

**Basic Information for MAT194F Calculus  
Engineering Science  
2004**

**1. Your Lecturers**

K. Consani  
Department of Mathematics  
Schedule: M 13-14 (MC252); T 11-12 (RS211); R 10-11 (BA1190).

Kyu-Hwan Lee  
Department of Mathematics  
Schedule: M 12-13 (MC254); T 12-13 (RS211); R 9-10 (MC254).

P.C. Stangeby  
Institute for Aerospace Studies  
Phone number: 416 667 7729  
Schedule: T 10-11 (RS211); R 10-11 (RS211); F 11-12 (MC254).

**2. Tutorials**

Wed. 16-18.  
BA3012 BA2139 BA3004 BA2159 BA3008 BAB024 HA410 HA401 WB219  
BA3116 WB342 BA2145

**3. Evaluation**

There will be two Term Tests, one on 13 October, one on 10 November. The first tutorial will occur on Wednesday 15 September, when there will be no Quiz or Test. Starting 22 September, unless there is a Test, there will be a Quiz, see below re material to be covered. There will be 9 Quizzes in total, of which the 6 highest marks will be counted. Thus 3 Quizzes can be skipped entirely, which is to cover conflicts with religious holidays, etc.

On all Quizzes, Term Tests and Final Exams, no calculator or electronic device of any kind is permitted.

Marking scheme:

Term Test #1	15%
Term Test #2	15%

Tutorial Quizzes	20%
Final Examination	50%

#### 4. Text Material

(a) **Textbook**: James Stewart, *Calculus* (5<sup>th</sup> edition) Brooks/Cole, 2003 ISBN 0-534-39339-X.

In the UofT Bookstore, this text comes bundled with "Trigonometry for Calculus", Chapter 7, an excerpt from Stewart's pre-calculus Text ISBN 017612271.

A solution manual for the text is available.

(b) **Supplement**: E.J. Barbeau and P.C. Stangeby, *Some Foundations of Analysis for Engineering Science (MAT194F)*. This is available on the Course website.

#### 5. Course Website

<http://courses.ece.toronto.edu/mat194h1f/> where announcements, assignments, etc. will be found. To register: click on STUDENTS (left side menu) and then click on first time users **CLICK HERE**.

#### 6. Material to Cover for Quizzes

Each Quiz will consist of a few questions taken directly from the Stewart Textbook and/or from the Supplement. These Textbook questions will, in fact, be taken from a subset of the questions at the end of each section in the Text. This subset of questions are indicated below in the Course Outline. The specific material to be covered in each Quiz will be posted on the course website by the start of the weekend preceding the Quiz.

It will be essential for you to know the basics of **trigonometry** for this, as well as for many of the other courses you will take. Some of you will have covered this material already in high school, but some of you will not have. In any event, this material will, for the most part, not be covered directly in this course or in your other first year courses. **You are responsible yourself for making sure that you are on top of this material.** You should set out to do this as early as you can – ideally in the first month of the fall term since **each of the first 3 Quizzes will include one trigonometry question, taken**

**from Appendix D of the Stewart textbook.** You will probably find that the material contained in Appendix D of the Stewart Text, 'Trigonometry', pages A24-A33, is clear enough for you and adequate preparation for the Quizzes. If you feel that you need more extensive coverage of the basics of trigonometry then you will find the "Trigonometry for Calculus", Chapter 7 of Stewart's pre-calculus Text ISBN 017612271, which is bundled with the text, useful.

The Quiz of 22 Sept will include one of the questions from Nos. 1 – 34, pg A32.  
The Quiz of 29 Sept will include one of the questions from Nos. 35 – 64, pgs A32, A33.  
The Quiz of 6 Oct will include one of the questions from Nos. 65 – 90, page A33.

Note that these 3 Quizzes will also include some questions from the material being covered in the lectures.

## 7. Course Outline

In the following:

L = lecture number

T = related section of the Textbook

TP = recommended problems in the Textbook

S = related section of the Supplement

SP = recommended problems in the Supplement.

