AC 2012-4205: CREATING A SEAMLESS PIPELINE INTO B.S. DEGREE PROGRAMS FOR PLACE-BOUND ET STUDENTS VIA A STATE-WIDE 2+2 ARTICULATION AGREEMENT

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Creating a Seamless Pipeline into BS Degree programs for Place-Bound ET Students via a State-Wide 2+2 Articulation Agreement

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Abstract

Engineering Technology (ET) programs around the US have been struggling in recent years to maintain their identity, viability, and continued relevance in the face of decreasing enrollments coupled with a harsh economy, and competition from Engineering programs. While some schools with ET programs have resorted to switching their programs entirely from ET to Engineering, others have resorted to developing highly innovative and specialized new curricula that seek to differentiate the ET programs from Engineering programs, and to entice potential students into their programs. Yet others have sought innovative ways to develop a pipeline for graduates from two-year ET degree programs to matriculate into the ET programs at their institutions in order to complete the upper division work leading to a BAS or BS degree in ET. Southern Polytechnic State University (SPSU) is one institution that has adopted this latter approach. The university has recently completed and signed a novel state-wide 2+2 articulation agreement with the Technical College System of Georgia (TCSG) for its BS programs in EET, IET and MET. The agreement benefitted from the timely coincidence of being worked out at the time the TCSG was switching from the quarter-based system to a semester-based system. SPSU was able to play an instrumental role in assisting the TCSG with this conversion process which greatly facilitated the smooth articulation of the programs. This agreement is in line with the missions of both SPSU and the TCSG, and is in line with the State's goal of providing state-of-the-art high-technology programs to its residents in the rural areas. The agreement calls for the delivery of the upper-division curricula in EET, IET, and MET to students at the TCSG schools via distance learning. The students register for the program at a participating TCSG school and upon completion of the first two years, they will have received approximately sixty credit hours towards the BS ET degree. They then matriculate into SPSU and complete the upper division requirements for their particular degree program via distance education courses offered by the faculty at SPSU. This paper details the articulation agreement, discusses the benefits of the agreement for both types of institutions, and examines some of the challenges presented in offering a predominantly laboratory-intensive curriculum at a distance. Some preliminary enrollment data is also presented that provides an early indication as to the future viability of the articulated programs.

I. Introduction

Southern Polytechnic State University (SPSU) is a Science, Technology, Engineering, and Math (STEM) focused university located in Marietta, Georgia. It is an urban institution with a population of approximately 5,400 students. For many years since its inception, the university offered a number of Engineering Technology programs in Civil CET), Computer (CpET), Electrical (EET), Industrial (IET), Mechanical (MET), and Telecommunications TCET)

Engineering Technology. The ET programs constituted the largest program offerings by the university and have consistently been ranked amongst some of the top-rated programs in the country. All six of these ET programs are ABET [1] accredited.

However, as has been the case for many ET programs across the country in recent years, SPSU has struggled to maintain the identity, viability, and continued relevance of its ET programs in the face of competition from Engineering programs. For a very long period of time, only one university in Georgia was allowed to offer programs in Engineering. As a result, most of the competition for students came from the "engineering" school within the state and from regional schools in neighboring states offering Engineering and ET programs. SPSU itself began offering specialized Engineering programs in 2008 starting with Construction Engineering (spring), Systems Engineering (fall), and Mechatronics Engineering (fall). In the spring semester of 2010, SPSU began offering traditional Engineering programs in Civil, Electrical, and Mechanical Engineering in an evening format. This brought the Engineering competition in-house and resulted in student attrition in the previously named ET programs. The IET, CpET, and TCET programs have not experienced a similar drop in their enrolments so far. In addition, two other state universities have been approved by the BOR to begin offering Engineering programs beginning in 2012, further increasing competition within the state. One of these institutions opted to phase-out their existing ET programs in favor of new Engineering programs.

For its ET programs to survive, the university had to seek innovative ways to preserve and maintain the identity, viability, and continued relevance of its ET programs in light of these new in-house engineering programs and the competition from within the state and outside as well. One option that has been adopted is to develop articulation agreements with the TCSG to create a pipeline for graduates from two-year ET degree programs to matriculate into the ET programs at SPSU in order to complete the upper division work leading to a BAS or BS degree in ET. This paper provides details of the articulation agreement for three BS-ET degree programs in EET, IET, and MET.

