Graduate Program Review

Petroleum Engineering Program

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Executive Summary

The graduate program commenced in 1986 with the approval of a M.S. degree. In the Fall of 2002, a doctoral program was initiated, and last, in the Fall 2007 a graduate certificate program was started. As the external reviewer my focus is on the doctoral program; however, many issues are common to all graduate students.

The strength of the program is its undergraduate education. Supporting evidence is the successful job placement of a majority of graduates, the career accomplishments of these graduates, and the generous “giving back” to the program in terms of endowments and gifts. This reputation has contributed to the explosion in the undergraduate population, unfortunately resulting in a strain on the faculty and resources to maintain the quality undergraduate education, while adding a viable research program.

The doctoral program is relatively new, and with significant faculty turnover in the past four years, has not had an opportunity to grow and flourish. Subsequently, a strong research program is absent. An identity is lacking; i.e., a research focus where a funding agency or a consortium of companies can associate your expertise to a particular research need. To overcome these obstacles the following items are recommended:

1. The additional hiring of more faculty to ease the heavy teaching loads of the current faculty and provide time for them to write grants, support graduate students and pursue research.

2. Consider hiring a senior faculty member to develop a research focus for the program, to foster a partnership with industry for support to this effort, and to network with funding agencies in promoting the program. A majority of current faculty are not in the position to accomplish this task. They are young and on the path of pursuing tenure.

The degree plan for a doctoral student is consistent with other U.S. universities. Lab facilities are adequate and the students believe improving. The students were satisfied with their education at TTU, and felt the faculty - student interaction was excellent. The student complaint was the inadequate stipends. A robust and viable research program would minimize this problem.

As a final note, I found it encouraging that the faculty (and chair) and students had the best interests of the program in mind. That is, all were looking to improve the program by providing constructive and reasonable ideas. No bitterness, whining or harsh criticism was evident.
Program Overview and Vision
Reviewers should examine the mission and organization of the academic unit, paying special attention to program planning, vision, and program size and compare this to their current strategic plan.

Grade Assessment: good to excellent

The Petroleum Engineering program has a long history of graduating top quality B.S. students. These students have gone on to have distinguished careers in the oil and gas industry.

The graduate program began with the approval of an M.S. degree in Fall 1986 in response to student and industry demand for more advanced knowledge. The doctorate program was approved in the Fall of 2002, and therefore is a relatively new program. A graduate certificate program commenced in the Fall 2007 to provide background petroleum engineering courses to students, whose previous B.S. degree was not in petroleum engineering and to provide preparation necessary for students entering the master or doctoral programs.

The undergraduate student enrollments have significantly increased in the past 7 years from 185 to 483, over 250% increase. The increase is a response to the external demand by industry for quality engineers, and the reputation of the program. The downside of this enrollment increase is it consumes the majority of time and effort of the faculty.

The graduate program currently (AY09-10) consists of 17 MS and 14 PhD students. To date, 13 students have had PhD degrees conferred since inception of the PhD program, with four additional graduates anticipated in the 09-10 AY.

The emphasis on undergraduate education is the strength of this program and its legacy. The development of a graduate program, particularly the doctoral program is new, and signifies an expansion into research.
Faculty Productivity

Factors that should be considered are: faculty profile, faculty scholarship and teaching awards, faculty teaching load, total faculty workload, and faculty service.

Grade Assessment: satisfactory

Of the seven tenure-track positions, five are progressing towards achieving tenure. The result is a relatively inexperienced faculty, working diligently to achieve tenure. All are in agreement that current teaching loads are too high at four to five courses per academic year; many with over 50 students per course and with associated labs. Evidence to support this claim is demonstrated by the high student: faculty ratio of 35:1. Typically, an assistant professor position is provided a reduced teaching load to allow him or her to establish a research program.

Available federal and state funding agencies for research in petroleum engineering are very limited. To be recognized many times requires a senior faculty member with a track record of research with these agencies or a research focus that is established as a strength of the program. As an example, the University of Tulsa is noted for its drilling engineering research, or the University of Texas for its reservoir characterization and enhanced oil recovery. In my opinion, both are missing at TTU and would greatly benefit from adding senior faculty and developing a research focus. Alternative funding is possible from industry in the establishment of an industry consortium. University of Tulsa and Texas A&M programs have such consortiums. Again, these take significant time and effort to initiate and more importantly, the industry will want to know what you are providing to them; i.e., what is your research focus/strength.
Quality and Quantity of Graduate Students and Graduates
Factors that should be considered are: student profile, student recruitment, student retention, program applicant pool, placement of graduates, career success of former students, student productivity, teaching/research assistant preparation, and support, and whether the program is at capacity and if so, why.

