Graduate Program Review – Department of Mechanical Engineering

Review Committee Report

The graduate program was reviewed in the spring semester of 2009. The committee consisted of TTU Profs. Roger Barnard (Mathematics), Mark Holtz (Physics), Hong Chao Zhang (Industrial Engineering), and external reviewer Prof. Afshin Ghajar (Mechanical Engineering, Oklahoma State University).

The process consisted of reviewing the documentation provided by the department, meetings with Prof. Jharna Chaudhuri, Chair, and Assoc. Prof. Stephen Ekwaro-Osire, Graduate Advisor. The efforts of these two individuals are greatly appreciated by the review committee. In addition, the review included separate meetings held with the general faculty, with graduate students, and a tour of the department facilities. The committee noted in the faculty discussion a clear lack of interest in this review process to improve the department. The committee perceives a distinct need for the faculty to contribute to the formulation of a plan to improve their graduate program, and then vigorously act on that plan.

1. Program Overview and Vision

The Department of Mechanical Engineering has as its stated vision “to be recognized as a top research and graduate ME department in the nation and the undergraduate ME department of choice in Texas.” Considering the first part of this vision, the subject of this review, the department offers a non-thesis course Master’s, a thesis-based research Master’s, and a dissertation-based Doctor of Philosophy.

The Department Chair clearly comprehends the mission and vision. As a well-qualified researcher herself, she understands the needs of the department and trajectory necessary to accomplish the graduate program objectives. To this end, the department has prepared a strategic plan, including nine goals\(^1\) to guide progress, aimed at increasing the quantity of PhD students while improving the quality of the student body and maintaining the Master’s degree programs. The review committee rates the overall vision of the department as good and achievable.

Recommendations: The committee fully supports the plan of the department to attain its stated mission, and encourages the faculty of the department and the university to provide cooperation, latitude, and resources required to realize this vision for the department.

2. Faculty Productivity

Rating: Good

The committee commends the graduate faculty on their qualifications and their efforts with their graduate students. The policies emphasizing the value of peer-reviewed publications are good. The recently developed document stating the criterion for promotion and tenure reinforces this and appears to be in the right direction to fulfill the department’s stated mission as a research-oriented department. A concern raised was the presence of inconsistencies in the CVs provided the committee in the self-study report. For example, there was a mixing of refereed journal articles and conference proceedings articles, and a clear distinction between their relative importance appears to be lacking. Overall the funding indicated a reasonable start toward their goal of becoming among the top 100 ranking ME departments. Several tables and figures in the self-study were confusing and contained inaccurate and misleading data as well as lack of information.

\(^1\) Several of these goals appear to be administration driven.
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The PhD production rates appeared low in comparison to the number of PhD students. It is clear that there is an uneven distribution among the faculty who are training the graduate students. Four faculty directed 37 of the 72 PhD dissertations in the last six years. Four faculty directed 57 of the 101 Master’s theses in the last six years. A more even distribution of these responsibilities is needed and the research-active faculty merit greater support in order to enhance productivity.

The overall workload for the untenured faculty is reasonable and appears to be sufficiently understood by them. The committee commends the chair in establishing and implementing this policy. With respect to the untenured faculty the committee was told that six of the seven newly hired assistant professors were told that they needed some definite improvements to better position themselves for tenure in a few years. Although this suggests a concern as to the quality of hires, it also shows the department’s desire to steadily improve and feedback to the untenured professors is commended.

Although the chair does not use an executive advisory committee, she does appear to readily appoint ad hoc committees to evaluate and make recommendations on critical issues.

The committee recommends the following:

- The chair needs to continue developing and implementing policies that assist the department toward realizing their vision of becoming a research oriented ME department ranked among the top 100, while fulfilling the needs of the graduate students, the college, the university, and the regional community they serve.
- Substantial discussion in the committee meeting with the general faculty suggests a broader departmental discussion should be held to discuss research versus teaching missions, particularly with respect to merit raises, priorities of expenditures, and workload. The discussion should be consistent with the graduate program’s stated vision of research as the primary goal.
- More joint efforts and mentoring between the productive senior faculty and the junior faculty could be helpful in their progress toward tenure.
- There are signs of over service and demands on the graduate recruiter/advisor. The committee recommends recruiting and advising be assigned as separate jobs.

3. Quality and Quantity of Graduate Students and Graduates

Rating: Satisfactory

The recently established requirement that PhD students must publish a refereed journal article before graduation is commended. Although it was noted that this could add to the time to graduate, which has been reasonable in recent years, the benefits to the student of the publication should outweigh the added time.