II. Motivation and Background

The main motivation for the articulation agreement was the desire to create a pipeline for students with two year ET degrees, who are mostly place-bound due to job and family responsibilities to get their BS-ET degrees without having to relocate to the Greater Atlanta/Marietta area. The agreement benefitted from the timely coincidence of being worked out at the time the TCSG was switching from the quarter-based system to a semester-based system. The ET faculty at SPSU were able to play an instrumental role in assisting the TCSG with this conversion process which greatly facilitated the smooth articulation of the programs. The agreement became effective in the fall semester of 2011, which coincided with the transition of the TCSG system from a quarter-based system to a semester-based system.

The agreement calls for SPSU to deliver the upper-division curricula in EET, IET, and MET to students at the TCSG schools via distance learning. Students register for the Pre-Engineering Technology program at a participating TCSG school and upon completion of the first two years, they will have received approximately sixty credit hours towards the BS-ET degree. They then matriculate into SPSU and complete the upper division requirements for their particular degree program via distance education courses offered by the faculty at SPSU. Some laboratory classes can be offered online depending upon the major. When labs cannot be effectively delivered

online, a low residency format will be offered on the SPSU campus. As the programs grow in enrollment we hope to partner further with the TCSG to offer the low residency laboratory format at selected TCSG schools.

This agreement is in line with the missions of both SPSU and the TCSG, and is in line with the State's goal of providing state-of-the-art high-technology programs to its residents in rural areas.

"The Technical College System of Georgia is a system of technical education, custom business and industry training, and adult education programs. Our programs use the best available technology and offer access to lifelong learning for all Georgians [2]."

"The agency's primary objective is to create a well-educated, technically trained, and highly competitive workforce, thus ensuring economic success for both the state and its citizens. The TCSG commissioner, along with the State Board of Technical and Adult Education, which is composed of members from the state's thirteen congressional districts, and nine members at large, establishes standards, regulations, and policies for the operation of the TCSG [3]."

SPSU's mission states:

"Southern Polytechnic State University is proud to be Georgia's technology university. Our academic, professional, outreach and service programs embrace all aspects of technology, including the practical applied skills (techne) needed to solve today's real-world problems and the theoretical knowledge (logos) necessary to meet tomorrow's challenges. SPSU graduates are well prepared to lead the scientific and economic development of an increasingly complex state, nation, and world.

Our mission is to serve both traditional and non-traditional students at the undergraduate, graduate and continuing education levels; in engineering and engineering technology, the sciences, applied liberal arts, business and professional programs. We work to develop the broader community's intellectual, cultural, economic, and human resources. Facilitated by our innovative faculty, dedicated staff, and supportive campus environment, our learning community empowers SPSU students with the ability and vision to transform the future [4]."

With this agreement, SPSU will be able to deliver its ET programs to various parts of the state, and will become one of the driving forces of the state's economic development efforts.

III. Articulation Program Development

The preliminary contact with the TCSG came through the Vice-President for Academic Affairs office via SPSU's Office of Faculty Support and Development. By working with a Sub-committee of the TCSG's President's Council at the TCSG System Office during the development of semester-based courses, SPSU administrators and faculty were able to share course outcomes and contents allowing them to be easily matched-up between SPSU and the TCSG schools.

The three programs chosen for this initial BS ET agreement were the EET, IET, and MET programs [5]. The IET program already had a well established BAS agreement with the TCSG which helped in facilitating the process as well. Students must earn an AAS degree in the appropriate pre-engineering Technology program to be eligible for the BS in EET, IET, or MET. The list of required courses for the EET program is provided Tables 1a and 1b. The list of required courses for the IET program is provided Tables 2a and 2b. The list of required courses for the MET program is provided Tables 3a and 3b. The total number of credit hours required to complete each of the three programs is shown in Table 4.

IV. Current Status

The articulation was signed in April of 2011 with the first cohort of students registering for the program during the fall semester 2011. This coincided with the switch over to semesters by the TCSG system. It is expected that the first set of graduates from the Pre-Engineering Technology AAS degree programs will be matriculating into SPSU during the fall semester of 2013.