Grade Assessment: good

The doctoral graduate program consists of 14 students in the current (AY 09-10) year; of which four students are anticipated to be granted their Phd degree. The program is limited from growing due to the before-mentioned high workload in other areas. A typical profile of a PhD student is male and international. This demographic is consistent with other U.S. petroleum engineering programs.

The pool of applicants is significantly greater than the number admitted and enrolled. (For 2008, 22% of applicants were admitted and 7% of applicants enrolled). This is not surprising and is consistent with trends in engineering across the country. The quality of applicants as measured by the GRE scores is very good and comparable to the college of engineering average. One faculty member stated he felt the quality of graduate students was improving with this renewed emphasis on research.

Student productivity is reasonable and is improving. An increase in student publications to journals and conferences is recommended. The publishing of scholarly work is directly related to the research endeavors of the program, and thus is a good measure of success.

Placement of PhD graduates is typical for Petroleum Engineering. The demand for PhD students in industry is low, thus the primary market is academia. It is too early to assess the careers of former students since the program is relatively new.

The most significant issue is the limited financial support for student stipends. The students indicated the stipends were too low to cover expenses. Doctorate students receive on average $1,000 per month (excluding tuition credit). In comparison, at New Mexico Tech we provide a minimum of $1,500 per month (excluding tuition credit). The low stipends are a result of lack of research funding to support RAs and teaching assistantship money to support TAs. The program supports the students on “soft money”; i.e., endowments and fund raising, many of which specify for undergraduate students only. The faculty including the department chair, agree this problem needs to be resolved.
Curriculum and Programs of Study
Factors that should be considered are: degree requirements, course offerings and frequency, areas of specialization, nature and type of qualifying exams. Reviewers should determine if the program is compatible with similar programs in peer institutions.

Grade Assessment: good

The overall requirements for the doctoral program are consistent with similar petroleum engineering programs around the nation. The majority of requirements follow the TTU Graduate School guidelines as posted on the web. [Note: Neither on the petroleum engineering website or the graduate school website could I find the number of dissertation hours required. I assume the standard, minimum of 24 hrs, applies.]

A balanced curriculum in five core areas (drilling, production, reservoir, formation evaluation and computational) are offered. The coursework for each student must meet the approval of the student’s doctoral advisory committee. Even though each core area is covered every academic year, some courses are offered only every other year. For an M.S. student this maybe of concern; however, for a doctorate student this is probably not an issue.

Applicants for the doctoral degree must have a degree in engineering disciplines and must meet the approval of the department’s graduate committee. Leveling courses are offered in progress a student the appropriate level. A preliminary examination is required and must be successfully passed by the doctoral student by the end of their second semester. These examinations are based on the undergraduate curriculum. Each student is required to take and pass the diagnostic examinations in the area of drilling engineering, production engineering, reservoir engineering, and formation evaluation. The timing and content of the prelim exam is typical of most petroleum engineering PhD programs in the U.S.

In addition to regulations established by the Graduate School, applicants for candidacy for the doctor’s degree are required to demonstrate high proficiency in a single research area. The department has no specific foreign language requirement (but a foreign language for the Ph.D. degree can be specified at the discretion of the student’s dissertation advisor). Both of the above statements are typical for petroleum engineering programs. The former to promote research, and the latter due to the high number of foreign students in the PhD field who already know multiple languages.

Students did not mention curriculum or exams as a concern during the group session.
Facilities and Resources
Determine if existing space, library resources, information technology, and support staff are adequate to support the program.

Grade Assessment: good

A tour of the office and lab space appears adequate to the needs of the program. Investigation into the availability and adequacy of the library resources and IT was not done. In discussion with the student group, neither was presented as an issue.

The student group felt that an improved research environment (particularly lab equipment and space) has occurred over the last several years. The faculty concurs; however, there was some disappointment at the length of time to receive start up funds from the university. Both groups (faculty and students) and the department chair agree the website needs updating and re-designing.