The department is experiencing growth in the number of graduate students, which is consistent with the goals statement. The majority of ME graduate students are from overseas. The domestic students are primarily TTU graduates. Although there is a difference of opinion among the department faculty, the B.S. and M.S. graduates who are upwardly mobile should be encouraged to apply to more highly ranked schools and the tendency to “inbreed” should be curtailed. In the long run this can improve the department’s image and produce benefits. The small ratio of minority and female enrollments to white males is consistent with nationwide statistics. A more
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concerted effort by the department to increase minority/female enrollment would improve the department (goal 1) and would be helpful to the university’s stated goal of increased diversity.

Among the applicant pool the GRE scores appear reasonable while the GPA as a metric of quality is problematic. Time to degree appears to be reasonable based on the data available to the committee. The placement of the MS graduates is reasonable and the placement of the PhD graduates is appropriate.

The recommendations of the committee include the following:

- Increase the productivity of quality PhD students by continuing to improve their research opportunities.
- Make/continue efforts to improve the minority-gender ratio.
- Several of the recommendations of the next section are guided toward improving the quality of graduate students and graduates.

4. Curriculum and Program of Study

Rating: Satisfactory

The course offerings, level, and frequency appear to be adequate for the Master’s students. However, the breadth, depth, and frequency of the courses for the PhD students appear to be significantly lacking in comparison with peer and more highly ranked institutions. More in depth course offerings by faculty in their specialty areas would be helpful. Alternatively, a reduction in the reliance on courses to educate PhD students would strengthen the research program. This is particularly feasible as more research-oriented faculty populate the department and specialty courses would be consistent with the research vision of the graduate program.

An ME Graduate Student Handbook, stating the specific requirements, the options, and the varieties of financial support available, would be particularly useful as was noted by many of the graduate students. Many of them pointed out that they receive sporadic documentation. The committee strongly recommends that this documentation be brought into a single handbook that is evaluated and revised on an annual basis.

There does not appear to be adequate quality control at the different levels of training. Students taking the non-thesis option seem to have little or no quality control, other than course grades.

Of special concern is the lack of a reasonable preliminary exam early in the PhD program, e.g., during the first or second year of enrollment, to determine the advisability of continuing in the program. There appears to be only a qualifying exam over the dissertation material late in the program, which very few or no students fail, and has the appearance of being ad hoc. This exam is permitted too late in the program to be useful to the students in assisting in their plans and studies, and too late to avoid “social” promotion. By producing a no-fail situation, the department does not further its stated research vision and does not appear to use the prelim process as a way to leverage students into an elevated state of achievement. The overall prelim procedure drew specific concern from the external reviewer.

The external reviewer made the point that the PhD program is neither compatible nor competitive with peer programs. The departmental report provided no information on PhD programs for their chosen peer institutions.
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There was no mention of any teacher preparation for the PhD students, although this was not of particular concern during the review.

The financial and advisory support to the students seems to be adequate in comparison to peer institutions based on data provided in the department report.

The recommendations of the committee include the following:

- Develop an ME-specific Graduate Handbook.
- Review all graduate degree programs so that policies and student direction are aligned with department vision statement.
- Increase the in-depth course offerings for the PhDs or move to a more research-oriented degree plan.
- Institute a reasonable PhD preliminary exam, as gauged by departments in peer institutions, at an early stage of the program.

5. Facilities and Resources

Rating: Satisfactory

Office spaces appeared to be adequate for the current faculty, although concerns were raised about space needed for future hires. Graduate student offices were mostly full and some were students have offices in labs.

Laboratory space was considerable, although in many cases it did not appear to be appropriate space nor did it appear to be efficiently used. There were several labs which were previously some form of high bay or factory halls which appeared to be designed for large-scale assembly. Some of this space was under renovation. Several of the spaces were well outfitted, although several had the majority of space dedicated to graduate student offices. Several of the lab areas were extremely cluttered and unkempt, giving the impression that little or no research was in progress in those areas and the sentiment that they should be more efficiently allocated. The committee assessment was that the department does not need more laboratory space, but it does need better laboratories.

There were no complaints about the availability of library resources.

There were several complaints from the graduate students about the availability of software licenses needed for their research. Much of this was isolated as a problem of the individual research groups not a department problem. Obviously, funding for research would go a long way to solving this problem.

IT facilities (hardware) appeared to be adequate and no concerns were raised. The department has one university funded staff member dedicated to IT, which appears to be working well. Other support staff included machinist (with one additional open position), secretaries, and student advisors. It was specifically noted by several faculty members that the advisors were a major asset to the department.

The recommendations of the committee include the following:

- Utilize existing space in a more efficient way.
- Pursue ways to improve lab spaces.