

ELECTRICAL ENGINEERING UNDERGRADUATE MANUAL

(June 28, 2004)

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The 2004-2005 University at Buffalo Undergraduate (UG) Catalog

The primary document for undergraduate education at the University at Buffalo (UB) is the UB Undergraduate (UG) Catalog. Information on Admission to the University, University Baccalaureate Degree Requirements, University General Education Requirements, University Academic and Degree Requirements, Study Abroad Programs, University Academic Services, University Opportunities for Academically Talented Students, and University Academic Regulations and Procedures can be accessed directly from the home page for the UB Undergraduate Catalog by clicking on the heading Undergraduate Education.

The web address for the homepage of the latest UB UG Catalog is <http://undergrad-catalog.buffalo.edu/>
Click on Undergraduate Education.

Electrical Engineering Entry in 2004-2005 UB UG Catalog

In addition to the university requirements for the baccalaureate degree the Department of Electrical Engineering also has specific requirements for the Bachelor of Science in Electrical Engineering (BSEE) and for a combined degree with the School of Management. The combined degree is a single degree for the Bachelor of Science in Electrical Engineering and Master of Business Administration (BS/MBA). The BS/MBA can be obtained in five years whereas a program to obtain sequentially both the BSEE degree and MBA degree would take 6 years to complete.

Electrical Engineering

Department of Electrical Engineering
School of Engineering and Applied Sciences
332 Bonner Hall
North Campus
Buffalo, NY 14260-2050
(716) 645-3115
Fax: (716) 645-3656
Web: <http://www.ee.buffalo.edu/>
Vladimir Mitin, Chair
James J. Whalen, Director of Undergraduate Studies

About the Program

The undergraduate degree offered by the department is the B.S. in electrical engineering. Electrical engineers work in research and development, product design, manufacturing, operations, service, technical sales and marketing, consulting, education, and environmental problem solving.

The undergraduate program provides the scope of knowledge and training for employment in the field and also forms the basis for further study at the graduate level. The curriculum emphasizes communications and signals, microelectronics and energy systems, and engineering materials and devices for electronics and photonics.

Communications and signals include wireless communications, communications systems, digital signal processing, and image and video processing. Microelectronics and energy systems include electronic instrumentation, integrated circuit systems, RF and microwave circuits, energy generation and conversion, and power conversion and control. Materials and devices for electronics and photonics include electronic device fabrication, electrical and optical characterization, laser spectroscopy, and photonics. Students interested in computer hardware and software may take courses offered by the Department of Computer Science and Engineering, including computer networks, high-performance computing, and VLSI.

The program is designed to serve both students who intend to enter industry directly and others who plan to continue their education through formal graduate study.

Acceptance Information

The most up-to-date information on admission to UB is given in the UB UG Catalog. The web address for the homepage of the latest UB UG Catalog is

<http://undergrad-catalog.buffalo.edu/>

Click on Undergraduate Education and then on Admission.

Additional information about acceptance into the School of Engineering and Applied Sciences (SEAS) or directly into the Department of Electrical Engineering is given in the SEAS section of the UB UG Catalog. On the UB UG Catalog home page click on Academic Programs and then on the School of Engineering and Applied Sciences. See Program Acceptance.

The web address is

<http://undergrad-catalog.buffalo.edu/academicprograms/>

Additional link to the School of Engineering & Applied Sciences

<http://undergrad-catalog.buffalo.edu/academicprograms/eas>

Advisement

During the first two years of all engineering programs, students are advised by one of the senior SEAS academic advisors in 410 Bonner Hall. The SEAS academic advisors should be consulted on General Education Requirements and on required courses in Chemistry, Engineering and Applied Science, Math, and Physics. When admitted to the BSEE program students are assigned an advisor who is an EE faculty member. Students are encouraged to consult their EE advisor about the sequence of EE requirements and technical electives, especially for the senior year.

The first two years of the undergraduate curriculum emphasize the physical sciences and mathematics. The third year consists of coordinated sequences in digital principles, microprocessors, and microcomputers; physical electronics and electronic circuits; electromagnetic theory and signal analysis and transform methods. Fourth-year courses are primarily elective and designed to broaden the background, reinforce lab skills, and develop design concepts. By selection of technical electives, undergraduates have the flexibility to concentrate in communications, photonics, semiconductors, lasers, signal processing, computers, energy systems and related studies.

Transfer Policy

Transfer students must first apply to the university and meet university transfer admission requirements before consideration for admission to the Department of Electrical Engineering. Electrical engineering courses completed at other colleges and offered as substitutes for UB courses are evaluated individually by the EE Undergraduate Curriculum Committee and determination is made by an evaluation of the student's transcripts, course content, contact hours, and grades earned. Most courses taken from an ABET-accredited college-level electrical engineering department are acceptable. Evaluations for transfer credits of general education, basic science, engineering science, and math courses completed at other universities and colleges including community colleges are done through the Office of Student Services, School of Engineering and Applied Sciences, 410 Bonner Hall. For more information see section on Transfer Policy in Engineering and Applied Sciences, School of, in the latest UB UG Catalog. The web address is

<http://undergrad-catalog.buffalo.edu/academicprograms/>

Click on School of Engineering and Applied Sciences and scroll down to section on Transfer Policy.

For information on Transfer Admission to UB see the home page of the current UB UG Catalog. The web address for the latest UB UG Catalog is

<http://undergrad-catalog.buffalo.edu/>

On the UB UG Catalog home page, click on Academic Programs, Admissions and then on Transfer Admission.

Another useful web address for information on transfer credit is that of the SEAS Office of Student Services:

<http://wings.buffalo.edu/eng/oss/>

Scroll down to the Section “Non-UB Credit” and click on Transfer Credit to access the TAURUS. TAURUS stands for Transfer Articulation System. Follow the instructions “How To Determine What Transfer Credit You’ll Get!!”

Practical Experience and Special Opportunities

An optional industrial cooperative education program is available to students with junior standing.

For EE course descriptions, the links are

<http://undergrad-catalog.buffalo.edu/coursedescription/index.php>

<http://undergrad-catalog.buffalo.edu/>

Click on Course Description Search and then select EE in the pull-down menu.

Electrical Engineering—B.S.

Acceptance Criteria

Minimum GPA of 2.0 overall

Minimum GPA of 2.0 in technical and engineering courses

Required Courses

CHE 107 General Chemistry for Engineers

CSE 379 Introduction to Microprocessors and Microcomputers

CSE 380 Introduction to Microprocessors Lab

EAS 140 Engineering Solutions

EAS 207 Statics
EAS 230 Higher-Level Language
EE 101 Basic Electronics or one technical elective
EE 202 Circuit Analysis I
EE 203 Circuit Analysis II
EE 310 Electronic Devices and Circuits I
EE 311 Electronic Devices and Circuits II
EE 352 Introduction to Electronics Lab
EE 353 Electronic Circuits Lab
EE 378 Digital Principles
EE 408 Senior Seminar
MTH 141 College Calculus I
MTH 142 College Calculus II
MTH 241 College Calculus III
MTH 306 Introduction to Differential Equations
PHY 107 General Physics I
PHY 108 PHY 158 General Physics II/Lab
PHY 207 PHY 257 General Physics III/Lab
Three electrical engineering requirements*

Two technical electives with design

Two restricted upper-division technical electives
Two unrestricted upper-division technical electives
One free elective

See Baccalaureate Degree Requirements (page 254) for general education and remaining university requirements.

