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Career Options in Engineering Education

Abstract

Engineers interested in careers in engineering education have options in the types of faculty positions and institutions to consider. Each position type has its own characteristics that should be evaluated by the individual when determining where they would most likely have a satisfying career. While some are drawn to tenure-track positions at traditional research universities, others choose lecturer positions or tenure-track positions at teaching institutions. Still others choose engineering technology or adjunct positions which allow them to teach either full or part-time and simultaneously practice as professional engineers. This paper discusses some aspects of the various types of positions available for individuals interested in a career in engineering education.

Introduction

Many people considering careers in engineering education pursue faculty positions at traditional research universities. These engineering schools and departments are typically large and the program offerings wide ranging such that a number of positions are advertised and filled each year. To succeed in these positions, faculty must contribute significantly through research to the development of their discipline. Performance expectations are high and often include measurable amounts of grant funding and journal articles while also achieving some level of proficiency in teaching and service. For many, this is their goal and efforts are expended to achieve tenure at such institutions. For others, a career in engineering education is sought where the expectations for scholarship, teaching and service are more in line with the interests of the individual.

At the 2002 ASEE Annual Conference and Exposition, two papers[1-2] discussed the advantages and disadvantages of lecturer positions, relative to tenure-track positions in engineering at research universities. While a lecturer position is one option available for those more interested in teaching than research, other faculty positions also emphasize teaching excellence over grant money and research accomplishments. Each position has its own characteristics that may be viewed as either advantages or disadvantages by different people. Tenure track positions in engineering technology[3-7] and at predominantly undergraduate teaching institutions[8-10] provide other options for those not interested in traditional tenure-track positions at research universities. Visiting positions,[11-12] adjunct[13-15] and laboratory instructor positions also provide alternatives to tenure-track positions at various institutions.

Most graduate students looking for academic positions have come through a traditional engineering science program and have attended a research university as part of their education. In addition to tenure-track positions at traditional research universities, tenure-track positions in engineering technology programs are quite common in a number of states and engineering fields and offer an alternative to tenure-track faculty positions at traditional research universities. In addition, institutions often utilize faculty of different ranks to educate students in their programs.[1,2] Institutions utilize tenured or tenure-track faculty, research faculty, lecturers and

adjunct faculty to various extents in achieving their educational objectives. Individuals interested in a career in academia may not be familiar with the range of options available and the aspects of each type of position. To help aspiring engineering educators determine where they will most likely be happy and succeed, this paper considers the various types of faculty positions available at different institutions and discusses their features which prospective educators must evaluate relative to their individual preferences.

Overview of Faculty Positions Available in Engineering and Engineering Technology

The different types of faculty positions will now be discussed. Each position has its characteristics relative to job security, position requirements and expectations, and intellectual stimulation. For many people, a truly perfect faculty position may not exist. A person considering a career as an engineering educator must consider their own goals and personal preferences when deciding which type of position will best match with their background and career goals.

Tenure-Track Position in Engineering at a Research University

This traditional faculty position requires a Ph.D. or equivalent, offers job security on achieving tenure and a high level of professional prestige. An intellectually stimulating environment is maintained through research and interaction with graduate students and professional colleagues. The teaching load is relatively light and is supported by graduate students. Research facilities and collaboration opportunities are generally good and sabbaticals typically provided.

The expectations are relatively high for obtaining sufficient grant funding, attracting and graduating graduate students, and producing sufficient quantity and quality of published journal articles. The pressure to perform and stress associated with such positions are significant and require individuals to often make substantial sacrifices in other areas of their lives during the tenure process.[1-2]

Tenure-Track Position in Engineering at a Teaching University

These faculty positions offer job security on achieving tenure, professional prestige, and an intellectually stimulating environment through interaction with primarily undergraduate students, research and professional interactions. The teaching load is often higher than at research universities but usually has some support from graduate students or upper division undergraduates. Research facilities and collaboration opportunities may not be as good, especially at smaller schools, but sabbaticals are typically provided.

Evolving missions of these institutions has resulted in rising expectations for seeking grant funding, and publishing appropriate journal articles generally without a corresponding increase in resources or reduction in teaching load. The pressure to perform and stress associated with such positions are significant and require individuals to often make sacrifices in other areas of their lives during the tenure process. These schools are generally smaller and open positions less frequently available.

