ASEN 5007 Spring 2013 Introduction to Finite Element Methods

HW Assignment #5: Chapters 11, 12 and 14 (long)

Due Thursday Oct 17, 2013 for on-campus students; Thursday Oct 24, 2013 for CAETE students

Please do not forget to attach this cover sheet to your returned homework and write your name(s) on it

Do these Exercises:

11.2

11.5

12.1

12.7

14.1 (short)

14.5

Note. To do Exercises 12.1 and 12.7 please read Chapter 12, which has not been covered in class yet. Those will be graded leniently.

Hints

For Exercise 12.1 check that if $I_i = I_j$ you get back (12.20).

Using a computer algebra system (CAS) to do any of the first four exercises is encouraged. (Exercise 14.1 can be done by hand; 14.5 may benefit from a CAS in reducing chances for mistakes in the last item, but is also doable by hand.)

If you use a CAS, attach the input script and output results. A presentation such as in Figure 12.11 is recommended; be sure to highlight or identify the answers to help the grader.

If you use *Mathematica*, please use separate cells for different exercises. Do not intermix exercise material in one cell as that complicates grading. Also be sure to do `ClearAll` to initialize the source variables and thus avoid cell cross-talk (computer scientists call that "namespace pollution"). For Exercise 12.1 be aware of the trick referred to in the footnote on pages 12–13 of Chapter 12 to get `EI` cleared before the prismatic-beam check.

Gauss Integration Rules

Exercise 12.7 uses 1D Gauss integration rules. The first 3 rules are stated in Exercise 12.6 in recipe form, and will be later discussed in more detail in Chapter 17 for 2D isoparametric elements. Gauss rules are covered in detail in numerical analysis books, where they are sometimes referred to as "Gauss-Legendre" or "Legendre-Gauss" rules.

If you have *Mathematica* with a full help file, go to subject `GaussianQuadrature`, or skim the MathWorld article posted at
`http://mathworld.wolfram.com/Legendre-GaussQuadrature.html`.