Pinaki Mazumder's Teaching Accomplishment

I have endeavored to pursue multidimensional education façades that transcend the confines of classroom and impact students as well as other professionals alike. My teaching contributions include authoring an undergraduate textbook and a video book, developing four advanced graduate courses, developing courseware for practicing engineers in industry, editing special issues in professional journals to stimulate research in emerging technologies, and fostering STEM education for K-12 students. Highlights of my teaching accomplishments are enumerated below:

- Breakdown of my course offering at the University of Michigan over the past 30 years: (i) nearly 60% of courses I taught are on *three* undergraduate courses for sophomore, junior and senior; approximately 10% of courses are on *two* regular graduate courses; and about 30% of courses are on *four* new graduate courses designed and developed by me to promote the state-of-the-art CMOS research and train the future engineering workforce. I have taught *three* distinct undergraduate and *six* graduate courses at the University of Michigan[1].

- Authored an undergraduate textbook, "Lectures on Digital Logic Design", *Pan Stanford Publisher*, 2018, about 500 pages. This book is based on my lectures in an introductory *Digital Logic Design* (EECS 270) course that I taught nearly twenty times at the University of Michigan.

- Developed an "on-line course" on *Digital Logic Design* (NEEP 2221), which was produced in June 2005 at the Disney MGM Studio, Orlando, Florida by National Technological University (NTU), now acquired by Walden University that is widely regarded as a global leader in on-line education. With the support of major technology companies such as IBM, Motorola, and Hewlett-Packard, the NTU was founded in 1984 to deliver academic courses to training facilities of corporations via a unique satellite network.

- Developed a new graduate course on *Ultra-Low-Power Sub-threshold CMOS Design* (EECS 598-1): http://web.eecs.umich.edu/~mazum/ClassDescriptions/EECS%20598%20Sub-Vt%20CMOS%20Design.pdf.

- Developed a new graduate course on *Nanocircuits and Nanoarchitectures* (EECS 598-2): http://web.eecs.umich.edu/~mazum/ClassDescriptions/EECS%20598%20Syllabus.pdf.

- Developed a new graduate course on *Terahertz Engineering: Theory and Applications* (EECS 598-6) to promote research in spoof plasmonics, photonics, and microwave electronics.

- Developed a new graduate course on *Optimization and Synthesis of VLSI Layout* (EECS 527) that I taught nearly half-a-dozen times. When I taught the course for the first time in 1988, there was no suitable textbook at that time. Therefore, I developed course materials, which were also adopted in other universities to teach the new VLSI computer-aided design (CAD) course at that time. The following of my survey papers comprising over 300 pages were part of courseware:

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[1] *Graduate courses developed and taught:* 1) EECS 527: Optimization and Synthesis of VLSI Layout, 2) EECS 579: Testing of Digital Circuits and Systems, 3) EECS 570: Advanced Computer Architectures, 4) EECS 598-1: Ultra-Low-Power Subthreshold CMOS Circuits, 5) EECS 598-2: Nanocircuits and Nanoarchitectures, and 6) EECS 598-6: Terahertz Engineering: Theory and Applications.

Undergraduate courses upgraded and taught: 7) EECS 270: Introduction to Digital Logic Design (sophomore level), 8) EECS 312: Digital Integrated Circuit Design (junior level), and 9) EECS 427: VLSI System Design (senior level).

1. VLSI cell placement: http://web.eecs.umich.edu/~mazum/PAPERS-MAZUM/cellplacement.pdf
2. VLSI routing: http://web.eecs.umich.edu/~mazum/ClassDescriptions/Routing.pdf
3. Gate Matrix: http://web.eecs.umich.edu/~mazum/ClassDescriptions/GateMatrixLayout.PDF

- Co-authored three advanced VLSI books to promote education in VLSI chip design and semiconductor memory technology. Our book on "Genetic Algorithms for VLSI Design, Layout and Testing", *Prentice Hall*, 2000 provides the foundation for developing distributed VLSI design automation tools by exploiting the multidimensional optimization capability of GA's running concurrently on a network of workstations to rapidly solve problems. The book not merely brings the evolutionary computing and the broader engineering community together enabling them to solve complex engineering problems. The book also unravels many mathematical insights for constructing multidimensional chromosome operators, and challenges mathematicians to develop theoretical models for the evolutionary algorithms. Two of books I coauthored on semiconductor memory systems are "Testing and Testable Design of Random-Access Memory", *Kluwer Academic Publisher*, 1996; and "Fault Tolerance and Reliability Aspects of Random-Access Memories," *Prentice Hall*, 2002. They are being widely used by practicing engineers and researchers in semiconductor memory technologies because of their pedagogical values.

- Edited a Special Issue in *The Proceedings of the IEEE* on Memristors: Devices, Models and Circuits, which can be adapted for teaching the next generation nano-circuits and nano-architectures, Please click the following URL to learn about the goal and scope of the special issue: http://web.eecs.umich.edu/~mazum/ClassDescriptions/MemristorIssueProceedings.pdf.

- To promote STEM education among K-12 students through imaginative mathematics software, I started developing Math Guru with the help of one of my ex advisees. The software was demonstrated in 1996-97 at local schools and distributed. http://web.eecs.umich.edu/~mazum/mathguru.pdf.

Numerous studies conducted by professional societies such as American Society for Engineering Education (ASEE) and National Academy of Engineering (NAE) have ardently advocated for educator's multidimensional impact, in addition to conventional measures such as numerical rating and student feedback that serve as a rough metric for classroom performance. My numerical scores[2] and student comments can be found at http://web.eecs.umich.edu/~mazum/pinakieval.pdf. While those data and comments reflect my deeper commitments for education and training, I continually strive to impart broader impact in the society by pursuing multidimensional teaching activities and training the future engineering workforces through integration of research and teaching.

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[2] **EECS 427: VLSI System Design** (senior undergraduate)
Winter 2016: Evaluation: 4.71/5.0 (Excellent Teacher) 4.58/5.0 (Excellent Course); Winter 2015: 4.71 and 4.55; Winter 2014: 4.58 and 4.42; Winter 2013: 4.2 and 4.33; Fall 1997: 4.71 and 4.58; Fall 1995: 4.55 and 3.94.

EECS 270: Digital Logic Design (sophomore undergraduate)
Spring 1991: Evaluation: 4.54 and 4.71; Spring 1992: 4.6 and 4.43; Winter 2001: 4.02 and 4.32.

EECS 598: Ultra-Low-Power Sub-threshold CMOS Design (graduate)
Fall 2013: Evaluation: 4.5 and 4.5; Fall 2012: 4.0 and 4.17.

EECS 527: Computer-Aided Design for VLSI Systems (graduate)
Winter 1996: Evaluation: 4.50 and 4.10; Winter 1995: 4.25 and 4.08; Winter 1992: 4.00 and 4.25.

Legend: 5.0 – Excellent, 4.0 – Very Good, 3.0 – Good, 2.0 – Fair, 1.0 – Poor.