Tenure-Track Position in Engineering Technology (ET)

These faculty positions offer job security on achieving tenure, but professional prestige is generally lower. At the same time, there are generally no expectations for obtaining external grant funding and publishing requirements are less demanding than for engineering faculty. Intellectual stimulation and challenges may be more limited, but through interaction with undergraduate students and applied research, individuals can be challenged technically. The teaching load is higher than in engineering programs and generally lacks support from graduate students. Research facilities are limited and collaboration opportunities may not be as good, especially at smaller schools. Engineering technology programs are intended to prepare graduates for careers in engineering practice using current applications and technology. Courses in engineering technology programs tend to be more hands-on, often including a heavy laboratory component, and incorporating practical applications from industry.[6] As such, the TAC of ABET requires ET faculty to have professional experience and many ET faculty are active in industry as practicing professional engineers. This provides opportunities for applied research through which ET faculty can prepare scholarly publications sufficient to achieving tenure.[5-6] In addition, the new ABET criteria[16-17] have eliminated requirements of minimum degrees for faculty. Faculty must still be qualified for a given job, but the educational background is not specified. Since research is usually not as critical for ET faculty as teaching, many ET programs will hire faculty with only a Master's degree. As a result, a broader pool of applicants and experiences may be available from which ET programs benefit. Sabbaticals are typically provided and may be used for a variety of professional development activities including course development, discipline specific research and professional education activities.

Rising expectations for scholarship without a corresponding reduction in other requirements have resulted in excellent teaching no longer being the sole requirement for tenure.[6-7] Thus ET faculty must have a plan for professional development that will meet the institution's expectations. Scholarship in engineering technology often focuses on applied research presented at technical conferences, or publications of a pedagogical nature.[5-6] With fewer resources and support than at a research university combined with heavy teaching loads, ET faculty must be creative in planning their scholarly activities.[6] The pressure to perform and stress associated with such positions are not as significant as at research universities, but they still require individuals to make sacrifices in other areas of their lives during the tenure process. One disadvantage with ET programs is the limitation on the number of schools offering engineering technology in certain parts of the country, and the lack of ET programs in certain engineering fields. Professional licensing issues for ET graduates have decreased the number of programs offering ET programs. ET programs tend to be more common in the eastern and several Midwestern states and in states with favorable licensing laws for ET graduates, such as Pennsylvania and Georgia. While a number of schools offer electrical and mechanical engineering technology, fewer programs are offered in fields such as manufacturing, civil and architectural engineering technology. Fields such as chemical or biomedical engineering are typically not taught at the engineering technology level.

Lecturer/Instructor Positions

A lecturer or instructor position does not offer job security in the same way as a tenure-track position does. However, a good lecturer or instructor is valuable in many engineering and engineering technology programs and will often remain on the faculty on a long term basis, following periodic reviews. The teaching load is higher than for tenure track faculty and to replace a good lecturer can be difficult.[1-2] Lecturers at research universities often have graduate as well as undergraduate teaching responsibilities.[1-2] They may be allowed to serve on graduate committees and have opportunities to perform research without the publication requirements.[1-2] Lecturers may have lower professional prestige than their tenure-track colleagues, but there are generally no expectations for obtaining external grant funding. At research universities, intellectual stimulation and challenges are available through interaction with tenure-track faculty and graduate students. At smaller schools and in ET programs, intellectual stimulation and challenges may be more limited, but through interaction with undergraduate students and applied research or consulting, individuals can be challenged technically. The teaching load is generally higher than for tenure-track faculty in engineering programs but at research universities lecturers typically have support from graduate students for grading. Lecturers at smaller schools however, may not have assistance with grading. Although sabbaticals are generally not available to lecturers, since the primary expectation is proficient teaching, summers can be spent on professional activities or personal endeavors, since professional development activities are not essential for continued employment.

Some may view the lack of job security offered by a non-tenure-track position and the need for contract renewal on a regular basis as a disadvantage. At some institutions lecturers may be made to feel second class resulting in dissatisfaction in their jobs. Teaching loads are higher and sabbaticals are generally not available, although summers can provide an opportunity to reinvigorate between semesters.

Adjunct Positions

Adjunct or part-time faculty are being utilized more and more in engineering and engineering technology programs as departments look to reallocate tenure-track positions, to teach courses related to professional practice,[13-14] or in disciplines where there is a lack of expertise either due to retirements or for newer or cutting edge technologies. Adjunct and part-time faculty often have other jobs or family responsibilities but are still interested in the rewards of teaching. They may have choices of courses and time slots or they may fill in where and whenever needed. Some programs greatly benefit from the professional practice expertise the adjuncts bring to their programs and students.[13-14] The interactions with students can be a rewarding aspect of the job for an adjunct professor who may be transitioning away from a dissatisfying job. In other cases interactions with students may be difficult due to not being on campus full time. Schedule conflicts between their full-time job and the adjunct position may also make an adjunct professor's work difficult.

