/23.5.html#23.5).

Evaluation

The course grade will be determined as follows:

	Percent
Quizzes	30%
Assignments	30%
Final exam	40%
Total	100%

Assignment of grades

The total numerical score will be converted to a grade on the University of Alberta's letter grading system (for students enrolled in ALES 291) or on Yukon College's letter grading system (for students enrolled in MATH 120).

STUDENTS WITH DISABILITIES OR CHRONIC CONDITIONS:

Reasonable accommodations are available for students with a documented disability or chronic condition. It is the student's responsibility to seek these accommodations. If a student has a disability or chronic condition and may need accommodation to fully participate in this class, he/she should contact the Learning Assistance Centre (LAC) at (867) 668-8785 or lassist@yukoncollege.yk.ca.

EQUIVALENCY/TRANSFERABILITY:

Transfer for credit, but not against other specific courses, is anticipated from the University of Alberta and BC colleges and universities.

TOPIC OUTLINE

Week	Content	Text Sections
1	**Course introduction**. **Linear equations and inequalities**. Solving systems of linear equations and inequalities algebraically, graphically and using matrices.	
2	**Linear programming**. Graphical solution.	
3	The simplex method.	
4	**Families of functions** Polynomial, logarithmic and exponential.	
5	**Derivatives and rates of change** Average rate of change. Instantaneous rate of change. Rules for differentiation: basic, products, quotients.	
6	Chain rule. Applications: Function sketching.	
7	Optimization problems. **Integration** Antidifferentiation	
8	Applications: Volumes of solids Work	
9	**Probability** Simple and conditional probability. Combinatorics.	
10	Bayes' Theorem.	
11	**Graph theory** Diagrammatic representation. Matrix representation. Euler circuits and paths; minimal spanning trees. Hamiltonian circuits and paths; shortest routes. Shortest route algorithm.	
12	Directed graphs. Critical path problems. Graph colouring.	
13	Matrix multiplication applied to graphs. Markov processes.	