

ASEN 5007 Fall 2009 Introduction to Finite Element Methods

HW Assignment #5: Chapters 11, 12 and 14

Due Thursday October 15, 2009 (October 22 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)

14.2 or 14.5 (pick one; 14.2 is more difficult in terms of math)

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. (Exercises 14.1 and 14.2 can be easily done by hand; 14.1 and 14.5 may benefit from a CAS in reducing chances for mistakes.)

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 to get EI cleared before the prismatic-beam check.

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>.