

2011



Civil and Construction Engineering

CCE 6480 – Finite Element Applications

COURSE DESCRIPTION

The course focuses on the study of finite element applications to common engineering problems including linear static, heat transfer, flow through porous medium, seepage, resistivity, etc. During the course, ABAQUS and HyperMesh are used as the analysis and pre/post-processing tools.

COURSE OBJECTIVES

The primary objective of this course is to introduce advanced analysis concepts and tools currently used in the industry. The graduates will be able to learn;

1. Application of finite element concepts in common engineering problems.
2. Application of 1-D, 2-D, and 3-D and other special element types.
3. HyperMesh as a pre/post-processor and ABAQUS as the analysis tool.

COURSE LEARNING OUTCOMES

The course prepares students who:

- are able to develop finite element analysis models using relevant element types, loads, and boundary conditions by using given physical problem descriptions.
- apply knowledge of traditional mathematics, science, and engineering skills to verify the accuracy of analysis models.
- are able to understand the analysis results as well as analyze and interpret data in more than one engineering discipline.
- can work in teams.
- are able to communicate effectively.
- can use the techniques, skills, and modern tools necessary for engineering.

PREREQUISITE

CCE 6440 or Equivalent
Departmental Approval

INSTRUCTOR

Dr. Upul Attanayake, P.E.
G242 – Parkview Campus
Office Hours: By appointment
Telephone: (269)-276-3217
E-mail: upul.attanayake@wmich.edu

TEXT BOOK

There is no assigned textbook for this course. A draft manuscript and extensive notes will be available to the students. Suggested reference material will be discussed in class.

REFERENCES

- The Finite Element Method, by Hughes, Thomas J. R., Dover Publ., 2000
Finite Element Procedures, by Bathe, K. J., Prentice Hall Inc., 1996.
HyperMesh User's Manual, Altair Engineering, Troy, Michigan.
ABAQUS User's Manual, SIMULIA, Providence, RI.
A first Course in Finite Elements, by Jacob Fish, John Wiley & Sons, Inc.
Introduction to Finite Elements in Engineering, by T. R. Chandrupatla and A. D. Belegundu

TENTATIVE COURSE OUTLINE

- ✚ Overview of 1-D, 2-D, and 3-D elements and common engineering problems
- ✚ Overview of modeling, solution techniques, and pre/post-processing.
- ✚ Introduction to HyperMesh pre/post-processor
- ✚ Introduction to ABAQUS
- ✚ Solution of 1-D and 2-D linear static problems.
- ✚ Introduction to solution of 3-D linear static problems.
- ✚ Introduction to simulation of flow through porous medium, seepage, heat transfer, resistivity, etc.

CLASS TIME AND LOCATION:

Date and Time: Monday from 6:30 p.m – 9:00 p.m from 10 January through 30 April

Location: Room C-227

No classes on: Monday January 17 (MLK day) and February 28 to March 4 (Spring break)

Final exam week: April 25-29

GRADING SCHEME

Homework	40 %
Paper/Project	30 %
Final Exam	30 %
Total	100 %

FINAL GRADE

GRADE	PERCENT
A	90 - 100
BA	85 - 89
B	80 - 84
CB	75 - 79
C	70 - 74
DC	65 - 69
D	60 - 64
F	< 60

Rules:

- ✚ Text sections referred in class discussions are required reading.
- ✚ **Late assignments will not be accepted.**
- ✚ **Please note following rules. You are required to follow these rules. You will be graded accordingly.**

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- Save your models, input data, output files, plots, and all relevant work in an organized manner (each problem/ analysis case in a separate directory, files and models named appropriately, etc.). Be ready to use them as part of your oral presentation.
- Be prepared to present and discuss your work orally (solution procedure, solution steps, input deck, animation, comments on the results you obtained, results you were expecting, comparison of obtained and expected results, critical steps of the solution, their significance on results, etc.).
- Return the relevant and useful information in a folder. Make sure that content of the folder are clearly defined. Make your folder easy to follow and understand.

NOTES

1. **Attendance:** Attendance in lectures/lab sessions is *mandatory*.
2. **Homework/ Reports:** All homework/ reports that require hard copy submission should be done in an organized and neat manner. Start each new problem on a new page. Provide a cover sheet with your name and homework number or report title clearly indicated. **Staple** all sheets.
Homework/reports are due at the *beginning of class on the dates specified*. Absolutely no late homework.
Use of available tools for producing reports, graphs, charts, tables, etc., are encouraged.
3. **Exams:** Absolutely no Makeup Exam except for medical reasons verified by WMU Health Center Physicians.

STUDENT CONDUCT:

You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at <http://catalog.wmich.edu> under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.