Recommended Sequence of Major Requirements

First Year

Fall—CHE 107, MTH 141, EAS 140
Spring—EE 101 or one technical elective; MTH 142, PHY 107

Second Year

Fall—MTH 306, PHY 108/158, EAS 207, EE 202
Spring—MTH 241, PHY 207/257, EE 203, EAS 230

Third Year

Fall—EE 310, EE 352, EE 378, one electrical engineering requirement*
Spring—EE 311, EE 353, CSE 379, CSE 380, one electrical engineering requirement*

Fourth Year

Fall—EE 408, one technical elective with design, one technical elective, one electrical engineering requirement*
Spring—One technical elective with design, three technical electives, one free elective

***Electrical Engineering Requirements**

The following three required courses may be taken in any order depending upon choice

of senior electives: EAS 305 Applied Probability, EE 303 Signal Analysis and Transform Methods, EE 324 Applied Electromagnetics.

Technical Electives (minimum 21 credits)

A total of 7 technical electives is required. At least six must be upper division technical electives. No more than one may be a lower division technical elective such as EE 101.

At least two of the upper division technical electives must be courses with significant design content from an approved list. The current approved list includes EE 402 Group Design Project; EE 410 Electronic Instrument Design; EE 413 Communications Electronics; EE 416 Digital Signal Processing; EE 425 Electrical Devices; EE 449 Analog Integrated Circuit Layout; EE 453 Microelectronic Fabrication; EE 455 Photonic Devices; EE 401/456 RF & Microwave Circuits I&II; EE 482 Energy Systems & Power Engineering; EE 483 Communications Systems I; EE 498 Analog Circuits; and CSE 497 Introduction to VLSI

In addition to the two technical electives with significant design content at least two other upper division technical electives must be: EE courses or CSE courses or MAE 340 Systems Analysis or MAE 443 Continuous Control Systems or MAE 444 Digital Control Systems.

Two of the upper division technical electives are unrestricted.

Summary

Required technical courses	85 cr
Technical electives (minimum)	21 cr
<i>Note: EE 101 is counted as a technical elective</i>	
Free elective	3 cr
General education	18-21 cr

Total required credit hours 127–130

Electrical Engineering/Business Administration—B.S./M.B.A.

Acceptance Criteria

Good standing as an electrical engineering undergraduate student and acceptance as a graduate student by the School of Management.

Advising Notes

To lighten the load in the fifth year the internship may be taken the previous summer.

Required Courses

CHE 107 General Chemistry for Engineers
CSE 379 Introduction to Microprocessors and Microcomputers
CSE 380 Introduction to Microprocessors Lab
EAS 140 Engineering Solutions
EAS 207 Statics
EAS 230 Higher Level Languages
EE 101 Basic Electronics or one technical elective
EE 202 Circuit Analysis I
EE 203 Circuit Analysis II
EE 310 Electronic Devices and Circuits I
EE 311 Electronic Devices and Circuits II
EE 352 Introduction to Electronics Laboratory
EE 353 Electronic Circuits Laboratory
EE 378 Digital Principles
EE 408 Senior Seminar
MGA 604 Introduction to Financial Accounting
MGB 601 Behavioral and Organizational Concepts for Management
MGE 601 Economics for Managers
MGF 631 Financial Management
MGM 625 Marketing Management
MGS 630 Operations and Service Management
MGS 641 Strategic Management
MTH 141 College Calculus I
MTH 142 College Calculus II
MTH 241 College Calculus III
MTH 306 Introduction to Differential Equations
PHY 107 General Physics I
PHY 108 PHY 158 General Physics II/Lab
PHY 207 PHY 257 General Physics III/Lab
Three electrical engineering requirements*
One electrical engineering technical elective with design content
Two other electrical engineering technical electives

Six M.B.A Electives
M.B.A internship
Two M.B.A. flex core courses

See Baccalaureate Degree Requirements (page 254) for general education and remaining university requirements.

Recommended Sequence of Major Requirements

First Year

Fall—MTH 141, CHE 107, EAS 140
Spring—MTH 142, EE 101 or technical elective, PHY 107

Second Year

Fall—MTH 306, PHY 108, PHY 158, EAS 207, EE 202
Spring—MTH 241, EE 203, PHY 207, PHY 257, EAS 230

Third Year

Fall—EE 310, EE 352, EE 378, one electrical engineering requirement*
Spring—EE 311, EE 353, CSE 379, CSE 380, one electrical engineering requirement*

Fourth Year

Fall— EE 408, MGA 604, MGB 601, MGE 601, one electrical engineering requirement*,
one electrical engineering technical elective with design
Spring—MGF 631, MGM 625, MGS 630, one electrical engineering technical elective,
M.B.A elective

Fifth Year

Fall—Two M.B.A electives, M.B.A internship, one M.B.A. flex core course, one electrical
engineering technical elective
Spring—MGS 641, three M.B.A Electives, one M.B.A. flex core course

Electrical Engineering Requirements

The following three required courses may be taken in any order depending upon choice of senior electives: EAS 305 Applied Probability, EE 303 Signal Analysis and Transform Methods, EE 324 Applied Electromagnetics.

***Electrical Engineering Technical Electives (minimum 12 credits)**

A total of 4 technical electives is required. At least three must be upper division technical electives. No more than one may be a lower division technical elective such as EE 101.

At least one of the upper division technical electives must be a course with significant design content from an approved list. The current approved list includes EE 402 Group Design Project; EE 410 Electronic Instrument Design; EE 413 Communications Electronics; EE 416 Digital Signal Processing; EE 425 Electrical Devices; EE 449 Analog Integrated Circuit Layout; EE 453 Microelectronic Fabrication; EE 455 Photonic Devices; EE 401/456 RF & Microwave Circuits I&II; EE 482 Energy Systems & Power Engineering; EE 483 Communications Systems I; and EE 498 Analog Circuits; CSE 497 Introduction to VLSI

In addition to the one technical electives with significant design content at least two other upper division technical electives must be: EE courses or CSE courses or MAE 340 Systems Analysis or MAE 443 Continuous Control Systems or MAE 444 Digital Control Systems.

*Contact the School of Management for flex core course and elective options.
Refer to the School of Management's MBA handbook for MBA candidate requirements.*

Upon completion of undergraduate program requirements and all management requirements, the combined degree will be conferred at the end of fifth year.

The School of Management and SEAS provide BSMBA WebPages outlining the five-year requirements for the combined degrees. Click on the link below and then click on Electrical Engineering:

<http://wings.buffalo.edu/eng/oss/bsmba.html>.

End of EE Entry in 2004-2005 UB Undergraduate Catalog

Choice of Technical Electives and Free Elective (Repeated)

Technical Electives (minimum 21 credits)

A total of 7 technical electives is required. At least six must be upper division technical electives. No more than one may be a lower division technical elective such as EE 101.

