

**Florida Atlantic University
College of Engineering**

**PROGRAM REVIEW
And
DEPARTMENTAL PERFORMANCE REVIEW**

**Prepared by
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The purpose of this review of programs in the College of Engineering is twofold. It is intended to serve (1) as a Program Review, as required by the Florida Division of Colleges and Universities (FDCU), and (2) as a Departmental Performance Review, as required by the Florida Atlantic University (FAU) Board of Trustees (BOT). This Review is compliant with the policies of the FDCU and with the guidelines and procedures of the BOT, included here as Attachment A.

According to BOT guidelines, the FAU Office of Institutional Effectiveness and Analysis (IEA) is to prepare annually a report of Department Dashboard Indicators (DDIs) that provide program performance data for the past three years. DDIs for the College of Engineering for 2002-2003 are included here as Attachment B. The accompanying Program Assessment Reports, providing program goals and outcomes for student learning, research, and service appear in Attachment C. This Review also incorporates findings from recent program accreditation reviews by the Accreditation Board for Engineering and Technology (ABET).

BOT guidelines also require that the Dean of the College review the DDIs and Program Assessment Reports with the departments and submit to the Provost an overall assessment of the department's performance. These performance assessments are provided herein.

ABOUT THE COLLEGE

The College of Engineering provides strong programs of teaching and research through five academic departments and twelve research centers. Degrees through the PhD are offered in five disciplines: Computer Science and Computer, Electrical, Mechanical, and Ocean Engineering. Academic offerings also include Baccalaureate and Master's degrees in Civil Engineering, a Master's degree in Manufacturing Systems Engineering, and a graduate certificate program in Bioengineering.

With a headcount enrollment of 2,600 and some 75 tenure-track faculty, the College ranks nationwide as a "mid-sized" college of engineering. The College is known for its strong teaching and advising, for its outstanding record of success in student diversity, and for its extensive programs of research. Expenditures from externally-funded contracts and grants are in excess of \$9M annually.

COLLEGE OVERVIEW

Fortunes of individual departments and programs are inextricably linked with the fortunes of the College. In this section, we present an overview of overall College status, performance, and resources. This information provides context and important benchmarks for review of individual program performance in the sections that follow. In brief, College productivity has increased in recent years and College resources have declined.

ABET Accreditation Reviews: Undergraduate programs in the College of Engineering are accredited by the Accreditation Board for Engineering and Technology (ABET). The Computer Science program is accredited by the Computer Accreditation Commission of ABET and the engineering programs are accredited by the Engineering Accreditation Commission.

All programs, except our new program in Civil Engineering, underwent accreditation reviews in October, 2002. The College was commended for its Improvement and Assessment Plan, its Resource Management Plan, and for its senior capstone design experiences. Satisfaction with the academic programs – curricula, educational objectives, student learning outcomes, instruction, advising, and student professional development – was high.

In August 2003, ABET extended accreditation of the aforementioned programs until September 30, 2005, with further extension to a full six-year period of accreditation requiring submission of an Interim Report by July 2004 showing acceptable resolution of designated problem areas related to Institutional Support. Absence of an identifiable source of continuing funding for laboratory equipment and lab staff support is the primary issue. The College and the University are working diligently to identify funds to address ABET concerns.

Our new Civil Engineering baccalaureate program, which began in fall 2001, underwent ABET review for initial accreditation in October 2003. The draft accreditation report, received in February 2004, was highly complimentary of the Department and its accomplishments in its short period of existence. The Chair, faculty, staff, students, and supporters from business and industry are to be commended for their outstanding efforts. As with our other engineering programs, lab equipment and lab staff were identified as problem areas requiring immediate attention. Provision of adequate numbers of faculty to serve the rapidly increasing program enrollments also was listed as a concern. The final accreditation report is expected in August 2004.

Program Assessment Reports: Each academic program in the College has a comprehensive set of goals, learning outcomes, and assessment procedures encompassing the principles of continuous quality improvement and supportive of institutional and College missions, goals, and objectives. Student learning at the undergraduate and graduate levels, research, and service are addressed. These efforts support both University assessment requirements and the requirements of ABET. These items appear in Attachment C.

