RESOLUTION TO ESTABLISH A MASTER OF ENGINEERING DEGREE IN COMPUTER SCIENCE AND APPLICATIONS (CSA-MENG)

MATERIALS INCLUDED

- Resolution
- Degree proposal

RESOLUTION TO ESTABLISH A MASTER OF ENGINEERING DEGREE IN COMPUTER SCIENCE AND APPLICATIONS (CSA-MENG)

WHEREAS, the mission of Virginia Tech is to discover and disseminate new knowledge through its focus on teaching and learning, research and discovery, and outreach and engagement; and

WHEREAS, there is a critical immediate need for graduates with knowledge and skills for mid-level and advanced positions in industries related to computing technology; and

WHEREAS, there is a growing regional and national demand for such programs, evidenced by the deficit of ~40,500 workers in the IT industry in the DC, VA, MD, WV region with top number of postings for master's level CS graduates primarily on the east coast, with Virginia ranked number 4 nationally after California, Texas and New York, with the highest job postings over the past 12 months; and

WHEREAS, the Bureau of Labor Statistics and the National Science Foundation have highlighted a crisis demand for well-trained technology professionals with a projection of 1 million more computing jobs than qualified applicants by 2020; and by comparison, this number is more than double the already significant current technology talent gap of 500,000 vacant positions; and

WHEREAS, this new Master of Engineering in Computer Science and Applications degree designation (CSA-MEng) will provide students with entrepreneurial, experiential learning through a project course requirement similar to a capstone course, by working in small teams to complete the full software project life cycle, from requirements gathering through customer and market need discover using NSF I-Corps principles to design, project management, communication and implementation; and

WHEREAS, this program has been developed with the same assessment criteria as the overall two year CSA -MS degree and similarly provides students with sufficiently rigorous courses in Computer Science to obtain and advance in successful careers in the computing field, it also provides opportunity for the degree to be completed in one year by eliminating the thesis and requiring a single new 3-credit course that satisfies a number of requirements; and similarly provides students with in-depth knowledge about software development, the research and development process, communication skills, and ethical issues related to computing technology; with specialty topics such as software engineering, internet software development, human-computer interaction, data analytics and machine learning, computer security and artificial intelligence;

NOW, THEREFORE BE IT RESOLVED, that the Master of Engineering in Computer Science and Applications be established, effective spring, 2020, and the proposal be forwarded to the State Council of Higher Education for Virginia for approval and to the Southern Association of Colleges and Schools for notification.

RECOMMENDATION:

That the above resolution recommending the establishment of the Master of Engineering in Computer Science and Applications be approved.

June 3, 2019

Addendum to

Commission on Graduate Studies and Policies
Resolution 2018-19F

Resolution to Establish a Master of Engineering Degree
in Computer Science and Applications (CSA-MEng)

Program Background

Virginia Tech is requesting approval to add a Master of Engineering (MEng) degree designation to the existing Computer Science and Applications (CSA) graduate degree program. The CSA-MEng is located in the College of Engineering, Department of Computer Science. The new degree designation would be initiated Spring 2020.

The purpose of the new CSA-MEng degree designation is to prepare graduates with the knowledge and skills needed for mid-level and advanced positions in industries related to computing technology. In part driven by the demands of the newly announced Innovation Campus, the MEng degree program will be developed in such a way as to be completable by students participating part time, full time, or full time accelerated (*i.e.*, in one twelve month period), as is now offered by several other universities (e.g. Cornell, Stanford, Purdue, Georgia Tech).

The program has been developed to provide students with sufficiently rigorous coursework in Computer Science to obtain and advance in successful careers in the computing field. The program provides students with in-depth knowledge about software development, the research and development process, communications skills, and ethical issues related to computing technology. It also provides access to a broad range of specialty areas within computer science. These include the opportunity to specialize in topics such as software engineering, internet software development, human-computer interaction, data analytics and machine learning, computer security, and artificial intelligence.

The CSA-MEng degree designation provides students with experiential learning through a project course requirement similar to a capstone course. To satisfy this requirement, students will work in small teams to complete the full software project life cycle, from requirements gathering through customer and market need discovery using NSF I-Corps principles, to design, project management, communication, and implementation.

Graduates with the CSA-MEng will be highly competitive for jobs in the computing industry, and will help to fill a critical need for skilled workers in this field. Graduates will have design skills, critical thinking skills, and an enhanced appreciation of their role in an industrial and applied setting.

Mission

Motivation to add the CSA-MEng has been building for years. As of 2018, there was an estimated deficit of ~40,500 workers in the IT industry in the DC, VA, MD, WV region[1]. According to Burning Glass, states with the top number of postings for Master's-level CS graduates are primarily on the east coast. The six states in the top ten in order are New York, Virginia, Massachusetts, Florida, New Jersey, and North Carolina. In 2018 the Commonwealth of Virginia recorded the highest demand for the master's level CS graduate degree in the US in

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[1] *Source: Burning Glass query on Master's graduates, Computer and Information Sciences, General /11.0101/ 1 Jan – 31 Dec 2018 for Washington-Arlington-Alexandria, DC-VA-MD-WV*

terms of postings per million with ~3200/million population. The states with the next highest demand included Massachusetts (~3,060), California (~2,700) and Washington (2,670).

