

2006-1832: A COLLABORATIVE EFFORT BETWEEN A TWO-YEAR COLLEGE AND A STATE UNIVERSITY

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A Collaborative Effort between a two-year College and a State University

Abstract

In this paper the authors will present the outcome of a two-year effort for the establishment a new AAS program in **Semiconductor Manufacturing and Nanotechnology** that is being offered by Hudson Valley Community College (HVCC) – a community college located in the capital region of New York state – and the State University of New York University at Albany (UAlbany). Because of the nature and the cost of the laboratories (clean rooms, and other expensive facilities) needed to support such a program that HVCC could not afford, it was decided to seek a “*partner universities*” that could provide the students of this program with the laboratory facilities to perform the laboratory experiments needed for some of the courses.

Introduction

Hudson Valley Community College (HVCC), a two-year college located in Troy, New York, and The State University of New York at Albany (Albany Nano Tech atUAlbany) have agreed to develop a unique two-year associate program in semiconductor manufacturing and nanotechnology. The benefit for both institutions is clear: HVCC will have the opportunity to provide to the local community with a program that will train young women and men in the exciting field of semiconductors and nanotechnology without having to invest in expensive equipment needed to create labs and clean rooms. UAlbany, on the other hand, will help fulfill the required responsibility of New York State grant.

Albany Nano Tech and Sematech International

Albany Nano Tech is an integrated research center for development, pilot manufacturing, and education for the semiconductor industry. Their state-of-the-art laboratory facilities are located in 228,000 sq. ft. buildings, and include supercomputers and one of the best 300 mm wafer manufacturing clean rooms. Among its many centers of technology the following are worth mentioning:

- **Workforce Training.** This center is dedicated to create a highly skilled workforce that will serve the State of New York in particular and the Nation in general.
- **Center of Excellence in Nanotechnology (CEN).** This center is a technology development center where product prototyping and manufacturing support takes place.
- **The INDEX Program.** The Institute for Nanoelectronics Discovery and Exploration (INDEX) is one of the two Nanoelectronics research centers in the nation. This center focus in cutting-edge research in the field of nanotechnology and related areas.
- **The INVENT Program.** The International Venture for Nanolithography (INVENT) is a world class university-industry consortium for research and development.

- **The Center for Advanced Technology in Nanomaterials and Nanoelectronics (CATN).** This center represents a partnership between research universities and the nanoelectronics industry.
- **The Energy and Environmental Technology Applications Center (E2TAC).** This center provides support to the integration of microelectronics and nanotechnology, energy and environmental applications.
- **Nanoscale Metrology and Imaging Center.** This center specializes in the development of technologies and semiconductor devices, optoelectronics, MEMS, and other related technologies.

Sematech North is located on the UAlbany campus in the CESTM building. Albany NanoTech at the UAlbany campus. The following from the Albany NanoTech website gives an indication of the scale of activities and research opening up within the region served by HVCC:

“Albany NanoTech supports the semiconductor industry in technology development for short-, medium- and long-term horizons through partnerships with International SeMaTech (ISMT), the Focus Center Programs and other programs funded by the Semiconductor Industry Association (SIA). Most recently, New York Governor George E. Pataki announced on July 18, 2002 that International SEMATECH (ISMT), the 12 member global consortium of major computer chip manufacturers, will establish a \$400 million next-generation, 300-mm R&D center --named International SEMATECH NORTH -- at Albany NanoTech, the University of Albany -- SUNY’s advanced nanoelectronics facility for industry / university technology development and application in nanoelectronics. To support the program over the next five years, New York State will contribute \$160 million while International SEMATECH and its member companies, including IBM will add \$193 million. The initial project will be aimed at R&D in the area of advanced lithography infrastructure for extreme ultraviolet (EUV) lithography. EUV will be crucial for computer chip manufacturing technology in the future because technical advances are expected to cause present day manufacturing methods to become obsolete for the most advanced chips.”

Assessment of Local Needs and HVCC Requirements

While many manufacturing segments have been declining in the U.S., the semiconductor manufacturing industry has continued to grow. In addition, developments in Nanotechnology are poised to further enhance the semiconductor manufacturing segment as well as generate new opportunities and industries. The location of HVCC and UAlbany in the heart of the Tech Valley corridor has necessitated the creation of a program of instruction Semiconductor Manufacturing and Nanotechnology. There are many companies and research organizations in the region such as IBM, GE CR&D and International Sematech North that will benefit from students with education in Semiconductor Manufacturing and Nanotechnology.

Hudson Valley Community College has a population of over 11,000 students. The school support facilities and staff are excellent, but when confronted with the task of creating a nanotechnology program several factors were considered.

Enrollment - The Nanotechnology & Semiconductor Manufacturing Technology option is open to Electrical Technology Program (ELT) students in their senior year. Assuming half of them elect the option, first-year enrollment in this course would be roughly 15 students. Beyond the first year, enrollment would depend in a large part on the expansion of SEMATECH needs at Albany NanoTech and the number of semiconductor manufacturing facilities attracted to the area and as such cannot be reliably foreseen. A reasonable estimate would project somewhere between 15 to 30 students will take the course each of the next two years the College offers the Option.