At least two of the upper division technical electives must be courses with significant design content from an approved list. The current approved list includes EE 402 Group Design Project; EE 410 Electronic Instrument Design; EE 413 Communications Electronics; EE 416 Digital Signal Processing; EE 425 Electrical Devices; EE 449 Analog Integrated Circuit Layout; EE 453 Microelectronic Fabrication; EE 455 Photonic Devices; EE 401/456 RF & Microwave Circuits I&II; EE 482 Energy Systems & Power Engineering; EE 483 Communications Systems I; EE 498 Analog Circuits; and CSE 497 Introduction to VLSI

In addition to the two technical electives with significant design content at least two other upper division technical electives must be: EE courses or CSE courses or MAE 340 Systems Analysis or MAE 443 Continuous Control Systems or MAE 444 Digital Control Systems.

Two of the upper division technical electives are unrestricted.

Example Elective Sequences

Examples of technical elective (TE) sequences follow. Each TE elective sequence contains at least two TE's with significant design from the approved list, at least two TE's that are EE, CSE or one or more of the allowed MAE courses, two unrestricted TE's and one free elective. Some of the sequences may have one more course than the minimum necessary for the BSEE degree. These are not the only acceptable sequences. Working with your faculty advisor, you may be able to work out an alternative sequence that meets the requirements for technical electives.

*The asterisk after the credit hours indicates that the course is on the list of technical electives with significant design content. Two such courses are required.

1. Communications and Signals (Revised March 20, 2004)

Junior Year

Fall	Hrs	Spring	Hrs.
EE 310 Elec. Dev. & Cir. I	3	EE 311 Elec. Dev. & Cir. II	3
EE 352 Intro to Elec. Lab.	3	EE 353 Elec. Circuits Lab.	3
EE 378 Digital Principles	3	CSE 379 Intro. Microcomp.	3
EE 303 Signal Analysis	4	CSE 380 Microcomp. Lab.	3
Gen Ed	3	EAS 305 Applied Probability	4
Total	16	Total	16

Senior Year

EE 408 Senior Seminar	1		
EE 483 Comm. Systems 1	4*	EE 484 Comm. Sys. II	3
EE 416 Signal Proc. Algor.	3*	CSE 489 Mod. Net. Con.	3
EE 324 EM Theory	4	EE 413 Comm. Electronics	4*
EE 492 Lasers & Photonics	4	EE 449 Analog Integrated Circuit Layout	3*
		Gen. Ed.	3
Total	16	Total	16

Communications and Signals Elective sequence contains 7 TE's and meets the requirements on selection of TE's for the BSEE.

2. Digital Electronics and Instrumentation (Revised March 20, 2004)

Junior Year

Fall	Hrs.	Spring	Hrs.
EE 310 Elec. Dev. & Cir. I	3	EE 311 Elec. Dev. & Cir. II	3
EE 352 Intro to Elec. Lab.	3	EE 353 Elec. Circuits Lab.	3
EE 378 Digital Principles	3	CSE 379 Intro. Microcomp.	3
EE 303 Signal Analysis	4	CSE 380 Microcomp. Lab.	3
Gen. Ed.	3	EAS 305 Applied Probability	4
Total	16	Total	16

Senior Year

EE 408 Senior Seminar	1	EE 402 Group Design Project	4*
EE 410 Elec. Instr. Design	4*	EE 413 Comm. Electronics	4*
EE 419 Industrial Controls	3	CSE 452 VLSI Testing	4
CSE 497 Intro. VLSI	4*	Free Elective	3
EE 324 EM Theory	4	Gen. Ed.	3
Total	16	Total	18

Digital Electronics and Instrumentation Elective sequence contains 6 TE's and one unspecified free elective and meets the requirements on selection of TE's for the BSEE.

3. Microelectronics and Photonics (Revised March 20, 2004)

Junior Year

Fall	Hrs.	Spring	Hrs.
EE 310 Elec. Dev. & Cir. I	3	EE 311 Elec. Dev. & Cir. II	3
EE 352 Intro. To Elec. Lab.	3	EE 353 Elec. Circuits Lab.	3
EE 378 Digital Principles	3	CSE 379 Intro. Microcomp.	3
EE 324 EM Theory	4	CSE 380 Microcomp. Lab.	3
Gen Ed	3	EE 303 Signal Analysis	4
Total	16	Total	16

Senior Year

EE 408 Senior Seminar	1		
EE 401 RF&Microwave Cir I	3	EE 456 RF&Microwave Cir II	3*
EE 448 Micro. Devices	3	EE 449 Analog Integrated Circuit Layout	3*
EE 455 Photonic Devices	3*	EE XXX Nanoelectronics	3
EE 492 Lasers & Photonics	4	EE 494 Consumer Optoelectronics	4
EAS 305 Applied Probability	4	Gen. Ed.	3
Total	18	Total	16

Microelectronics and Photonics Elective sequence contains 8 TE's and meets the requirements on selection of TE's for the BSEE. Those students who will pursue a Master's degree in EE at UB may take the graduate version of one the courses listed and count that course toward their graduate degree.

4. Energy Systems (Revised April 5, 2004)

Junior Year

Fall	Hrs.	Spring	Hrs.
EE 310 Elec. Dev. & Cir. I	3	EE 311 Elec. Dev. & Cir. II	3
EE 353 Elec. Circuits Lab.	3	EE 353 Elec. Circuits Lab.	3
EE 378 Digital Principles	3	CSE 379 Intro. Microcomp.	3
EE 324 EM Theory	4	CSE 380 Microcomp. Lab.	3
Gen. Ed.	3	EE 303 Signal Analysis	4
Total	16	Total	16

Senior Year

EE 408 Senior Seminar	1		
EAS 305 Applied Prob.	4	EE 402 Group Design Project	4*
EE 403 Intro. Plasma Proc.	3	EE 495 High Voltage Eng.	3
EE 419 Industrial Controls	3		
EE 429 Intro to EMC	3	Gen. Ed.	3
EE 482 Power Engineering I	4*	EE 425 Electrical Devices	4*
	3	Free Elective.	3
Total	18	Total	17

Energy Systems Elective sequence contains 7 TE's and one free elective and meets the requirements on selection of TE's for the BSEE. Those students who will pursue a Master's degree in EE at UB may take the graduate version of one the courses listed and count that course toward their graduate degree.