Departmental assessment reports and plans for 2002-2003 all were rated as Adequate or Strong by the FAU Director of Assessment. One exception was for the baccalaureate program in Civil Engineering, which was rated as weak. This program was very new at the time and did not yet have available a full suite of assessment data. The success of this program in its recent ABET accreditation review demonstrates clearly that this situation has been resolved.

Dr. Gary Salivar, Chair of Mechanical Engineering and an expert in continuous quality improvement, serves as College Coordinator for Improvement and Assessment. He and the Chairs work continuously to improve assessment plans and procedures and to translate outcomes to program improvements. The College places high priority on these efforts, as does our accreditation agency (ABET).

Enrollment Trends: Undergraduate enrollments in the College of Engineering mirror national trends. Graduate enrollments closely follow the levels of funding available for graduate student stipends and tuition waivers. As indicated in Section I.B5 of the DDIs, College annual headcount enrollments in 2002-03 totaled 2603 - 1935 Undergraduate, 445 Graduate, and 223 Non-Degree. On a national scale, these numbers would rank the FAU College of Engineering as “mid-sized”.

Undergraduate enrollments have grown substantially (up 41.9% since 1997-98), but declined slightly in 2002-03. This decline is largely attributable to softening of enrollments in Computer Science, a nationwide trend. Reversal of this trend is expected as demand for computer technology accelerates with the expanding national economy. Potential impact on College enrollments from the growing practice of outsourcing of high technology jobs from the U.S. is unknown at present.

Graduate enrollments are up 21.2% over the past two years, reflecting the College’s continuing strength in funded research and its emphasis on graduate studies. The College is a major provider of graduate courses and instruction for the Florida Engineering Education Delivery System (FEEDS), the State’s renowned distance learning program for serving Florida business and industry. One-third of the College’s annualized FTE at the graduate level comes from students enrolled through FEEDS (see Section I.C1 of the DDIs).

Student Diversity: The College has a strong record of performance for women and minorities. Of the 209 baccalaureate degrees granted in 2002-03, 23% were awarded to women, 39% to minorities, and 20% to foreign nationals. These figures for women and minorities are well above national averages for engineering. Thirty-five percent (35%) of the 108 Master’s degrees awarded went to women.

In a recent ranking of top 50 U.S./Canadian engineering schools¹, our College of Engineering ranked 14th in Engineering Bachelor’s Degrees Awarded to Women, 20th in Engineering Bachelor’s Degrees Awarded to African Americans, and 31st in number of Electrical/Computer Engineering Degrees Awarded. Additional information on student diversity is provided in Section I.B6 of the DDIs.

Student Satisfaction: College results from surveys of Student Perception of Teaching and of Satisfaction with Courses, Instruction, and Advising (DDIs, Sections I.E1-3) mirror closely overall results for the University. The College is known for excellent instruction and for strong student advising. Regular faculty members provide instruction for a very high percentage of

¹ *Profiles of Engineering and Engineering Technology Colleges-2002*, American Society of Engineering Education.

courses in the College (DDIs, Section I.B3). This is fitting, given the highly specialized nature of engineering and computer science programs.

Funded Research: The College of Engineering expects to be a leading contributor toward the University goal of \$100 million in funded research and achievement of Carnegie classification as Doctoral/Research University – Extensive. Our commitment is firm and our programs are uniquely positioned to address research needs of regional, State, and national priority.

Among other projects, the College is a major participant in the State of Florida \$10M Center of Excellence for Biomedical and Marine Biotechnology, in a \$5.25M Federal earmark for Coastline Security, and a \$3M earmark for Secure Telecommunication Networks. Our Imaging Technology Center, currently funded at an annual level in excess of \$2.5M by NASA, ONR, Panavision, and others, is a leader in design and development of high definition imaging systems. FAU-developed cameras are expected to be on board when NASA space shuttle flights resume, they currently are being used on U.S. Navy aircraft carriers for surveillance and security, and they may well be the power behind the scenes on a future blockbuster movie.

College expenditures from externally-funded grants and contracts totaled \$9.02M in 2002-2003 (see DDIs, Section II.C3), which equates to 44% of the \$20.51M total College budget. Indirect costs accruing to the University from this research totaled \$1.98M and total salary recovery amounted to slightly more than \$575K. This funding was generated by 34.9 FTE personnel paid on a faculty pay plan (Section II B.1 of the DDIs), which equates to the highly respectable figure of \$285,000 per FTE personnel.