In order to be able to meet its obligations for providing the upper-level curriculum to students in the articulated Pre-Engineering Technology programs, SPSU faculty have been developing distance learning versions of their upper division courses through the SPSU Office of Instructional Design. The courses will be delivered through GeorgiaView Vista which is supported through the University System of Georgia Office. Many of the EET and MET courses have already been developed and are being offered to existing student so that any bugs will be worked out prior to the full roll-out in 2013. All of the IET courses have been developed to date. In order to ensure that all course offered through distance learning are of uniform quality, each faculty member developing a course has to go through the a training program offered through the Teaching Academy for Distance Learning (TADL) in the Office of Faculty Support and Development.

Since the signing of the articulation agreement, a number of the TCSG schools have indicated their interest in participating in the agreement. Table 5 provides a list of colleges who plan to participate as of fall 2011 and the programs in which they will be participating in. Some institutions are not planning to participate in the agreement at this time, but may choose to do so in the future. SPSU faculty will be working with faculty at those institutions in implementing the Pre-Engineering Technology program at their schools. The SPSU administration is actively working with the Presidents at the TCSG schools to ensure that they are fully committed to the agreement.

A major concern in the implementation of the articulation agreement was how to offer the required laboratory components of the highly technical ET programs to students through distance learning. It has been decided that initially all laboratory exercises will be conducted at the SPSU main campus in Marietta, Georgia, over a three or four weekend period during the semester. Some EET laboratory exercises may also be offered remotely utilizing equipment such as the NI ELVIS II platform provided by National Instruments [6] for teaching Circuits and Electronics labs. The ultimate goal is to establish regional locations around the state at TCSG schools that will serve as facilities where students can go to complete their laboratory work, instead of having to travel to Marietta to do so. Agreement for the use of such facilities will have to be worked out between SPSU and the TCSG schools involved.

Preliminary data on enrollment figures have yet to be provided by the TCSG who have been dealing with issues related to the changing over to a semester-based system.

V. Conclusion

Given the challenges posed with preserving and maintaining the identity, viability, and continued relevance of its ET programs, SPSU has adopted as one of its strategies for continued excellence

in offering premium engineering technology programs, implementation of a state-wide articulation agreement with the TCSG. This agreement has the potential of providing a pipeline for graduates of two-year AAS ET programs to matriculate into SPSU's ET programs in EET, IET, and MET.

The university hopes to become the "Go To" university in the state for all ET related programs. It is anticipated that in the future the articulation agreement will be expanded to include the other ET programs that are currently offered at SPSU, as well as those that will be developed in the near future, such as in Renewable Energy ET (REET), and Biomedical ET (BMET).

The agreement is a win-win for both SPSU and the TCSG. It is also in line with the missions of both SPSU and the TCSG, and is in line with the State's goal of providing state-of-the-art high-technology programs to its residents in the rural areas.

References

[1]   ABET Inc. Web Page: http://www.abet.org
[2]   Technical School System of Georgia Website: http://www.tcsg.edu
[3]   The New Georgia Encyclopedia: http://www.georgiaencyclopedia.org/nge/Article.jsp?id=h-3292
[4]   The SPSU Mission Statement : http://www.spsu.edu/officeofpresident/univmission.htm
[5]   SPSU TCSG Articulation Web page: http://www.spsu.edu/tcsg/welcome.htm
[6]   National Instruments Website: http://www.ni.com/elvis
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Table 1a. BS EET - TCSG Program Components

COURSE TITLE	TCSG Course	SPSU Course	EET
TCSG COMMON			
English Comp I	ENGL 1101	ENGL 1101	3
English Comp II	ENGL 1102	ENGL 1102	3
Pre-Calculus	MATH 1113	MATH 1113	4
Calculus I	MATH 1131	MATH 2253	4
Public Speaking	SPCH 1101	COMM 2400	2
Arts & Culture	ARTS 1101or MUSC 1101	ARTS 2001or ARTS 2003	3
World History	HIST 1111 or HIST 1112	HIST 1111 or HIST 1112 (E2)	3
Physics I	PHYS 1111 & PHYS 1111L	PHYS 1111K *	4
Physics II	PHYS 1112 & PHYS 1112L	PHYS 1112K*	4
Technical Writing	ENGL 1105	TCOM 2010	3
Chemistry I	CHEM 1211 & CHEM 1211L	CHEM 1211K	4
Eng Graphics I	DFTG 2010**	EDG 1211	2
TCSG Common Subtotal			**39**