Visiting Professor

A visiting professor position is typically for a fixed time to teach courses during a sabbatical or while a permanent position is being filled. Generally they are not renewable, although a failed search may result in renewal. If a search is ongoing, the visiting professor may apply for the

position, but there is no guarantee that the individual will be offered the position, or even interviewed for it, potentially creating a tense situation as on campus interviews occur.[12] Visiting faculty are required to teach and the course load could be high or low, depending on the institution. As outsiders in a department, visiting faculty may not be fully welcomed by colleagues, as well as students. At other institutions visiting faculty are welcomed and appreciated for the refreshing contributions to the department.[11-12] Visiting faculty are generally free from the research and service requirements of tenure track faculty, but the term of employment is finite.[12] As many individuals in visiting positions are eventually seeking a permanent faculty position of some sort, they often perform some service activities for their department and prepare scholarly publications to help improve their CV before searching for a permanent position.[11-12] A visiting faculty position can provide a needed break between the rigors of graduate school and a tenure track position.[12] Developing good teaching skills through experiences gained in a visiting position will enable a new faculty member to focus more on the research requirements once they begin a tenure-track position.[11-12]

Advice for Aspiring Engineering Educators

To evaluate various faculty positions and institutions, prospective engineering educators have several resources to help in the process. In addition to reviewing publications and web sites of various universities and programs, several national publications are available which classify or profile various institutions. ASEE annually publishes "Profiles of Engineering and Engineering Technology Colleges,"[18] giving statistical summaries, information, and profiles of universities and programs throughout the country. The Carnegie Foundation for the Advancement of Teaching[19] classifies institutions of higher education based on various institutional characteristics. U.S. News and World Report[20] annually provides national and regional rankings of America's universities and major areas of study based on their Carnegie Classification.[19] Reviewing these publications relative to advertised faculty positions can help prospective educators compare the institutions and positions.

Quantifying the differences between several positions so an individual can assess their preference for one position over another may be difficult, but a table can be used to provide a sense of the differences. Table 1 presents a hypothetical example by which an individual might consider the differences between the requirements, expectations, advantages and disadvantages associated with several types of positions when deciding how to focus their job search.

Summary

Different types of engineering faculty positions are available at a variety of institutions. Each position has its unique characteristics which may be advantages or disadvantages to a given individual. While no one position is perfect for everyone, most people will find several types of positions where they will be able to succeed and have a satisfying career. An individual interested in a career in engineering education must evaluate their goals, motivation and true interests in deciding where they would most likely have a successful and rewarding career. Someone with a strong interest in conducting research and having high level intellectual interactions will most likely prefer a research university, as long as they are motivated toward the level of work required to succeed. Others may be better off at a teaching university where

research is still important, but good teaching is rewarded and helping students learn is more rewarding to the individual than research accomplishments. Lecturer, adjunct and visiting positions offer lower stress and job pressure, while still providing the rewards of helping students learn and grow and may be ideal for certain individuals. Engineering technology positions provide an option where excellent teaching and student interaction are highly valued, programs tend to be more hands-on and less theoretical, and scholarly activities focus more on applied research or pedagogical developments designed to improve student learning. Whichever type of faculty position a person chooses to pursue in engineering, they should fully understand the expectations of the position, develop a plan to successfully fulfill those expectations, and use their talents and abilities to create a rewarding and satisfying career in engineering education.

Table 1. Hypothetical example comparing several faculty positions

Institution Type	**Research University**	**Research University**	**Teaching University (Undergrad. Only)**	**Teaching University (Grad. Program)**	**Teaching University (Undergrad. Only)**
Position Type	Engineering/ Tenure Track	Engineering/ Lecturer	Engineering/ Tenure Track	Engineering/ Tenure Track	Engineering Technology/ Tenure Track
Teaching Load (credits/year)	3 + 6 = 9	9 + 9 = 18	9 + 9 = 18	6 + 9 = 15	12 + 12 = 24
Research Requirements	Significant	No, but available	Some	Yes	Some
External Funding Requirements	$$$$	No	$	$$	No
Publication Expectations	Significant/ Top Journals	Not Required	Some/ Midlevel Journals	Significant/ Midlevel Journals	Some/ Lower level Journals, Conf. Proceedings
TA's	Grad. Students	Grad. Students	Maybe	Grad. Students	No
Sabbaticals	Yes	No	Yes	Yes	Yes
Intellectual Stimulation	High	High Potential	Moderate Potential	Moderate Potential	Moderate Potential