The announcement that Amazon would build its new headquarters in Northern Virginia is predicted to add a demand of 25,000 more information technology (IT) workers in that area over the next 20 years, with roughly half of those jobs at the Master's level. In order to respond to this need, Virginia universities need to increase production of degrees at all levels. But the greatest deficit comes at the Master's degree level.

The Department of Computer Science at Virginia Tech has a thriving research-oriented graduate degree program, with both an MS and PhD in Computer Science and Applications (CSA). While the existing program does a good job at training students for the workforce, its primary focus is on developing skills in working independently while formulating and answering research questions. One strategy for an expanded Master's level production might be to increase enrollment in the existing CSA-MS program, but its research-oriented emphasis will not satisfy the needs of a large segment of the workforce that wants a degree more targeted toward software development. The CSA-MS degree's research requirements result in completion times longer than needed for a more implementation-focused program. The CSA-MEng is designed for the purpose of satisfying this need, and is designed to operate at the scale needed to have a serious impact on the current shortage in workers with advanced degrees in the IT area.

The CSA-MEng will differ from the existing CSA-MS degree in several respects. The CSA-MEng will be coursework-only (that is, no thesis track will be offered). Where the CSA-MS degree satisfies a number of requirements (such as university-mandated ethics and diversity training) through mechanisms outside of normal 3-credit courses, the CSA-MEng degree will satisfy these requirements with a single new 3-credit course that is part of the 30 credit degree requirements. Rather than using a thesis and research hours as the primary mechanism to satisfy university final exam requirements, the CSA-MEng primarily will use an entrepreneurial-focused, projects-based course for that purpose. The result will be a degree that can be completed in a shorter time-frame and is also more compatible with part-time study.

Target Population

The CSA-MEng program is designed to appeal to particular types of potential students. IT professionals or recent graduates with a Bachelor's degree in CS or a related field are often motivated to get a Master's-level degree, as this provides additional career opportunities and leads to higher salaries. We expect that the job demand especially in Northern Virginia will make getting a Master's degree particularly attractive to the student living in that geographic area. Additionally, we expect that many to opt for the CSA-MEng degree over the research-oriented CSA-MS degree because it can be completed in a shorter time-frame. The CSA-MEng can reasonably be completed in three academic semesters. An aggressive schedule would allow a student to reasonably complete the program in twelve months (four courses in Fall, four courses in Spring, and one course each of two summer terms, for example).

We expect a large demand for training and certification at the Master's-level degree from IT employees in the area who already hold a Bachelor's degree in Computer Science or a related field. Such students will prefer a part-time format, taking one or two courses per semester, while they continue to work full time. Since the CSA-MEng program has no requirements for seminars, research hours, thesis, or external mechanism to fulfill University ethics and diversity training requirements (all in contrast to the CSA-MS degree), the CSA-MEng will be much easier to complete as a part-time student.

Many workers have relatively little formal background in Computer Science, but have gained some practical experience with programming, and would like to improve their career opportunities by obtaining as Master's degree in Computer Science. The existing CSA-MS

degree has more stringent requirements for entry into the program: students must have the equivalent of a CS minor (which often takes at least two years of courses to obtain). In contrast, entrance requirements for the CS-MEng degree require less formal CS training. Students can enter this program in good standing after completing a traditional second-semester programming course, which can be taken at any community college or undergraduate degree-granting institution. Thus, the CS-MEng degree should be more attractive to such students.

Student Retention and Continuation Plan

All students in the CSA-MEng program will be assigned a primary academic advisor (typically the program director for the CSA-MEng program). This person will conduct orientation sessions for incoming students. They will also organize and conduct the annual evaluation and feedback process for all students. This is similar to the existing annual evaluation process already used for all CSA students, where every student is checked to see if they are on track for completion in a timely manner, with individual feedback given as appropriate. The academic advisor will be available to meet with students as needed to discuss student progress and issues.

Faculty

Full-time or adjunct faculty in the Department of Computer Science will teach core and required courses in the CSA-MEng program. All current faculty members possess terminal degrees in Computer Science or a related field. The university is preparing a hiring plan to meet the faculty demand for the anticipated enrollments.

Program Administration

The proposed CSA-MEng degree designation program will be under the direction of the Associate Department Head for Graduate Studies, who is also the Program Director for all graduate programs in Computer Science. Day to day administration will be handled by a dedicated CSA-MEng Program Director.

Employment Skills/ Workplace Competencies

The CS-MEng degree designation program is designed to prepare students for mid-level and advanced careers in the computing industry. It is anticipated that most graduates of the CS-MEng program will already be computing professionals when they begin the program (whether on leave or taking the program part-time), or will immediately enter the IT industry after graduation. Typical job titles will include Software Engineer and Senior Developer. Graduates will be able to use computer science knowledge to solve technical problems; develop effective software solutions; collect and analyze data appropriate to the problem; and report, through both written and oral communication, on their activities and results.

Impact on Existing Programs

The proposed addition of the CSA-MEng degree designation will not compromise the existing CSA degree program. Rather, it will complement the existing research-oriented MS and PhD options. All courses currently required for the CSA program will still be available, and the addition of the CSA- MEng program will not negatively impact course offerings for the other CSA options. It is not anticipated that student enrollment in the existing CSA degrees will be impacted as students who enroll in the CSA-MEng will have a different career focus than students who typically enroll in the CSA program. Virginia Tech will continue to offer the CSA-MS and CSA-PhD degrees.