

GRADUATE CHE EDUCATION ON A STATEWIDE CLOSED-CIRCUIT TELEVISION NETWORK

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THROUGHOUT THE COUNTRY, colleges and universities are seeking to meet the educational needs of today's mobile society. The medium of television is being used most effectively to reach people who cannot conveniently attend classes on campus. The engineering community especially finds need for such educational opportunities because of today's rapidly changing technology. To provide the means by which practicing engineers can continue to keep abreast of current trends, the University of South Carolina (USC), in 1969, started *A Program of Graduate Engineering Education (APOGEE)*.

Most of the chemical and related industry in South Carolina is scattered throughout the state and is not located near the USC campus in Columbia. Thus, a majority of the practicing chemical engineers who desire an advanced degree in Chemical Engineering would not be able to attend regular on-campus classes. These engineers look to APOGEE as a means of continuing career growth. To meet this need, APOGEE offers graduate courses in ChE at remote locations throughout South Carolina via full-color video tapes and closed-circuit television broadcasts. The locations where APOGEE facilities are to be found are listed in Table I.

THE APOGEE PHILOSOPHY

THERE ARE SEVERAL ways in which a statewide television network could be used to offer courses for graduate credit. Professionally produced lectures, complete with rehearsals, video tape editing, and specially prepared notes would provide nearly perfect 'shows' for the student. In some instances, this technique has been tried with

success. However, it is felt that student-teacher contact, where the student is free to ask questions during the lectures, is an important part of engineering education. Also, student performance has been found to be unaffected by imperfections in the lecture presentation. Thus, the additional time required for the making of professionally produced 'shows' is not time which is efficiently used by the instructor.

The philosophy with which APOGEE courses are prepared is one of keeping as much of the regular classroom 'flavor' as possible. Classes for the on-campus students are held in modified classroom-studios. The off-campus students attend classes in classrooms containing television monitors and video tape players. Course lectures are presented twice a week. One lecture is video taped before the on-campus students in Columbia. The video tapes are then distributed to the remote locations so that they may be viewed at the con-

TABLE I. Locations of APOGEE Facilities

Aiken, South Carolina
Barnwell, South Carolina
Camden, South Carolina
Charleston, South Carolina
Columbia, South Carolina
Duke Power; Charlotte, North Carolina
Dupont Savannah River Plant, South Carolina
Florence, South Carolina
Georgetown, South Carolina
Greenville, South Carolina
Greenwood, South Carolina
Hartsville, South Carolina
North Augusta, South Carolina
Oconee, South Carolina
Orangeburg, South Carolina
Rock Hill, South Carolina
Savannah, Georgia
Shaw Air Force Base, South Carolina
Sumter, South Carolina
Spartanburg, South Carolina
Waterboro, South Carolina



Thomas G. Stanford received the BSChE degree from Wayne State University in 1966, the MSE(ChE) degree and the MS(Math) degree from The University of Michigan in 1968, and the PhD degree in Chemical Engineering from The University of Michigan in 1977. He has worked for Monsanto Company and Continental Oil Company as a process chemical engineer. Since 1976, he has been Assistant Professor of Chemical Engineering at the University of South Carolina. His research interests are in the areas of chemical reactor engineering, mathematical modeling of chemical systems, and thermodynamics.

venience of the off-campus student. The other lecture is presented live on closed-circuit television both to the on-campus students and to the students at the remote locations. Because most of the off-campus students are not able to attend classes during regular business hours, this lecture is presented either on a weekday evening or on Saturday morning. It is in 'talk-back' format so that each student may talk freely with the instructor via telephone. Several 'Saturday in Columbia' class meetings are scheduled throughout the semester. All of the students come to Columbia for these sessions to take exams, to discuss homework, or to do experiments. Students are also free to contact the instructor by phone during regular office hours if they have specific questions.

APOGEE DEGREE PROGRAMS

APOGEE OFFERS MASTER of Engineering (ME) and Master of Science (MS) programs in ChE. Any person who holds a baccalaureate degree from an Engineers' Council for Professional Development (ECPD) accredited engineering school is eligible for admission to either of these programs. Prospective students who hold degrees from nonaccredited engineering schools will be required to take the Graduate Record Examination (GRE) prior to admission into a degree program. Under certain circumstances, persons holding degrees in related fields such as biology, chem-

istry, and pharmacy may be admitted into a degree program. Admission of such persons will be based on previous college studies, work experience, and any other factors deemed relevant.

The ME program requires a minimum of 30 semester hours of coursework for completion. The course requirements are listed in Table II. A student may elect to undertake a suitable engineering project in lieu of up to 6 semester hours of FREE ELECTIVE credit. However, most persons who wish to obtain an ME degree choose to do coursework only. Because neither a research project and thesis nor an engineering project is required for this degree, it lends itself well to the APOGEE program.