Bibliography

1. Bullard, L., Knoll, P., and Saterbak, A. "Choosing the Road Less Traveled: Alternatives to the Tenure Track." Proceedings, 2002 ASEE Annual Conference, Montreal, Canada, June 2002.
2. Bell, J., Ford, A., Goncharoff, V., Montgomery, S., Reed, D., Theys, C., Troy, P., "Lecturer – An Alternative to the Tenure Track," Proceedings, 2002 ASEE Annual Conference, Montreal, Canada, June 2002.

3. Fox, P.L., and Hundley, S.P. “Engineering Technology Faculty: Attract, Retain, and Motivate Through Total Compensation and Work Experiences.” Proceedings, 2002 ASEE Annual Conference, Montreal, Canada, June 2002.
4. Lipscomb, J.W. “Acquiring Tenure in Engineering Technology.” Proceedings, 1999 ASEE Annual Conference, Charlotte, NC, June 1999.
5. Lozano-Nieto, A. “Integrating Teaching, Research and Service to Develop Scholarly Publications.” Proceedings, 2002 ASEE Annual Conference, Montreal, Canada, June 2002.
6. Rose, A.T. “Role of Consulting Engineering Experiences for Civil Engineering Technology Faculty and Other Engineering Educators in the Next Century.” (FIE New Faculty Fellow Grant Paper), Proceedings, 2000 Frontiers in Education Conference, October 18-21, 2000, Kansas City, MO.
7. Rennels, K. “Mission Creep in Engineering Technology Education?” Proceedings, 2003 ASEE Annual Conference, Nashville, TN, June 2003.
8. Haering, W. “Technical Engineering Research, Publication and Pedagogical Scholarship in a Teaching Oriented Small Campus Environment.” Proceedings, 2005 ASEE Annual Conference, Portland, OR, June 2005.
9. Finley, D., “Tips for Greasing the Tenure Track 3,” Proceedings, 2001 ASEE Annual Conference, 2001.
10. Engelken, R.D. “Engineering Research at Predominantly Undergraduate Institutions: Strategies and Pitfalls for the New Engineering Educator.” Proceedings, 1999 ASEE Annual Conference, Charlotte, NC, June 1999.
11. Murad, M. M. and Samples, J. “Challenges and Opportunities in Visiting and Tenure Track Positions.” Proceedings, 2003 ASEE Annual Conference, Nashville, TN, June 2003.
12. Owens, L. “Just Visiting.” The Chronicle of Higher Education (on line) Chronicle Careers (URL http://chronicle.com/jobs/2005/09/2005092901c.htm), Accessed Sept. 30, 2005.
13. Massie, W.W. “Bringing Practicioners (and Practice) into the Curriculum.” Proceedings, 2004 ASEE Annual Conference, Salt Lake City, UT, June 2004.
14. Falkowski, S.A. “Bringing Members of Industry into the Teaching Profession.” Proceedings, 2005 ASEE Annual Conference, Portland, OR, June 2005.
15. Lo, J.L., Knott, T.W., and Gregg, M.H. “Transitioning from Adjunct to Tenure Track.” Proceedings, 2005 ASEE Annual Conference, Portland, OR, June 2005.
16. Technology Accreditation Commission, ABET, “Criteria for Accrediting Engineering Technology Programs (2005-2006)” URL http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/T001%2005-06%20TAC%20Criteria%209-15-05.pdf, accessed March 3, 2006.
17. Engineering Accreditation Commission, ABET, “Criteria for Accrediting Engineering Programs (2005-2006)” URL http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/E001%2005-06%20EAC%20Criteria%209-15-05.pdf, accessed March 3, 2006.
18. ASEE, “Profiles of Engineering & Engineering Technology Colleges.” 2004 edition, American Society for Engineering Education, Washington, D.C., 2005.
19. The Carnegie Foundation for the Advancement of Teaching. “The Carnegie Classification of Institutions of Higher Education.” URL: http://www.carnegiefoundation.org/classifications/, accessed March 3, 2006.
20. U.S. News & World Report. “America's Best Colleges.” URL: http://www.usnews.com/usnews/edu/college/rankings/rankindex_brief.php, accessed March 3, 2006.