TCSG SPECIFIC			
TCSG SPECIFIC			
Calculus II	MATH 1132	MATH 2254	4
Orientation	ENGT 1000	ECET 1000	2
Fundamentals	ECET 1101	ECET 1011	3
Circuits I	ECET 2101	ECET 1100	4
Digital I	ECET 1110	ECET 1200	4
Electronics I	ECET 2120	ECET 2300	4
TCSG Option Specific Subtotal			**21**
TCSG TOTAL	**AAS PRE-ENGINEERING TECHNOLOGY-EET**		**60**

Notes: *Calculus based Physics preferred by EET although Trig. based will be accepted.

**A two credit 2D based course is acceptable as a substitute for IET and EET.

Table 1b. BS EET - SPSU Program Components

Course Title	SPSU Course	EET
SPSU COMMON		
Behavior Science	E3	3
American History	E1	3
Cultures & Societies	E4	3
Literature	C1	3
STS	STS 2400	2
Balance of A-E		**14**

Course Title	SPSU Course	EET
SPSU DEGREE SPECIFIC		
Ordinary Diff Equa	MATH 2306	3
Circuits II	ECET 2110	4
Digital II	ECET 2210	4
Electronics II	ECET 2300	4
Digital III	ECET 3220	4
Data Comm	ECET 3400	4
High Freq Systems	ECET 3410	4
Survey of Elect Mach	ECET 3500	4
Test Eng	ECET 3600	4
Signals & Systems	ECET 3620	4
Control Systems	ECET 4610	4
Department Electives		13
Degree Specific Subtotal		**56**
SPSU TOTAL		**70**

Table 2a. BS IET - TCSG Program Components

COURSE TITLE	TCSG Course	SPSU Course	IET
TCSG COMMON			
English Comp I	ENGL 1101	ENGL 1101	3
English Comp II	ENGL 1102	ENGL 1102	3
Pre-Calculus	MATH 1113	MATH 1113	4
Calculus I	MATH 1131	MATH 2253	4
Public Speaking	SPCH 1101	COMM 2400	2
Arts & Culture	ARTS 1101or MUSC 1101	ARTS 2001or ARTS 2003	3
World History	HIST 1111 or HIST 1112	HIST 1111 or HIST 1112 (E2)	3
Physics I	PHYS 1111 & PHYS 1111L	PHYS 1111K *	4
Physics II	PHYS 1112 & PHYS 1112L	PHYS 1112K*	4
Technical Writing	ENGL 1105	TCOM 2010	3
Chemistry I	CHEM 1211 & CHEM 1211L	CHEM 1211K	4
Eng Graphics I	DFTG 2010**	EDG 1211	2
TCSG Common Subtotal			**39**

COURSE TITLE	TCSG Course	SPSU Course	IET
TCSG SPECIFIC			
Computer Prog	CIST 2361	CS1301E	3
Mfg Processes	MEGT 1010	MET 1311	3
Mach & Welding	MEGT 1321	MET 1321	1
Accounting I	ACCT 1100	ACCT 2101	3
Statistics	MATH 1127	IET 2227	3
Department Elective		Approved List	3
Free Electives		Credit Course	6
TCSG Option Specific Subtotal			**22**
TCSG TOTAL	**AAS PRE-ENGINEERING TECHNOLOGY-IET**		**61**

Note: **A two credit 2D based course is acceptable as a substitute for IET and EET.