5 RF/Microwave and Communications Electronics

Junior Year

Fall	Hr s.	Spring	Hrs.
EE 310 Elec. Dev. & Circuits I	3	EE 311 Elec. Dev. & Cir. II	3
EE 352 Intro. To Elec. Lab.	3	EE 353 Elec. Circuits Lab.	3
EE 378 Digital Principles	3	CSE 379 Intro. Microcomp.	3
EE 324 EM Theory	4	CSE 380 Microcomp. Lab.	3
Gen. Ed.	3	EE 303 Signal Analysis	4
Total	16	Total	16

Senior Year

EE 408 Senior Seminar	1	EE 402 Group Design Project	4*
EAS 305 Applied Probability	4	EE 413 Communications Electronics	4*
EE 401 RF&Microwave Cir I	3	EE 456 RF&Microwave Cir II	3*
EE 458 RF/Microwave Lab	3	Gen. Ed.	3
EE 483 Comm. Sys. I	4*	EE 484 Comm. Sys. II	3
EE 498 Analog Circuits	3		
Total	18	Total	17

RF/Microwave and Communications Electronics Elective sequence contains 8 TE's and meets the requirements on selection of TE's for the BSEE. Those students who will pursue a Master's degree in EE at UB may take the graduate version of one the courses listed and count that course toward their graduate degree.

6 Analog & Digital Electronics & Instrumentation

Junior Year

Fall	Hr s.	Spring	Hrs.
EE 310 Elec. Dev. & Circuits I	3	EE 311 Elec. Dev. & Cir. II	3
EE 352 Intro. To Elec. Lab.	3	EE 353 Elec. Circuits Lab.	3
EE 378 Digital Principles	3	CSE 379 Intro. Microcomp.	3
EE 324 EM Theory	4	CSE 380 Microcomp. Lab.	3
Gen. Ed.	3	EE 303 Signal Analysis	4
Total	16	Total	16

Senior Year

EE 408 Senior Seminar	1	EE 402 Group Design Project	4*
EAS 305 Applied Probability	4	EE 413 Communications Electronics	4*
CSE 497 Intro. VLSI	4*	CSE 452 VLSI Testing	4
EE 410 Elec. Instr. Design	4*		
EE 429 Intro. To EMC	3	Gen. Ed.	3
EE 498 Analog Circuits	3*	EE 449 Analog Integrated Circuit Layout	3*
Total	19	Total	18

Analog & Digital Electronics & Instrumentation Elective sequence contains 8 TE's and meets the requirements on selection of TE's for the BSEE. Those students who will pursue a Master's degree in EE at UB may take the graduate version of one the courses listed and count that course toward their graduate degree.

Using Graduate Courses to Satisfy Elective Requirements

It may sometimes be appropriate for Seniors to use graduate courses as Technical Electives. This takes some advance planning. Obtain and complete a "petition" from DUAS, 255 Capen Hall. Undergraduates need a QPA of 3.0 or better to take graduate courses. Students may obtain a petition at the Office of Engineering Student Services, 410 Bonner Hall.

Summary of University General Education Requirements for UB's School of Engineering and Applied Sciences Majors

General Education Requirements depend upon the date of entry into UB and whether a student starts as a freshman or transfer student. The SEAS Senior Academic Advisors maintain an up-to-date summary of **General Education Requirements** on one of the SEAS websites. The web address is

<http://wings.buffalo.edu/eng/oss/gened.html>

Dean's List & Honorary Societies

University at Buffalo Dean's List

Students will be included on the Dean's List if, in any single semester, they earn a 3.6 grade point average or better. Students must have completed at least 15 credit hours of study during the semester, 12 of which are letter graded. Students will be nominated to the Dean's List for each semester in which they achieve this standard.

Engineering Dean's list

Students will be included on the University's Dean's List if, in any single semester, they earn a 3.6 grade point average or better. Students must have completed at least 15 credit hours of study during the semester, 12 of which are letter graded. Engineering students obtaining a 3.2 grade point average or better with at least 12 graded credit hours and a minimum of 15 credits for the semester will be recognized on the Engineering Dean's List.

Eta Kappa Nu - Honorary Electrical and Computer Engineering Society

Eta Kappa Nu is an internationally recognized honor society comprised of both undergraduate and graduate students in Electrical and Computer Engineering. Eta Kappa Nu admits the top 1/4 of the junior class and 1/3 of the senior class, as well as all graduate EE students. If you want some more general info about Eta Kappa Nu, visit the national webpage at

<http://www.hkn.org/worthwhilegoal.html>

Eta Kappa Nu performs various projects for the EE department, which provides our funding. This year, we instituted tutoring of all the classes that EE's take and aren't covered by regular tutoring (like MTH, PHY, etc). We also sponsored a robot for botwars this semester, which finished second in the overall competition.

Office located in 406 Furnas.

Faculty Advisor: Dr. Dimitris Pados, 645-3115, ext. 2134.

Tau Beta Pi, New York Nu Chapter

Honorary national engineering society, engineering-wide

Tau Beta Pi elects its membership from juniors and seniors demonstrating exceptional academic performance and exemplary character: juniors in the top 12.5% of their class and seniors in the top 20%.

The web site is -- <http://wings.buffalo.edu/sa/tbp/>

Office: 706 Furnas Hall

Messages: 415 Bonner Hall, 645-2768, x-1110 attention Deanie

Faculty Senior Advisor: Dr. Robert Barnes, 645-2768, ext. 1111.

Golden Key - Honorary society, university-wide

Office: Student Activities Center

Junior and senior students with a 3.25 grade point average or better are elected to membership.

Faculty Advisor: Dr. Peter Gold, 645-3479

Golden Key website

<http://wings.buffalo.edu/sa/goldenkey/>

Student Clubs & Technical Societies

IEEE (Institute of Electrical and Electronics Engineers) Student Branch:

Office: 406 Furnas Hall.

IEEE Student Chapter participates in many events throughout the year including school and community events as well as regional conferences/competitions. More information, including the dates of IEEE events and meetings are posted on the website:

www.wings.buffalo.edu/sa/ieee.

You may obtain an application to join IEEE at www.ieee.org or by stopping by 406 Furnas during posted office hours.

Faculty Advisor: Dr. W. James Sarjeant, 645-3115, ext. 1208

More Questions? Email: ieee@eng.buffalo.edu

Student Branch - IEEE Computer Society

Office: 404 Furnas Hall

This affiliate of the international IEEE brings the benefits of membership in an international technical society to students with computer interests. The society posts its meeting notices throughout Bell Hall and near computer labs in Furnas Hall.

Faculty advisor: Dr. R. Sridhar, 645-3180, ext. 136.

Robotics Club

UB Robotics (UBR) is an undergraduate club of the University at Buffalo, dedicated to engineering excellence. The field of robotics is by nature a multidisciplinary field with strong emphasis on electrical, mechanical, and computer engineering. Students involved in UBR are offered a unique opportunity to collaborate collectively on real world problems typically not present in a university setting. The club's current project involves developing a team of intelligent and autonomous soccer-playing robots, which are going to compete at the RoboCup World Cup.