*Note: The following specifies the material that will be covered in the lectures and the order of coverage. It gives, however, only a rough indication of how the material will be divided between successive lectures.*

**L1** A brief introduction, including: the problem of defining the derivative in a rigorously logical way; problem with  $a/0$ ,  $0/0$ ,  $\infty$ ; basic idea of the limit; the use of  $\delta, \epsilon$  ideas; the difference between  $f(c)$  and  $\lim_{x \rightarrow c} f(x)$ .

T: A preview of calculus, pages 2-9; Sec. 2.1.

TP: pages 69, 70: 3, 5

S: Sec. 1.

**L2, L3, L4** The real number system, including: field and order axioms; absolute value; function; roots; intervals; increasing/decreasing; inequalities; intervals described by inequalities; inequalities involving  $\delta, \epsilon$ ; triangle inequality.

T: Secs. 1.1, 1.2, 1.3, 1.4.

TP: pages 22-24: 16, 19, 21, 27, 31, 35, 40, 52, 55, 59, 64; pages 35-38: 1, 2, 3, 4, 9, 11, 16, 19; pages 45-48: 3, 6, 7, 9, 17, 24, 26, 31, 38, 43, 60; pages 53-55: 2, 9, 26, 31, 34; page 63: 5, 9.

S: Secs. 2.1 to 2.7.

SP: Ex 3, Ex 5d, Ex 7a,b,c,d,e, Ex 8a,b,c Ex 9c, Ex 10a,c, Ex 11 all, Ex 12 all.

**L5, L6** Rigorous definition of the limit; examples using  $\delta, \epsilon$ ; right-hand/left-hand limits; vertical asymptotes; infinite limits.

T: Secs. 2.2, 2.4.

TP: pages 79-82: 5, 9, 13, 15, 19, 25, 38; pages 100-102: 3, 4, 6, 9, 13, 17, 19, 22, 34, 38, 42.

S: Secs. 3.1, 3.2.

SP: Ex 14, Ex 15, Ex 18, Ex 20.

**L7, L8** Limit theorems/laws; continuity; Intermediate Value Theorem.

T: Secs. 2.3, 2.5.

TP: pages 89-91: 1, 2, 5, 7, 10, 15, 26, 35, 43, 45, 48. pages 110-112: 3, 4, 7, 11, 15, 17, 20, 21, 27, 31, 33, 37, 39, 43, 44, 46, 50, 61.

S: Secs. 2.8, 3.3, 3.4, 4.1.

SP: Ex 22, Ex 24, Ex 25, Ex 26, Ex 27.

**L9, L10** Tangents, velocities, rates of change; the derivative; the derivative as a function; differentiability implies continuity; differentiation formulas; rates of change.

T: Secs. 2.6, 3.1, 3.2, 3.3, 3.4.

TP: pages 119-121: 8, 9, 18, 20, 22, 26, 28. pages 132-133: 5, 13, 15, 17, 19, 23, 27, 33, 36. pages 142-145: 1, 4, 19-29, 35, 41, 44. pages 154-157: 1-20, 22, 30-40, 53, 57, 65, 74, 80, 85. pages 166-168: 1, 11, 13, 18, 21, 28, 35.

**L11** Trig functions; chain rule; implicit differentiation; higher derivatives; related rates.

T: Secs. 3.5 to 3.9.

TP: pages 174-175: 10, 19, 23, 33, 37, 46. pages 181-184: 25, 37, 66, 71. pages 188-190: 10, 12, 14, 27, 41, 43, 49, 53. pages 195-197: 1, 2, 3, 11, 29, 37, 39, 51, 55. pages 202-204: 10, 20, 27, 33.

**L12** Applications of differentiation; Extreme Value Theorem; Fermat's Theorem; Maximum/minimum test.

T: Sec. 4.1.

TP: pages 229-232: 3, 13, 21, 27, 41, 47, 53, 56, 64, 68.

S: Sec. 4.2.

SP: Ex 31, Ex 32.

**L13, L14** Mean Value Theorem; differentials and differences; linear approximation; derivatives and shape of graphs; increasing/decreasing test; first derivative test; concavity; point of inflection; concavity test; second derivative test; limits at infinity; horizontal asymptotes.

T: Secs. 3.10, 4.2 to 4.4.

TP: pages 210-212: 21, 25, 29, 33, 41. pages 238-239: 11, 14, 21, 22, 26, 31, 33. pages 247-249: 11, 14, 19, 23, 29, 37, 50. pages 260-263: 4, 7, 13, 21, 36, 42, 43, 51, 60, 70.

