TO: The Faculty of the College of Engineering

FROM: Elmore Family School of Electrical and Computer Engineering

RE: New Graduate Concentration: Microelectronics and Advanced Semiconductors

The faculty of the School of Electrical and Computer Engineering has approved the following new concentration. This action is now submitted to the Engineering Faculty with a recommendation for approval.

Concentration Microelectronics and Advanced Semiconductors

- **Justification:** Advanced semiconductor chips form the backbone of the entire computing and electronics industries. A worldwide shortage of semiconductors has brought into sharp focus the need for more design, engineering, and manufacturing capacity (especially domestically in the US) to keep pace with the demand for semiconductor-based products and services. Thanks to this demand, the semiconductor industry needs a lot more workforce-ready engineers (50,000+ new jobs in the coming decade, as per some industry forecasts) to ramp up such capacity and the proposed concentration will help position Purdue as a national leader in workforce development in this crucial field.

- **Focus of the research or professional program:** The proposed graduate concentration will require students to complete 9 credits of coursework, as per the Purdue guidelines for graduate concentrations. Students can choose their courses from a wide suite of available course options in ECE related to microelectronics and advanced semiconductors. Coherent sets of course options will allow students to focus on one of several sub-fields of their interest including, but not limited to semiconductor device design and modelling, integrated circuit design, and system-on-chip design.

- **A description of how they fit into and support the degree program**: This concentration will provide transciptable, specialized training to students interested in joining the microelectronics and advanced semiconductors workforce. The concentration will be a part of the existing MSECE degree and will support the existing degree program by providing a specialization in the areas of microelectronics and advanced semiconductors. It is estimated that about 30% of the MSECE graduate students choose to focus on topics related to microelectronics and advanced semiconductors and this concentration is expected to be very popular amongst those students. It will also help us attract new graduate students to both the residential as well as the online tracks of the MSECE degree.

Milind Kulkarni,
Associate Head for Teaching and Learning
Elmore Family School of Electrical and Computer Engineering

Concentration Coursework

Additional core and elective course options may be added following faculty review.

Devices and Manufacturing Focus

Core Requirement (3 credits)

ECE 60600 - Solid State Devices I

or

ECE 59500 - Semiconductor Fundamentals (1 credit)
ECE 59500 - Fundamentals of Current Flow (1 credit)
ECE 59500 - Essentials of Transistors (1 credit)

Elective Courses (minimum 6 credits)

ECE 61200 - Advanced VLSI Devices (Nanoscale Transistors) (3 credits)
ECE 50616 - Physics and Manufacturing of Solar Cells (3 credits)
ECE 60614 - Reliability Physics of Nanoelectronic Transistors (3 credits)
ECE 55900 - MOS VLSI Design (3 credits)
ECE 55700 - Integrated Circuit/MEMS Fabrication Laboratory (3 credits)

Circuit Design Focus

Core Requirement (3 credits)

ECE 55900 - MOS VLSI Design (3 credits)

Elective Courses (minimum 6 credits)

ECE 59500 - CMOS Analog IC Design (3 credits)
69500 High-Speed Mixed-Signal IC Design (3 credits)
ECE 69500 - Advanced VLSI Design (3 credits)
ECE 59500 - Semiconductor Fundamentals (1 credit)
ECE 59500 - Essentials of Transistors (1 credit)
ECE 60420 - Radio Frequency Integrated Circuits (3 credits)
69500 Primer on RF Design (1 credit)
69500 RF System Design (1 credit)

System Design Focus

Core Requirement (3 credits)

ECE 55900 - MOS VLSI Design (3 credits)

Elective Courses (minimum 6 credits)

ECE 69500 - System-on-chip Design (3 credits)
ECE 59500 - Digital Systems Design Automation (3 credits)

ECE 56800 - Embedded Systems (3 credits)
ECE 59500 - Semiconductor Fundamentals (1 credit)
ECE 69500 - Advanced VLSI Design (3 credits)
ECE 59500 - Applied Algorithms (3 credits)