Space/facilities – The courses will require a classroom with computer projection and ordinary classroom support. A laboratory will be required for the courses, along with various items of equipment and furniture. The laboratory will be set up with equipment placed peripherally around the room along with centrally located tables & seating. The studio style classroom design will allow dual use of the laboratory as a lecture classroom or combined lab-lecture classes. Some lab sessions can utilize equipment in current Materials Lab or and Chemistry facilities at the College. Additional semiconductor lab classes will be provided at the clean room or microelectronics research facilities at our RPI and SUNY-Albany partners. For a class of HVCC students to receive training in an Rensselaer Politechnic Institute (RPI) clean room, the total cost will be \$40/hour/class, which will fund a teaching assistant (\$15/hour) and the teaching assistant's clean room usage fee (\$25/hour). The access to RPI and SUNY-Albany eliminates the need for new multimillion-dollar semiconductor specific laboratories at HVCC.

Faculty – Twenty-nine contact hours of faculty load would be generated by the new courses required by the program. Existing faculty and/or adjunct faculty will teach the seven technical course electives in the area of Nanotechnology and semiconductor manufacturing technology (SMT). Other NYS research institutions (Rensselaer, University at Albany-Center for Thin Film Technology, RIT) have provided HVCC faculty technical assistance in course development and materials. Rensselaer, SUNY-Albany and RIT are internationally recognized for their expertise in Microelectronics and Semiconductor research and education.

Other unit(s) of the College – No new requirements with the exception of assistance from the Chemistry & Physics Department at HVCC.

Equipment – New equipment is required for the program and is estimated to cost \$507,244. An equipment list is attached.

Three \$28,000 vacuum trainers were purchased with funds from the now defunct Center For Technology Skills Training at no cost to the college. Center For Technology Skills Training also purchase a Semiconductor Manufacturing Trainer at no cost to the college. We have set up and evaluated the equipment and believe that existing HVCC lecture or lab space can be converted into a Nanotechnology laboratory space that the units can fit in. Additional Semiconductor and Nanotechnology lab classes will be provided at clean room facilities at RPI and SUNY-Albany partners. At RPI, the only cost will be for a teaching assistant (\$15/hour) and the teaching assistant's clean room usage fee (\$25/hour).

To fund the equipment for the Nanotechnology & Semiconductor Manufacturing Technology option the College is applying for \$500,000 in Title III grant monies over the course of the next

three years. Perkins grant money for equipment in the amount of \$175, 000 has been secured for 2003-2004. In addition, donations will be sought from industrial sources such as IBM. Some lab sessions can utilize equipment in current Materials and Chemistry Lab facilities at the College.

The Program

Hudson Valley Community College created a two-year AAS program that has been approved by the State Education Authorities, in “*Semiconductor Manufacturing and Nanotechnology*”. This program started in the Fall Semester of 2005, shares the first year with the existing TAC-of-ABET accredited Electrical Engineering Technology (ELT) program. During the second year the students will take semiconductor and nanotechnology courses. The following courses are the core of the program:

- a. ELET 262 - Semiconductors and Nanotechnology Overview
- b. ELET 250 – Vacuum and Power RF
- c. ELET 265 – Materials Chemistry for Semiconductors and Nanotechnology
- d. ELET 255 –Semiconductor Manufacturing Processes
- e. ELET 270 – Semiconductor Metrology and Process Control
- f. ELET 280 – Semiconductor / Nanotechnology Practicum

The first three of these courses are totally supported by the existing and future HVCC facilities. Laboratories will be performed in existing laboratory rooms and by using simulation software similar to the ones developed by MATEC (<http://www.matec.org>). These three courses will require a classroom with computer projector and ordinary classroom support. HVCC has developed a special laboratory room for the program, along with various items of equipment and furniture. The laboratory will be set up with equipment placed peripherally around the room along with centrally located tables & seating. The studio style classroom design will allow dual use of the laboratory as a lecture classroom or combined lab-lecture classes. Some lab sessions can utilize equipment in the current HVCC Materials Lab and the Chemistry facilities at the College. Additional semiconductor lab classes will be provided at the clean rooms and microelectronics research facilities at the UAlbany partner, as indicated below. HVCC is also negotiating with the Rensselaer Polytechnic Institute (RPI) - a local eminent Engineering College – for the use of their facilities to train the HVCC students. Some costs will be involved for an class of HVCC students to receive training in an RPI clean room. The access to RPI and SUNY-Albany eliminates the need for new multimillion-dollar semiconductor specific laboratories at HVCC.

UAlbany Standing

UAlbany will help HVCC by providing the facilities and technical personnel for the needed laboratory exercises for at least two courses: ELET 255 and ELET 270. The modality of this collaboration is as follows: During each Spring Semester of the second year of the program (when these courses will be taught) the HVCC Students will perform laboratory exercises at the facilities of UAlbany (CESTM) every two weeks. One week the students will prepare the theory of the labs and they will perform simulation labs at HVCC, and the next week the students will perform the labs in situs at UAlbany. UAlbany and HVCC have decided already for the list of labs that will be performed for the courses. This list may change as the

technology changes and according to the facilities and equipments available at the time of the performance of the labs.

Conclusion

In conclusion, engineering hubs and search engines such as GlobalSpec provide a wealth of tools to enable engineers to perform their jobs more efficiently. The GlobalSpec website also contains many resources to be useful in educating engineering and technology students. Proficiency in online searching of industrial components is a useful skill for new engineers to acquire and can be integrated into engineering curricula.

References

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Biographical Data

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