<http://www.eng.buffalo.edu/ubr/>

Co-op and Internship

Student Work Experience Programs such as co-op and internship are available and are administered by the SEAS External Affairs Office. The web address is

http://www.eng.buffalo.edu/admin/external_affairs.html

Alternatively go to the SEAS home page at

www.eng.buffalo.edu

and click on Administration. Then scroll down to Corporate educational programs and click on Engineering Career Institute (ECI). Then click on one on the “Links within UB Engineering Student Employment” at the bottom such as Co-op Employment or Summer Employment. The relevant EE courses are

EAS 495 Engineering Career Institute

Credits: 3

Semester:

Prerequisites: senior standing in engineering

Corequisites: None

Combines an industry internship with seminars and workshops on leadership, teamwork, communication, total quality management, project management, and career launching in an eight-week engineering summer program. Open to pre-senior year students in any of the engineering majors. (Some departments may not accept credit for both EAS495 and a departmental internship. Please consult specific degree program.)
TUT

436-437-438 EE Co-op (2-2-2) (F; Sp; Su)

Prerequisite: junior standing

An opportunity for electrical engineering juniors to apply knowledge to problems of interest to industry in a cooperative education program. LAB

439 EE Internship (3) (F)

Prerequisite: EAS 495 and permission of the director of undergraduate studies

Restricted to those students who are continuing an internship initiated in EAS 495

Graduation Requirement Check

There are two checks that all graduation requirements for each student are met. One of the central offices at UB checks that all university requirements are met. This is limited to checking that at least 120 credit hours have been completed, that General Education requirements have been met, that Library Skills have demonstrated, etc. The second

check is done by the SEAS Student Service Office (410 Bonner Hall). The SEAS staff checks to see that all SEAS and EE requirements are met. The principal visual aid is the flowsheet. When the student enters the program, the flowsheet is started and it is filled in as courses are successfully completed. The SEAS staff confer with the EE Director of Undergraduate Studies whenever questions arise, for example, during the transfer of engineering courses. It is noted that the DARS report also exists. Although the accuracy of the DARS report is improving, it is often not as accurate as the flowsheet maintained by the SEAS staff.

It is advisable to check with the SEAS Senior Academic Advisors during the next to last semester to verify that your program is on track and, especially, that no required course has been overlooked.

Academic and Degree Options

The official document on Academic and Degree Options is the UB Undergraduate Catalog. The web address is

<http://undergrad-catalog.buffalo.edu/undergraduateeducation/index.shtml>

Click on Academic and Degree Options in the column to the left. The following information has been copied from the 2003-2004 UB UG Catalog currently at that website. It is anticipated that the 2004-2005 UB UG Catalog will soon replace the 2003-2004 UB UG Catalog.

Degree Options

The primary undergraduate degrees awarded at UB are the B.A., B.S., B.F.A., and Mus.B.

In addition, academic options that allow the undergraduate to develop a unique educational experience or degree program are described below.

Double Majors

A double major is the awarding of one degree with two majors (e.g., the student completing a double major of psychology and social sciences interdisciplinary studies earns one B.A. degree). Students must be accepted into each major and fulfill all requirements of each major in addition to satisfying all university requirements. This may be completed within the usual 120-credit minimum. Following conferral of the degree, the student's transcript will note one baccalaureate degree and two majors.

Joint Majors

A student may elect to work toward a joint major, combining the subjects of two departments as an area of concentration (e.g., geography and economics, philosophy and history, classics and political science, psychology and sociology, or physics and mathematics). Joint majors must be between departments leading to the same degree. For example, a student may not have a joint major between engineering (B.S.) and psychology (B.A.).

Although a few academic departments, such as economics, geography, mathematics, and physics, have firmly established optional joint majors with other departments, students are normally free to choose their own joint majors. The Social Sciences Interdisciplinary Degree Program does not permit a joint major but uses a double major instead.

The director of undergraduate studies of each department concerned will assist in planning a joint major. In arranging the program, students must obtain a statement from both departments involved and gain the approval of their advisors. In special cases, students may arrange a program cutting across several departments, so that the program involves more than one faculty or school.

Minors

A [minor](#) is a secondary field of study that is typically composed of six courses. The minor offers students a means to complement the major, explore a subspecialty, and/or broaden career alternatives. Minors are available in many subject areas, but may not be taken within the student's majors. Consult the [Academic Programs of Study](#) section for individual minor requirements.

Double Degrees

The double degree is the concurrent awarding of two different baccalaureate degree types (B.A., B.S., B.F.A., Mus.B.). Students pursuing two majors in two different degree types are expected to have the full range of skills, competencies and experience as students graduating from each of the programs individually. Thus students must take all courses required for the major including required elective courses, internships, etc. In no circumstance may the course work in the second degree be fewer than 30 credit hours. For a double degree a minimum 150 credits or

30 credits beyond the full requirements of the first degree must be earned, whichever is greater.

Because the two degrees must be in significantly different fields of study, courses taken as requirements for one major in one degree cannot also be counted as part of the required courses for the other major in the other degree. In the rare circumstance when a single course taken for the first degree program is a stipulated requirement in the second degree program, a substitution from the electives of the second degree may be approved by petition to the undergraduate program directors of both programs. Following the conferral of the double degree, the student's transcript will note each of the two baccalaureate degrees. (Note: If a student completes two majors within one degree type, they will be awarded one degree with two majors, not two degrees, regardless of how many credits they earn.)

Note: Students wishing to use TAP awards are eligible for only eight semesters of assistance.

Subsequent Degrees

When a degree is conferred, the courses and credits from that degree cannot be used in subsequent degrees. In order to take a subsequent degree, the student who has previously earned a baccalaureate degree from UB or an accredited U.S. institution must: 1) be accepted to UB as a matriculated student; and 2) be accepted into the new major. Students pursuing a second bachelor's degree must have the full range of skills, competencies, and experience in the major as the students who complete the requirements for the regular degree program. Thus, students must take all courses required for the major, including required elective courses, internships, etc.

In no circumstance may the coursework in the second degree program be fewer than 30 credit hours after the conferral of the first degree. The two degrees must be in significantly different fields of study; therefore, coursework completed for the first bachelor's degree will not count toward completing the major requirements of the second degree. In the rare circumstance when a single course taken for the first degree program is a stipulated course in the second degree program, a substitution from the electives of the second degree may be approved by petition to the

undergraduate program directors of each program. Following the conferral of the new degree, the student's transcript will note this degree and major.

Comments on DOUBLE DEGREE (Computer Engineering, Electrical Engineering and Engineering Physics)

The New York State Education Department requires that double degrees be in substantially different areas of study. This regulation has been in existence for years, but UB has not been in compliance. That has now changed. Neither Electrical Engineering & Engineering Physics nor Computer Engineering & Electrical Engineering qualify as substantially different areas of study. Double degree in **Electrical Engineering & Engineering Physics and in Computer Engineering & Electrical Engineering** will not be awarded to student who started at UB in fall 2003. Students who started at UB prior to fall 2003 and have been pursuing a double degree of any kind should check with one of the SEAS Senior Academic Advisors in 410 Bonner Hall to determine if sufficient progress has been made so that application for "grandfather status" is appropriate.

Bachelor of Science in Engineering Physics

A program leading to a Bachelor of Science degree in Engineering Physics is available. The program is intended for those students whose interests center on the more fundamental aspects of electrical engineering and physics, but who also wish more extensive contact with the applied aspects (instrumentation, circuit design) of those subjects. The program is designed such that a student can pursue a graduate program in electrical engineering or applied physics, depending on interest. This course of study will provide a student with a unique combination of the fundamental principles of modern electronics as well as a thorough education in electrical measurements and instrumentation. Only students whose academic performance is very strong should consider this program. It should be noted that only courses in which a grade of "C" or better has been earned would be considered for application to this program. Course descriptions may be found under the Electrical Engineering program and the Physics program.