Creative and Scholarly Activities: All programs of the College are very actively involved in creative and scholarly activities, including development of courses and curricula, publication of journal and conference articles, authoring of books and book chapters, and presentations of seminars and colloquia. Additional information is provided in Section II C.1 of the DDIs.

Service: All departments in the College are strong in terms of service, both for departmental, College, and University governance and for service to business, industry, the community, and the profession. Service to the profession includes items such as review of professional books, journal articles, and research proposals; editorial positions with professional publishers; service with a wide variety of advisory groups and panels; and service as an officer or speaker for professional societies. Additional information is available in Section III. B.1. of the DDIs.

Faculty: Faculty members are the most important resource of the College. While College productivity has been increasing, numbers of faculty have been decreasing. Budget cuts and realignments have required the College to lapse faculty positions to use for operating funds.

From fall 1995 to fall 2003, the College lost the equivalent of twenty-two (22) nine-month tenure track faculty positions² - a 23% decline in faculty man/woman power. This situation is placing severe restrictions on the ability of the College to meet instructional needs in Computer Science & Engineering; to expand academic offerings in promising new areas such as Bioengineering and Nanotechnology; and to grow programs of funded research. The inability to hire new

² *College of Engineering Questionnaire for Review of Engineering Programs (Self-Study Reports), ABET, 1995 and 2002 (data updated to fall 2003).*

faculty, even to replace retirements and resignations, is depriving the College of the vitality, energies, and ideas that accompany “new blood”.

Staff: Staff support in the College has improved over the last two years, but still is inadequate. Technician support for laboratories is an accreditation issue and remains a high priority need. With inadequate staff support, faculty members end up having to do lab setups and equipment maintenance and repairs – a very inefficient use of their time and expertise.

Graduate Teaching Assistants (GTAs) also are a problem of long standing. Over the period from fall 1995 to fall 2003, the number of FTE GTAs in the College declined by 59%². A GTA/faculty ratio of 1 to 2 is generally considered necessary to provide adequate support for a faculty actively engaged in research as well as in teaching. The GTA/faculty ratio in the College currently is about 1 to 6. Very recently, the FAU Division of Research & Graduate Studies provided the College additional funding to support Graduate Teaching Assistants, which will bring this ratio to about 1 to 4 – a good improvement and tremendous help to the College, but not a total solution.

Space: Space is the most serious challenge facing the College of Engineering. Additional space on the Boca Raton campus is required immediately; else the College will have no alternative but to cap its research efforts and to hold on development of new courses, programs, and other academic initiatives needed to sustain enrollment growth. We simply are out of space to put people, either in labs or in offices. In the intermediate term (18-24 months), some additional space for the College has been identified. Short term and long term space needs remain critical.

DEPARTMENTAL/PROGRAM REVIEWS

BOT Guidelines require that the Dean of the College provide the Provost an overall assessment of departmental performance. These evaluations, based upon detailed performance data from the DDIs (Attachment B) and from the Program Assessment Reports (Attachment C), are presented in this section. They are based primarily upon productivity. The College of Engineering is blessed in having highly competent faculty and staff. Quality is not an issue.

Any assessment of program performance must be tempered with consideration for the fact that funding support for programs has declined significantly in recent years. This is particularly true for the number of Ph.D. degrees awarded, which is the College’s one area of general concern. These numbers have declined over the past 5-6 years, along with diminishing funding support for graduate students.

A generally accepted guideline for assessing the viability of engineering programs is that doctoral programs should average at least three (3) graduates per year, that master’s programs should average at least five (5) graduates per year, and that baccalaureate programs should average at least ten (10) graduates per year. College production of PhD degrees currently is about half that projected by this guideline. With Electrical Engineering as an exception, this shortfall is spread over all departments. The College and University are making every effort to identify funding to support increased production of doctorates to a level of 15-20 per year.