Table 2b. BS IET - SPSU Program Components

Course Title	SPSU Course	IET
SPSU COMMON		
Behavior Science	E3	3
American History	E1	3
Cultures & Societies	E4	3
Literature	C1	3
STS	STS 2400	2
Balance of A-E		**14**

Table 2b(contd.). BS IET - SPSU Program Components

SPSU DEGREE SPECIFIC		
Orientation	IET 1000	1
Logistics	IET 2449	3
Work Measurement	IET 3322	4
Statistical QC	IET 3339	3
Quality Concepts	IET 3356	3
Ind Experimentation	IET 3403	3
Engineer Economy	IET 3424	3
Eng Prod & Costing II	IET 3433	3
Operations Res	IET 4405	3
Plant Layout	IET 4422	4
Systems Simulation	IET 4451	3
Senior Project	IET 4475	3
Safety & Ethics	IET 4810	1
HR Mgt	MGNT 4115	3
Project Mgt	MGNT 4135	3
Operations Mgt	MGNT 4151	3
Departmental Electives	Approved List	6
Free Electives		3
Degree Specific Subtotal		**55**
SPSU TOTAL		**69**

Table 3a. BS MET - TCSG Program Components

COURSE TITLE	TCSG Course	SPSU Course	MET
TCSG COMMON			
English Comp I	ENGL 1101	ENGL 1101	3
English Comp II	ENGL 1102	ENGL 1102	3
Pre-Calculus	MATH 1113	MATH 1113	4
Calculus I	MATH 1131	MATH 2253	4
Public Speaking	SPCH 1101	COMM 2400	2
Arts & Culture	ARTS 1101or MUSC 1101	ARTS 2001or ARTS 2003	3
World History	HIST 1111 or HIST 1112	HIST 1111 or HIST 1112 (E2)	3
Physics I	PHYS 1111 & PHYS 1111L	PHYS 1111K *	4
Physics II	PHYS 1112 & PHYS 1112L	PHYS 1112K*	4
Technical Writing	ENGL 1105	TCOM 2010	3
Chemistry I	CHEM 1211 & CHEM 1211L	CHEM 1211K	4
Eng Graphics I	DFTG 2010	EDG 1211	3
TCSG Common Subtotal			**40**

COURSE TITLE	TCSG Course	SPSU Course	MET
TCSG OPTION SPECIFIC			
Computer Prog	CIST 2361	CS1301E	3
Mfg Processes	MEGT 1010	MET 1311	3
Mach & Welding	MEGT 1321	MET 1321	2
Calculus II	MATH 1132	MATH 2254	4
Eng Graphics II	DFTG 2020	EDG 1212	4
American Literature	ENGL 2130	ENGL 2131	3
Free Elective		Credit Course	3
TCSG Option Specific Subtotal			**22**
TCSG TOTAL	**AAS PRE-ENGINEERING TECHNOLOGY-MET**		**62**

Note: *Calculus based Physics preferred by MET although Trig. based will be accepted.

Table 3b. BS MET - SPSU Program Components

COURSE TITLE	SPSU Course	MET
SPSU COMMON		
Behavior Science	E3	3
American History	E1	3
Cultures & Societies	E4	3
STS	STS 2400	2
Balance of A-E		**11**

SPSU DEGREE SPECIFIC		
Orientation	MET 1000	1
Ordinary Diff Equa	MATH 2306	3
Electrical Principles	ECET 3000	4
Dynamics	ENGR 3122	3
Statics	ENGR 2214	3
Strength of Mat	ENGR 3131	3
Strength of Mat Lab	ENGR 3132	1
Fluid Mechanics	ENGR 3343	3
Fluid Mech Lab	MET 3344	1
Mfg Process Lab II	MET 2322	3
Eng Materials	MET 3132	4
Machine Design I	MET 4141	4
Instr & Controls	MET 4421	4
MET 1 of 3 Courses	MET 3123, 3331 or 3402	3
Thermodynamics	MET 3401	3
Department Electives		12
Degree Specific Subtotal		**55**
SPSU TOTAL		**66**

Table 4. Student Total Credit Hours

STUDENT TOTAL	BS ENGINEERING TECHNOLOGY (BSEET)	130

STUDENT TOTAL	BS ENGINEERING TECHNOLOGY (BSIET)	130

STUDENT TOTAL	BS ENGINEERING TECHNOLOGY (BSMET)	128

Table 5. List of Participating TCSG Schools and Programs

TCSG College	EET	IET	MET
Albany	X		
Athens		X	
Atlanta	X	X	
Augusta	X		
Chattahoochee	X	X	X
DeKalb	X		
Gwinnett	X	X	X
Middle Georgia		X	X
North Georgia	X	X	X
Savannah	X		
Southeastern	X		
Southwest Georgia	X	X	
West Georgia	X		
Wiregrass	X	X	