S: Sec. 4.3.

SP: Ex 35, Ex 36, Ex 37.

**L15** Curve sketching.

T: Secs. 4.5, 4.6.

TP: pages 270-271: 1, 5, 9, 20, 28, 31, 39, 47, 54.

**L16** Optimization problems; Newton's method; anti-derivatives.

T: Secs. 4.7, 4.9, 4.10.

TP: pages 283-288: 3, 9, 11, 14, 20, 28, 42, 51, 55. pages 298-300: 5, 15, 27, 32. pages 305-307: 1, 8, 16, 19, 28, 31, 36, 53, 67.

**L17** Review for Midterm Test.

**L18, L19** Integrals; areas; the definite integral.

T: Secs. 5.1, 5.2.

TP: pages 324-326: 3, 11, 18, 19, 21, 26. pages 336-339: 3, 9, 14, 15, 17-20, 23, 29, 37, 47, 49, 59, 67.

**L20** The Fundamental Theorem of Calculus.

T: Sec. 5.3.

TP: pages 347-350: 2, 5, 9, 13, 23, 31, 35, 40, 41, 44, 58, 59.

**L21** Indefinite integrals; substitution rule.

T: Secs. 5.4, 5.5

TP: pages 356-359: 4, 11, 13, 21, 27, 39, 44, 47, 51, 55. pages 365-367: 3, 6, 7-32, 59, 60.

**L22** Applications of integration; areas between two curves.

T: Sec. 6.1.

TP: pages 380-382: 5-26, 32, 44, 45.

**L23** Volumes.

T: Sec. 6.2.

TP: pages 391-393: 1, 5, 11, 17, 31-36, 43, 47, 53, 62.

**L24, L25** Volumes by cylindrical shells; work; average value of functions.

T: Secs. 6.3 to 6.5

TP: pages 396-397: 3, 7, 11, 21-26, 42, 44. pages 401-402: 9, 13, 19, 27, 30. page 405: 7, 9, 13, 17, 20, 21, 22.

**L26** Inverse functions.

T: Sec. 7.1.

TP: pages 420-421: 3, 5, 7, 11, 16, 24, 25, 27, 39-42, 44, 48.

**L27** The natural log function.

T: Sec. 7.2\*. {Note: **not** Sec. 7.2.}

TP: pages 458-459: 9-12, 13, 19, 25, 31, 35, 45, 57, 61, 63, 67, 71, 73, 79, 83.

**L28** The natural exponential function.

T: Sec. 7.3\*

TP: pages 465-467: 2-12, 17, 21, 25, 27, 29, 31-44, 51, 69-76, 87, 89.

**L29** General log and exp functions.

T: Sec. 7.4\*.

TP: pages 475-476: 3-10, 13, 21, 23-38, 41-46.

**L30, L31** The inverse trig functions; hyperbolic trig functions; indeterminate forms and L'Hospital's Rule.

T: Secs. 7.5 to 7.7.

TP: pages 483-485: 22-35, 48, 61, 69, 78. pages 491-493: 14, 17, 18, 35, 45, 49, 50.  
pages: 501-503: 22, 33, 37, 46, 47, 52, 54, 78, 87.

**L32** Differential equations; modeling with diff eqns; separable equations.

T: Secs. 10.1, 10.3.

TP: pages 627-628: 3, 12, 14. pages 643-645: 1-14, 37, 39, 42.

**L33** Exponential growth and decay.

T: Sec. 10.4.

TP: pages 656-657: 4, 8, 11, 13, 17, 21, 22.

**L34** Logistic equation; linear equations.

T: Secs. 10.5, 10.6.

TP: pages 665-667: 3, 5, 7, 9, 13. pages 672-674: 3, 7, 11, 19, 27, 35.

**L35, L36** Second order linear differential eqns.

T: Sec. 18.1.

TP: page 1183: 3, 7, 11, 13, 17, 19, 21, 25, 27, 29, 32.

S: Sec. 5.

**L37** Non-homogeneous linear diff eqns.

T: Sec. 18.2.

TP: pages 1190-1191: 3, 7, 9, 13, 17, 19, 21, 23, 25.