At the baccalaureate level, all programs except Civil Engineering exceed the guideline of ten or more graduates per year. Civil Engineering, new in fall 2001, clearly will meet the guideline

after sufficient time has passed for students to progress through the curriculum and graduate. With the exception of Mechanical Engineering, all programs meet or exceed the guideline of five or more graduates per year for master's programs. As will be discussed later, the Master's program in Manufacturing Systems Engineering is being phased out.

Civil Engineering: Formed July 1, 2001, this department offers degrees at the baccalaureate and master's level. The B.S. degree program started in fall 2001; the Master's program was transferred from the Department of Ocean Engineering, where it previously was administered. A doctoral program is planned within the next five years.

Since the Department is so new, current DDI data for this program has little significance. Suffice it to say that the Department is off to a very strong start. Departmental leadership has been particularly effective in establishing a productive and collegial atmosphere for faculty and students, in establishing ties with civil engineering business and industry, in student recruitment, and in preparing the undergraduate program for accreditation review.

DEAN'S EVALUATION OF PERFORMANCE Civil Engineering S=Satisfactory U=Unsatisfactory				
Item	UG	MS	PhD	
Enrollments/Degrees Granted	S	S-	NA	
Student Satisfaction				S
Funded Research				S
Scholarly Activities				S
Service				S

Civil Engineering has the potential to become one of the stronger departments of the College within the next few years, provided the additional faculty, space, and operational resources it needs to sustain growth are forthcoming.

Computer Science & Engineering: Computer Science & Engineering, which offers degrees through the doctorate in both computer science and in computer engineering, enrolls over half (53%) of the students in the College of Engineering. The Annualized FTE per Faculty Instructional Year (DDI, Section I.D1) and Degrees Awarded per Faculty Instructional Year (DDI, Section I.D2) are extremely high, both by local and by national standards. These programs have been under tremendous accreditation pressure because of their stratospheric student/faculty ratios. The College and University have made every effort to address this problem over the past two years through addition of faculty and increased funding support for adjuncts and Graduate Teaching Assistants. DDI data show that progress has been made (e.g.,

FTE/Faculty Instructional Year has declined from 24.2 in 2000-01 to 22.3 in 2002-03), but staffing problems in this department are far from resolution.

This department is well along in a transition from being primarily a teaching unit to a unit with a strong complement of funded research. Departmental leadership, along with a cadre of outstanding young faculty, is placing increased emphasis upon research and graduate studies. This is fitting, as some of the best opportunities for research available to the College fall within the purview of this Department. Expenditures for grants and contracts in Computer Science & Engineering exceeded \$1million in 2001-02 and in 2002-03.

DEAN'S EVALUATION OF PERFORMANCE				
Computer Science				
S=Satisfactory U=Unsatisfactory				
Item	UG	MS	PhD	
Enrollments/Degrees Granted	S+	S+	S-	
Student Satisfaction				S
Funded Research				S
Scholarly Activities				S
Service				S

DEAN'S EVALUATION OF PERFORMANCE				
Computer Engineering				
S=Satisfactory U=Unsatisfactory				
Item	UG	MS	PhD	
Enrollments/Degrees Granted	S+	S	S-	
Student Satisfaction				S
Funded Research				S
Scholarly Activities				S
Service				S

The Department of Computer Science & Engineering is a very strong program, on the verge of national and international prominence. Whether or not it can take this additional step will depend largely upon whether its needs for additional faculty and space can be met.

Electrical Engineering: Electrical Engineering offers degrees through the doctorate. This department also is in transition from being primarily a teaching unit to a unit with a strong complement of funded research. Departmental leadership and faculty are placing increased emphasis upon research and graduate studies. Undergraduate enrollments have declined in recent years, in keeping with national trends. Graduate enrollments have remained stable, reflecting the departmental commitment to graduate studies.

An emerging effort in Bioengineering holds great promise. Not only is this area attractive to students (a new graduate certificate program attracted an enrollment of forty-five in the first course offering in fall 2003), but the potential for research funding is high. Opportunities are outstanding for collaboration with the FAU College of Science, the FAU Biomedical program, and emerging programs with Scripps.

DEAN'S EVALUATION OF PERFORMANCE Electrical Engineering S=Satisfactory U=Unsatisfactory				
Item	UG	MS	PhD	
Enrollments/Degrees Granted	S	S-	S	
Student Satisfaction				S
Funded Research				S-
Scholarly Activities				S
Service				S

The Department needs an infusion of new faculty blood and additional laboratory space and facilities to support the Bioengineering effort and other areas of research and graduate studies.

