The Maryland Governor’s Institute of Technology:
The Electrical and Computer Engineering Technical Program

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Goals

• Provide students with a solid conceptual knowledge of underlying mechanisms and principles of ECE and emphasize the prevalence of ECE in daily life
• Provide students with a vantage point from which they can branch into exploring ECE technology practically
• Teach college level material to high school students, creating the analogue of a high-tech Advanced Placement type course

Methodology

• Develop a hands-on concept-based syllabus, which presents a survey of key topics in electrical and computer engineering
• Teach theory using projects
• Develop unique text written specifically for this course.
• Provide intense five week experiential curriculum that gives solid background in key ECE topics.

Topics Covered

• Analog Electronics: Basic analog components; voltage, current, gain, filtering
• Digital Electronics: Basic gates, binary arithmetic, designing from truth tables
• Computer Architecture: Basic microprocessor structure
• Optoelectronics: Light detection, introduction to fiber optics

Experiments and Projects

• Multiple experiments in the textbook that doubled as a lab manual
• Sample experiments:
  – Voltage dividers
  – Rectifiers
  – Comparators and level indicators
  – Passive and active filters
  – Small signal gain in a CE amplifier
  – A full adder implementation
  – 7-segment display driver implementation
• Major projects:
  – Audio hi-fi amplifier
  – Computer-interfaced optoelectronics-based arcade game, LaserAim

Audio Hi-Fidelity Amplifier

• Audio-range stereo amplifier with optional tone control circuitry
• Bringing together concepts of frequency, voltage and current amplification, power
• Students soldered their own circuits on prototype boards and placed the whole assembly, including power supplies, in boxes that were drilled for connection jacks and doubled as heatsinks.

Assessments

• Administered exam containing questions typically found in 2nd and 3rd year classes.
• Result: 1/2 the class scored better than 90%
• All students successfully prototype audio system and most completed fabrication
• All students completed all laboratory assignments in the 180 page text

Student Evaluations; Conclusion

• Evaluations, focus groups and surveys indicated that
  – Students found the experience enjoyable and worthwhile
  – The methodology, using a conceptual and experiential approach rather than a mathematical one, was successful
  – The course met its aims of
    • Placing ECE in the context of the students’ daily lives and emphasizing the ways it improves our quality of life
    • Teaching basic ECE concepts and applications to students without any necessary prior background
    • Supplying students with hands-on experience in an EE lab

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