Double Major -- Engineering Physics & Electrical Engineering

The Bachelor of Science Degree in Engineering Physics has not been submitted for ABET accreditation. Students who wish an ABET accredited degree because of employment or professional registration considerations should consider a Double Major in Engineering Physics & Electrical Engineering. The student's transcript will note one

baccalaureate degree with majors in Engineering Physics & Electrical Engineering. A double major in Engineering Physics & Electrical Engineering must satisfy all the requirements of both majors. This adds 6 courses (21 credits) to the Engineering Physics requirements:

Add EE 203 (4 credits, should precede EE 310-311)

Add CSE 378, 379, 380, and EE 303 (13 credits).

Add EAS 305 (4 credits).

Engineering Physics requires three upper division technical electives. Electrical Engineering requires seven technical electives and one free elective. One of the EE TE's may be lower division. It should be possible to satisfy both sets of elective requirements by selecting the correct courses. Note that EE 410 is required in Engineering Physics. EE 410 is on the EE list of courses with significant design. Thus one more course with significant design must be selected from EE 402 Group Design Project; EE 413 Communications Electronics; EE 416 Digital Signal Processing; EE 425 Electrical Devices; EE 449 Analog Integrated Circuit Layout; EE 453 Microelectronic Fabrication; EE 455 Photonic Devices; EE 456 RF & Microwave Circuits II; EE 482 Energy Systems & Power Engineering; EE 483 Communications Systems I; EE 498 Analog Circuits; and CSE 497 Introduction to VLSI. In addition to the two technical electives with significant design content at least two other upper division technical electives must be: EE courses or CSE courses or MAE 340 Systems Analysis or MAE 443 Continuous Control Systems or MAE 444 Digital Control Systems. The other TE's required by EE and the free elective can be courses required for Engineering Physics but not required by EE, e. g. CHE 108, MAE 335, MTH 417, MTH 418, PHYS 401, PHYS 402, etc.

Substitute PHY 403-404 for EE 324 (6 credits for 4 credits).

Double Major – Computer Engineering & Electrical Engineering

During the 2003-2004 academic year the EE Director of Undergraduate Studies has approved programs for several students for a double major in CEN & EE. These students are following the program that leads to the BS in CEN and taking additional courses required by EE that are not part of the CEN program. These courses are Physics III 207/257 (lecture & lab), EE 324 Applied Electromagnetics, and EE 353 Electronic Circuits Lab. Also EE 352 Introductory Electronic Circuits Lab should be taken instead of EE 312 Basic Electronic Instrumentation Lab. The upper-division courses required for the CEN degree but not required for the BSEE degree are being used to satisfy the upper-division TE requirements in EE. The courses CSE 442 Software Engineering & CSE 453 Hardware/Software Integrated Systems Design are being accepted as two TE's with design. The courses CSE 305 Introduction to

Programming Languages, CSE 341 Computer Organization, CSE 421 Introduction to Operating Systems, and MTH 309 Linear Algebra or MTH 437 Numerical Analysis are being accepted for the other 4 upper-division TE's required by EE. The two engineering design electives courses required for the CEN are being accepted for the lower-division TE and free elective required by EE. Other courses taken during the first two years of the CEN program have been accepted in place of courses taken during the first two years of the EE program. Students interested in a double major in CEN & EE should consult with one of the SEAS Senior Academic Advisors in 410 Bonner at the beginning of their freshman year. They should consult with both the CEN & EE Directors of UG Studies in the spring semester of their sophomore year prior to registration for the junior year.

Computer Science Minor

[\(Check with CSE Department for Current Information\)](#)

The Computer Engineering minor comprises 24 credits (6 courses) of designated Computer Science and Engineering courses. By choosing technical electives properly, students may complete a minor in computer engineering with a minimum of 13 additional credits beyond the BS in EE. The requirements for the minor in computer engineering translates to

1. At most four of CSE 113, CSE 114, CSE 191, CSE 192, CSE 241 or CSE 250
2. At least two CSE courses at the 300-level or above, except CSE 498 or CSE 499 (internship or independent study)

CSE 114 may be used to satisfy the EE requirement of higher-level languages (3 credits). If other EE technical electives are chosen to satisfy the laboratory and design requirements, students may use two 300 or 400-level Computer Science and Engineering courses to complete both the EE program and the Computer Engineering minor. Admission to the minor requires completing three of the courses above with an average QPA of 2.5. A QPA of 2.5 over the six designated CSE courses is required to be awarded a minor in computer engineering. For admission and current information, consult the Computer Science and Engineering Department. You must fill out a form with the EE department for record keeping purposes, which can be obtained from the Undergraduate Secretary in 332 Bonner Hall.

Mathematics Minor

[\(Check with Math Department for Current Information\)](#)

The mathematics minor comprises 26 to 28 credits of designated mathematics courses. By choosing technical electives properly, students may complete a minor in mathematics and add only two credits to the BSEE program. Required courses for the mathematics minor are MTH 141, 142, 241 and 242 and MTH 309 (Introduction to Linear Algebra). The first four are also required in EE and MTH 309 is a suitable senior TE. If other EE technical electives are chosen to satisfy the laboratory and design requirements, students may use 2 300 or 400-level courses in mathematics to complete both the EE program and the mathematics minor.

Admission to the minor requires completing MTH 141, 142 and 241 with a 2.5 QPA. A QPA of 2.5 over the seven mathematics courses is required to be awarded the minor in mathematics. For admission and current information, consult the Mathematics Department. You must fill out a form with the EE department for record keeping purposes, which can be obtained from the Undergraduate Secretary in 201 Bell Hall.

Combined Bachelors/Masters Degree Program

(Check with EE Director of Graduate Studies for Current Information.)

The program combines the BSEE degree and the MEng or MS degree (30 CH). The savings are achieved by taking two or three graduate courses in the senior year (and perhaps following summer) in addition to the usual requirements. One course may be part of the Master's project.

Affiliating with a particular research group is encouraged. Graduate courses may be taken in the first, as well as second semester of the senior year, if a decision to apply is made early enough. Application for a research or teaching assistantship is automatic, but funding is limited.

A grade point average of 3.30 at the time of application is required for the MS program. For the MEng (a more flexible, but terminal degree), it is 3.10.

Planning for Graduate Studies

(Check with EE Director of Graduate Admissions for information on admission to UB.)

Students who have completed the BSEE program with QPA in the B+ to A range are in great demand as graduate students. Opportunities exist nationwide for graduate study. There are also some very attractive options for graduate study at UB. You should begin planning for graduate study no later than the spring semester of your junior year.

Information is posted outside the EE Department Office.

Usual Requirements for Graduate Study

Although they may differ in detail, most graduate schools have three general requirements for admission: 1) a completed application form; 2) letters of recommendation; 3) a transcript and/or GRE (Graduate Record Exam) scores.