Mechanical Engineering: Mechanical Engineering offers degrees through the doctorate. Undergraduate enrollments have increased in recent years, contrary to national trends. Funded research and graduate degree production need to be strengthened.

With programs structured to serve Pratt & Whitney, Motorola-Boynton, and other large mechanical engineering enterprises in south Florida – enterprises that no longer exist – the Department needs to transition to a new identity and to new areas of activity. Emerging efforts

in Biomechanics, Nanotechnology, Fuel Cells, and Computational Engineering are attractive to undergraduate and graduate students and offer strong potential for research funding.

DEAN'S EVALUATION OF PERFORMANCE Mechanical Engineering S=Satisfactory U=Unsatisfactory				
Item	UG	MS	PhD	
Enrollments/Degrees Granted	S	S-	S-	
Student Satisfaction				S
Funded Research				U
Scholarly Activities				S
Service				S

Lack of resources is severely slowing the metamorphosis this Department needs to make. The College is actively working with the University to identify sources of funding for the several additional faculty positions that will be required to bring the Department's funded research activities from an unsatisfactory to a satisfactory level.

Manufacturing Systems Engineering: This Master's program is administered through the Department of Mechanical Engineering. It has been under-funded and under-staffed from the outset and never reached its true potential. In the meantime, the major manufacturing enterprises it was intended to serve (Motorola-Boynton, Pratt & Whitney, etc.) have left south Florida.

The decision has been made to cease admissions and to request that the FAU BOT close the program after all students enrolled have completed their degrees. A fall 2004 request to the BOT for program closure is anticipated. Of the three faculty members assigned to the program initially, one has retired and one has transferred to another department. The other will remain with the Department of Mechanical Engineering.

Ocean Engineering: Ocean Engineering, offering degrees through the doctorate, is the College's most prominent program. It leads the College in funded research (\$4.75M in 2002-03; 53% of the College total), its programs are high in quality and broad in scope, its graduates are in high demand, and it enjoys an international reputation for excellence. Graduate enrollments and degree production, particularly at the PhD level, are lower than would be expected considering the levels of research funding. Departmental leadership and the faculty are dedicated to correcting this situation and to increasing enrollments at the undergraduate level. The department is seeking funding for new research initiatives in the areas of coastline security technology, ocean energy and advanced materials.

DEAN'S EVALUATION OF PERFORMANCE Ocean Engineering S=Satisfactory U=Unsatisfactory				
Item	UG	MS	PhD	
Enrollments/Degrees Granted	S-	S	S-	
Student Satisfaction				S
Funded Research				S+
Scholarly Activities				S
Service				S

The major challenge with this department is to provide sufficient numbers of highly-qualified faculty to continue to acquire, conduct, and manage major programs of research.

SUMMARY

Three key points emerge from this process of program assessment:

- Program performance needs to be maintained at current levels or above. Over time, performance needs to be brought to satisfactory levels in all areas of activity.
- The College needs enhanced presence in the emerging areas of bioengineering, biomechanics, nanotechnology, and alternate energy systems. These areas, consistent with the priorities of Florida Atlantic University and the Florida Board of Governors, provide the best opportunities for growth of enrollments and research.
- The critical space needs of the College must be addressed. Current facilities are not adequate to support growth.

Progress on these items will require that the University provide the College additional resources. In turn, the College will help address the resource issue by:

- Closing the M.S. program in Manufacturing Systems Engineering.
- Sharing of fiscal support staff across departments and consolidation of computer support staff into a single unit that provides services college wide.

- Partnering across departments, with other FAU Colleges, and with firms in the FAU Research Park. Several partnership efforts are ongoing. For example, we are collaborating with the College of Science for teaching and research in the areas of Bioengineering, Nanotechnology, and Cryptology; we sharing faculty positions with the College of Architecture Urban and Public Affairs in the area of transportation; we are partnering with the College of Business in the areas of Information Technology and Computer Security; and we are discussing joint-use laboratories and other collaborative efforts with firms in the Research Park