**The Integrated Mechanical Engineering Curriculum**

- Vertical Integration:
  - Pre-engineering courses: Math, Chem, Physics
  - Introduction to ME: ME Tools
  - Micromechanics, Thermodynamics
  - Mechanics & Materials I & II: integrate Mechanics of Materials and Thermal & Fluids I & II: integrate Thermal & Fluids
  - Dynamic Systems I & II: replace Mechanism Design, Design of Machine Elements and Elements of CAD
- Horizontal Integration:
  - Machine shop hands-on experience
  - Programming language (C, MathCAD, Matlab)
  - Machine Elements
  - Thermal systems

**Difficulties/Obstacles**

- Obtain a consensus among the faculty members
- Smooth transition between subjects
- Time-consuming: Material selection
- Unrealistic expectations from the instructors
- Coordination between classes is critical but difficult, if possible
- Lack of experience in teaching integrated disciplines

**Suggestions/Solutions**

- Avoid team teaching if possible. Preferably, one faculty be assigned to develop one complete course-sequence
- Be patient and plan early. Selective omission is not a disaster
- Establish frequent and effective communication with the students
- The development of a new class is an iterative process that requires many modifications
- Adopt teamwork and cooperative learning concepts
- Taking advantage of web-based technology
- Provide on-line guidance throughout the learning period
- Introduce real-world applications and the state-of-the-art technology

**Vertical Integration**

- Should include the complete integration of mathematics, physics and engineering process together.
- Schools such as those in the NSF Foundation Coalition have established such an experimental integration program.

**Horizontal Integration:**

- Provide “Just-in-Time” hands-on laboratory experience
- Increase the total number of technical electives from two to four:
  - Diversification
  - Establish in-depth understanding of selective subjects
- Extend the design course from one semester to a two-semester format:
  - Emphasis on “In-Practice” learning by analyzing through the entire design cycle
  - Team-based projects in cooperation with industrial partners whenever possible

**Vertical Integration:**

- Introduction of computer and machine tool skills:
  - Programming language (C, MathCAD, Matlab)
  - Machine shop hands-on experience
  - Introduce fundamental concepts through case studies (use model Sterling Engine: energy concept, efficiency, etc.)

**Difficulties/Obstacles**

- Why? How? Who?
- “Enthusiastic” participation from all faculty is a must
- Coordination between classes is critical but difficult, if possible
- Lack of experience in teaching integrated disciplines
- Unrealistic expectations from the instructors
- Time-consuming: Material selection
- Smooth transition between subjects
- Students’ resistance/indifference
- Why us? Why now?
- No suitable textbooks/references

**Suggestions/Solutions**

- Avoid team teaching if possible. Preferably, one faculty be assigned to develop one complete course-sequence
- Be patient and plan early. Selective omission is not a disaster
- Establish frequent and effective communication with the students
- The development of a new class is an iterative process that requires many modifications
- Adopt teamwork and cooperative learning concepts
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**An Integrated Thermal and Fluids Curriculum**

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**SUMMARY**

A new Thermal and Fluids curriculum is developed as a part of our recent efforts to implement an Integrated ME curriculum. The new format integrates the three traditional thermal subjects of thermodynamics, heat transfer and fluid mechanics into a single two-semester course sequence.

**The College and the Department**

A unique institution jointly administered by Florida A&M University, a Historically Black University, and Florida State University. Its mission is to provide greater minority and women participation in engineering education while achieving national and international recognition through outstanding teaching, research, and professional development. The department has an enrollment of more than 300 undergraduate students of which 60% are underrepresented minorities and 20% are female. The diverse population in our school makes the transition to the new curriculum both challenging and necessary since it can provide better motivation to our students and, hopefully, can significantly improve the retention rate. In addition, the tightly-structured program encourages the establishment of positive relationship among students thus promoting the development of a true learning community.