Application form: request directly from the graduate school. For UB, request one from the department office. Application forms are available for download from the EE Homepage: http://www_ee.eng.buffalo.edu/admission. The application form will tell you what else you need.

Letters of recommendation: request these from faculty members who know you. This is an opportunity to get to know the faculty better (see next paragraph for hints about how to introduce yourself).

If you are serious about applying to graduate schools, it is not impolite to see a faculty member (during posted office hours) and introduce yourself with "... you may not remember me, but I received an "A" in your course last semester. I wonder if you would be willing to write a letter of recommendation for Graduate School." If you are applying to several graduate schools, the Career Planning and Placement office provides a convenient mechanism to distribute your letters of recommendation to several schools.

Transcripts and GRE scores: All fellowships in EE, and many others as well, require the GRE. Generally, graduate schools require the GRE scores by January 31 of the year of proposed entrance. This requires that you take the test sufficiently in advance of the deadline date so those test scores are available in time. You can pick up a booklet containing detailed information about how to register for the GRE and deadline dates from the information rack outside of Career Planning and Placement. You may note that the GRE must be taken seriously. Without sufficient preparation, you may not excel in the exam.

Students may also consider the Master of Engineering option. Master of Engineering is a terminal degree and unlike the Master of Science, M.Eng. cannot lead to the Ph.D. program. Interested students should contact the Director of the M.Eng. Program.

The department also offers a Merged 5 year Bachelor/Masters Program. This program allows students to take graduate courses during their senior year. The intent of this program is to let the students plan on graduate studies early on. Information and application forms are available at the EE Graduate Office in 332 Bonner Hall.

Special Fellowships Available at UB

Undergraduate Fellowships are awarded by EE to outstanding seniors nominated by the

EE faculty. These fellowships are unique in that they take effect at the beginning of the senior year, and include a stipend during the senior year. Students selected for this program are expected to complete both their undergraduate program and one or two graduate courses during their senior year, to apply for admission to the graduate program in EE, and to begin working with one or more faculty members in a research area of mutual interest. They may earn credit for their research activity by registering for EE 499 or EE 501- 502. Note that ample opportunity exists to obtain research experience as undergraduates, but it may require contacting the right faculty member.

Taking Graduate Courses for Graduate Credit

Some undergraduates (typically seniors) may begin their graduate studies while completing their undergraduate degree. For example, some students find that they need to carry less than a full-time schedule (12 credits) during one or both semesters of their senior year. To register for a graduate course, obtain written permission from the course instructor. Take this to the department office during the drop-add period at the beginning of the semester, and obtain an exceptional registration (forced registration) form according to posted procedures. Take the exceptional registration form to drop-add, and add the course.

The Fine Print: Department Regulations About Grades and Other Survival Issues

Grades: Maintaining Status and Good Standing

The following grading alternatives are currently in effect:

Letter grades A, A-, B+, B, B-, C+, C, C-, D+, D, F carrying quality points of 4, 3.67, 3.33, 3, 2.67, 2.33, 2, 1.67, 1.33, 1, 0 respectively. All courses receiving these letter grades are included in computing QPA (quality point average).

Satisfactory/Unsatisfactory grades, with "S" indicating credit and "U" no credit. Courses receiving S/U grades are not included in calculating the QPA. Students cannot elect an S/U grade for courses prerequisite to or required in their major OR FOR GENERAL EDUCATION REQUIREMENTS. Many advisors counsel students never to elect S/U. The engineering dean's office tracks three cumulative QPA averages: an overall QPA, a QPA in all technical courses, and an engineering QPA. The engineering QPA includes all courses with engineering prefixes such as required EAS, CSE and EE courses and elective with the prefixes ASE, CE, CIE, IE, MAE and SYS. The QPA in all technical courses includes all math and science courses in addition to the engineering courses. The requirement for graduation is completion of all required and specified elective courses with all three cumulative QPA's equal to or greater than 2.0.

Probation

Students may be placed on academic probation, and receive formal written notification from the office of the Vice-Provost for Academic Affairs if their overall cumulative QPA falls below 2.0. Students also may be placed on academic probation, and receive formal written notification from the engineering dean's office, if any of their cumulative QPA's falls below 2.0. Students are also given warning or placed on probation, regardless of their cumulative average if the overall QPA for the most recent semester falls below 2.0. Students placed on probation are expected to show marked improvement in their next semester's work. A student who has not attained good standing at the end of two consecutive semesters on probation will be dismissed from the EE program.

Failure to Make Satisfactory Progress toward a Degree

Students who fail to maintain satisfactory progress towards the requirements for the engineering degree are subject to dismissal from the EE department. The following are representative examples of unsatisfactory progress:

1. Two successive "F" grades in any course.
2. Two or more "F" grades in a given semester.
3. Receiving an "F" grade for cause (academic dishonesty).

4. Repeated or excessive resignations "R" or incomplete "I" grades. Having grades of "R" or "I" in one-half or more of courses for two successive semesters is considered excessive.

Readmission to EE

Students academically in good standing who have withdrawn voluntarily are eligible to return (on a space-available basis) if they file the Reentry Application form in a timely manner so that the application can be processed before the start of the semester. For the fall semester file before July 1. For the spring semester file before December 1. It is recommended that an appointment be made with one of the SEAS Senior Academic Advisors in 410 Bonner Hall.

Students who have been dismissed for receiving two successive "F" grades in a required course are not eligible for readmission. Students who have been dismissed, readmitted, and dismissed again are not eligible for readmission.

Students who have been dismissed for other reasons may work toward re-admission by demonstrating that they are able to progress satisfactorily toward completion of their degree programs. It is recommended that an appointment be made with one of the SEAS Senior Academic Advisors in 410 Bonner Hall so that a suitable plan can be developed. Since they are dismissed from the program, they cannot take EE, CSE or SYS courses. They may, however, make use of the two unrestricted technical electives and the free elective prescribed for the senior year. These three electives are 9 to 12 credit hours of courses at the 300 or 400 level, selected from the faculties of Engineering and Applied Science, Natural Science and Mathematics, and the School of Health Sciences. Permission to take Junior and Senior EE courses via "forced registration" is not granted to students who have been dismissed from the EE Department unless approved by the EE Director of Undergraduate Studies. The EE Director consults with SEAS Senior Academic Advisors before granting such approval. Student who will need the approval of the EE Director of UG Studies should not wait until the last day (the second Friday) of the registration period at the beginning of the semester. To be eligible for readmission, students must raise their cumulative technical average to at least 2.0. Having done this, they may petition SEAS for readmission to the EE Department. .

The Arithmetic of QPA

Students whose QPA is less than 2.0 should be concerned with a quantity called the "Quality Point Deficiency" (QPD).

Let Q be the quality points earned to date.

Let K be the credits earned to date.

Then $QPD = 2 * K - Q =$ Quality Point Deficiency.

You cannot graduate with a positive Quality Point Deficiency. "C" grades are useless for reducing the quality point deficiency except where the "C" grade replaces a lower grade in the same course. For students with an "F" grade in a required course there is no alternative to repeating the course and obtaining a passing grade. Students who have many "D" grades may also be forced to repeat one or more of these courses to reduce their QPD by obtaining a grade of "C" or higher.