The MS is a research degree. The student who receives this degree must successfully conduct research in a suitable area of ChE and document his work with a written thesis. The coursework requirements for the MS degree are identical to those listed in Table II for the ME degree. The

TABLE II. Requirements for the ME Degree in Chemical Engineering

A. Required Courses	
Diffusional Operations	3
Chemical Engineering Thermodynamics	3
Chemical Process Analysis	3
B. Required Electives	3
One course to be chosen from the following	
Distillation	(3)
Chemical Reactor Design	(3)
Advanced Chemical Flow Systems II	(3)
A 700 level control course such as	
Dynamic Process Analysis	(3)
Computer Control I	(3)
Computer Control II	(3)
Modern Control Theory I	(3)
Modern Control Theory II	(3)
C. Free Electives	18
Graduate courses at the 500 level or above in engineering, mathematics, or chemistry. At least 6 of these credit hours must be in courses at the 700 level.	
Total Credit Hours	30

student must elect 6 semester hours of thesis preparation (ENGR 799). These credit hours may be counted as part of the FREE ELECTIVE requirement for the degree. A student who chooses to do so may complete his coursework via APOGEE. Under special circumstances, the thesis research may be completed at a location other than the main USC campus in Columbia. This

work would, of course, be conducted under the supervision of a member of the ChE faculty.

APOGEE also offers those who do not wish to pursue an advanced degree the opportunity to keep abreast of the latest technology. The College of Engineering at USC offers courses in energy systems, air and water pollution, computer process control, distillation, and chemical reactor design. In addition, the technical expertise of nationally and internationally known scientists and engineers is made available through video tape programs produced by the Association for Media-Based Continuing Education for Engineers (AMCEE) of which the College of Engineering at USC is a charter member.

THE SUCCESS OF APOGEE

THE APOGEE PROGRAM has experienced rapid growth since its inception in 1969. Table III shows the number of on-campus and APOGEE students in the graduate ChE program at USC for each year since 1971. This indicates that APOGEE has been well received by those chemical engineers in industry who wish to pursue an advanced degree in ChE.

TABLE III. On-Campus and APOGEE Students in the Graduate Chemical Engineering Program at USC

Year	ME		MS	
	On-Campus	APOGEE	On-Campus	APOGEE
1971	15	3	7	—
1972	14	12	8	2
1973	8	13	10	6
1974	4	23	11	4
1975	2	31	6	7
1976	1	31	6	4
1977*	0	25	8	4

*spring semester enrollment

The classroom performance of the off-campus students is also an indication of the success of the APOGEE program. It has been found that these students do as well as or better than the students who attend the classes live. The video tapes of lectures allow each student to go over certain parts of the material several times. This 'play-back' feature has been a beneficial teaching tool both for off-campus and for on-campus students

in the APOGEE program. The 'talk-back' broadcasts are well received by the students. These sessions often deal only with student questions. This student-teacher contact takes the place of that which is normally available to the on-campus student; contact which often teaches more than any formal lecture could. Thus, the APOGEE format of video taped lectures and live 'talk-back' television lectures has provided the student-teacher contact so important to engineering education and, at the same time, places no more demand on the instructor than preparation for a regular class would. APOGEE also provides direct interaction between the College of Engineering at USC and the industry of South Carolina. This interaction has not only stimulated discussions in the classroom but also provided a way of introducing practical graduate engineering problems into the coursework.

APOGEE has proven to be an unqualified success for both students and teachers. Its rapid growth and evolution make it a current and meaningful program of graduate engineering education. More information about the APOGEE programs in ChE at the University of South Carolina may be obtained by writing to the APOGEE Program Director, Dr. W. K. Humphries, at the College of Engineering, University of South Carolina, Columbia, South Carolina 29208. □

BOOK REVIEW: Uhl Continued from page 149.

conventional for capital costs, operating costs and profitability criteria. The emphasis in capital cost estimation is for "order of magnitude" and factored estimates. The profitability methods include discounted cash flow. Where this book differs from other works is in the presentation; it is terse and striking. There are many tables and figures to elucidate the concepts and examples to illustrate them. Some new, useful compendia appear; these are the fruit of the prodigious labors of Professor Woods. There is a survey of the single (Lang) factor approach to compute capital cost from the sum of the cost of the major pieces of equipment. Also, there is an extensive critical view of the various schemes for using more detailed factors in capital cost estimates. Unfortunately only passing mention is given to continuous interest, uncertainty analysis (which is not mentioned as such), and sensitivity.