Students who have a $QPD > 10$ should make an appointment with one of the SEAS Senior Academic Advisors in 410 Bonner Hall so that a suitable plan can be developed. An important part of that plan will be repeating courses in which grades less than "C" have been obtained.

Common-Sense Advice on Academic Survival

Don't be a loner. At UB, students learn from each other. You need to know at least one fellow student in EE as a friend. If you don't know anybody, labs and recitations give you the chance to meet your fellow students.

Class attendance: No formal record is kept of attendance; nevertheless, you are responsible for all material covered in every lecture, recitation, and laboratory. Attend class regularly. If you should unavoidably miss a class, perhaps a friend would be willing to let you look at his or her notes, thereby making up, in part, for what you missed.

Know and adhere to the official academic calendar. Register early, attend classes from day one, don't take unauthorized holidays, and plan to be on campus until the very end of the final-examination period.

Academic problems: if you foresee an academic problem, see your faculty advisor as early as possible. If seen early, your advisor may be able to help you. If you delay, it could be too late for your advisor to take appropriate action. In particular, be aware of the last date to add courses and the last date to drop courses.

English: If English is not your mother tongue, you will need to comprehend rapidly spoken technical English. To keep up with the quick pace of technological development, the faculty frequently supplements the textbook material by covering recent developments in lecture. Your comprehension of formal written English may be much better than your comprehension of rapidly spoken English. Methods that have been used successfully by other foreign students to improve their comprehension of spoken English include:

Listen to and read the English all around you in the media of mass communications: radio, TV, movies, and newspapers. Investigate programs that may be offered by UB's own Institute for Intensive English Language Instruction (IELI).

Listening to the same material repeated can be helpful. Some examples of how you can do this: all-news radio stations (locally, WNED--AM 970 Khz) repeat news again and again during the day. Movies shown on campus are often repeated three times. Some lectures and many recitations are repeated.

A professor's office hours give you an opportunity to ask questions in a less pressured environment than the lecture.

Talking to Americans whose native language is English can be a big help.

APPENDIX A:

Electrical Engineering Faculty and Staff

Chairman:

Vladimir Mitin, Ph.D.

Director of Undergraduate Studies:

James J. Whalen, Ph.D.

PROFESSORS

Wayne A. Anderson, Ph.D., State University of New York at Buffalo, (semiconductors; photovoltaics, thin-film technology; defect spectroscopy)

Ping-Chin Cheng, Ph.D, University of Illinois at the Medical Center, (X-ray lithography; biomedical instrumentation; X-ray microscopy and microtomography; confocal microscopy)

Adly T. Fam, Ph.D., [Associate Chairman], University of California-Irvine, (systems theory; digital signal processing; digital control)

Donald D. Givone, Ph.D., [Director of Graduate Admissions], Cornell University, (switching circuit theory; automata theory; digital systems)

Raj K. Kaul, Ph.D., [Director of Graduate Studies], Columbia University, (elasticity; piezoelectricity; wave propagation in periodic structures, optical waveguides)

Pao-Lo Liu, Ph.D., Harvard University, (optoelectronics; fiber optics, compound semiconductors; laser spectroscopy)

Dennis P. Malone, Ph.D., [Emeritus], Distinguished Service Professor; Yale University (quantum electronics; atomic and molecular physics)

Walter J. Sarjeant, Ph.D., [Director of Master of Engineering Program], James Clerk Maxwell Professor, University of Western Ontario-Canada, (power conditioning and applications; lasers; high-voltage pulse techniques; high-current switching)

David T. Shaw, Ph.D., Purdue University, (high temperature superconductivity; thin films, plasma dynamics; aerosol mechanics; superconducting power systems)

Mehrdad Soumekh, Ph.D., University of Minnesota, (signal processing; inverse scattering)

James J. Whalen, Ph.D., [Director of Undergraduate Studies], The Johns Hopkins University, (semiconductor electronics; electromagnetic compatibility; microwaves)

Chu R. Wie, Ph.D., California Institute of Technology, (electronic and optoelectronic devices; materials and integrated circuits)

ASSOCIATE

Stella N. Batalama, Ph.D., University of Virginia, (statistical communications, adaptive signal processing, detection and estimation, learning algorithms)

Alexander N. Cartwright, Ph.D., University of Iowa, (ultrafast laser spectroscopy of semiconductor heterostructures and photonic devices)

Kasra Etemadi, Ph.D., University of Minnesota, (arc technology; plasma chemistry, emission spectroscopy)

Dimitris A. Pados, University of Virginia, (communications; adaptive antenna and radar arrays; neural networks)

Darold C. Wobschall, (Emeritus) Ph.D., State University of New York at Buffalo, (sensors; instrumentation; bioengineering)

ASSISTANT

Lisimachos P. Kondi, Ph.D., Northwestern University, (image and video processing, data compression, multimedia signal processing, digital communications)

Albert H. Titus, Ph.D., Georgia Institute of Technology, (analog VLSI, hybrid VLSI microsystems)

ADVANCED TECHNOLOGY APPLICATIONS PROFESSOR

Mohammed Safiuddin, Ph.D., State University of New York at Buffalo, (optimal control; microprocessors and applications)

Instructors

Khadija Bargach, Ph.D., Abelmalik Essaiadi University, (applied electromagnetics, electromagnetic compatibility, electronics)

Jennifer Zirnheld, M.S., State University of New York at Buffalo, (energy systems, electromagnetic devices)

Adjunct Faculty

Victor Demjanenko, Ph.D., State University of New York at Buffalo, (computer networks; operating systems; digital systems) - (part-time)

Marlin R. Gillette, Ph.D., State University of New York at Buffalo (microwaves)

Wilson Greatbatch, M.S., University of Buffalo; Sc.D. (Hon), State University of New York at Buffalo; Sc.D. (Hon.), Houghton College, Houghton, NY, (implantable cardiac pacemakers; batteries)

Nihar Mahapatra, Ph.D., University of Minnesota, (VLSI; computer architecture)

Chunming Qiao, Ph.D., University of Pittsburgh (parallel and distributed computing, optical interconnection networks, photonic switching)

John K. Schneider, Ph.D., State University of New York at Buffalo (ultrasonics)

Peter D. Scott, Ph.D., Cornell University, (machine vision; digital holography; pattern recognition)

Ramalingam Sridhar, Ph.D., Washington State University, (digital systems; computer architecture; VLSI design)

Shambhu J. Upadhyaya, Ph.D., University of Newcastle, Australia, (fault tolerance computing; VLSI testing; knowledge engineering)

INSTRUCTIONAL SUPPORT SPECIALIST (FOR ELECTRONICS)

James W. Keptner, Instructional Support Specialist, Furnas 408

STAFF

Betty Brown, Assistant to the Chair, Bonner 332C

Marie Huber, Secretary, Bonner 215F

Cheryl L. Rance, Graduate Admissions and Undergraduate Secretary, Bonner 332A

Cathy Muscarella, Graduate Secretary, Bonner 332B

Meta Reuse, Secretary, Bonner 215D