

PROPOSAL FOR

A MASTER OF SCIENCE DEGREE PROGRAM

IN

ELECTRICAL ENGINEERING

UNIVERSITY OF THE DISTRICT OF COLUMBIA

SCHOOL OF ENGINEERING AND APPLIED SCIENCES

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

I Proposal Summary

The department of Electrical and Computer Engineering at the University of the District of Columbia proposes the establishment of a Master of Science degree program in Electrical Engineering (MSEE).

The MSEE is designed to meet the needs of working professionals in the greater Washington DC metropolitan area and full-time graduate students. The MSEE will offer a high-level graduate program with strong foundations in theory to: a) equip students with interdisciplinary skills required to grasp and develop new technologies and trends in the electrical engineering field; and b) prepare electrical engineers with the knowledge and tools needed to advance into leadership roles and to shape the future of this dynamic field.

The MSEE has the following two areas of emphasis:

- Communications and Signal Processing
- Digital Systems Engineering

The MSEE requires a minimum of 30 credit hours of graduate-level course work. The program offers both thesis and non-thesis options. However, students who are supported as research assistants are required to pursue the thesis option.

The following sections provide details of the MSEE program administration, student advising and supervision, program educational objectives and why it is needed, admission standards and requirements, program options and course requirements for each offering option, and details of core and elective courses for each option.

II Program Administration

The Chair of the Department of Electrical and Computer Engineering will be responsible for the implementation and administration of the new MSEE Degree Program in Electrical Engineering. All requirements in the program will be in compliance with the Graduate Studies Requirements of the Academic Policies of the University.

The MSEE Degree Program Committee, referred to as the Graduate Committee, will be

composed of all faculty in the Department of Electrical and Computer Engineering with a PhD degree. The members of the graduate committee will be responsible for curriculum development and periodic review of the MSEE Degree Program in Electrical Engineering.

The Graduate Committee will formulate academic policy, guidelines, and requirements consistent with the university policies. The course development and day-to-day operations of the MSEE degree program will be the responsibility of the Graduate Committee. The Graduate Committee members will elect the Chair of the committee annually at the beginning of the fall semester.

The course work for each area of emphasis consists of a set of required core courses and a set of elective courses in the areas of electrical engineering, computer science, mathematics, and other related fields. To integrate the technological advancement in the Electrical Engineering discipline into the curriculum, members of the graduate committee may propose new courses or changes in course content of any existing course. Proposals for adding new courses or

curriculum changes to reflect the changing industry trends will be reviewed and recommended by the graduate committee. Recommendations for the addition of a new course or change of course content will then be presented to the entire Electrical and Computer Engineering faculty for formal review and approval. Formal university procedure for approving the addition of new courses or changing the contents of existing courses will be followed. After formal university review and approval, the course additions/changes will be entered into the appropriate academic catalog and the University's course inventory.

Advising

Each student admitted into the program can select an advisor in his/her area of interest. An interim advisor will be assigned to each student until he/she chooses an advisor. Each student is responsible for discussing any special needs they may have with his/her advisor. Each student must also select an advisory committee that is composed of at least 3 members of the graduate faculty, the majority of whom must be members of the Department of Electrical and Computer Engineering. The advisor serves as the chairman of the student's advisory committee. The advisory committee for each student must be formally approved by the dean of the graduate school. The selection of advisor and the advisory committee for each student must be completed before the end of the second semester of his/her graduate studies. The dean of the graduate school may also elect to add an external member to the advisory committee. The advisory committee of each student is responsible for approving the course planning guide for that student, monitoring his work progress, and approving the successful completion of his/her studies.

Curriculum Requirements

- Satisfactory completion of 30 hours of approved graduate credits is required.
- The Master's thesis is optional. If undertaken, it counts as 6 semester hours and must be conducted under the supervision of faculty member in the Department of Electrical and Computer Engineering. Non-Thesis option students must pass a comprehensive exam to

graduate. A 3-credit project report based on a current practical industry-type problem may be substituted for the comprehensive exam.

III. The Educational Objectives of the Program

A. Educational Objectives

Why a separate Electrical Engineering Program is needed:

A Master's Degree is offered by institutions and sought by students as a further extension and specialization of undergraduate studies. Electrical Engineering is unique from the other fields of specialization at UDC, such as computer science because it centers on the use of electrical signals and electronics for the very special purpose of processing and transmitting of electrical information (Digital Communication, Digital Signal Processing, Digital Image Processing, Digital Integrated Circuit Design and Computer Architecture). This leads to the focus on digital communications; the propagation of signals as binary data; the organization of digital circuits into electrical processors, connecting mechanisms and digital storage (memories); the design of digital components; the programming of processors; the development of digital systems for

specialized functions. A Master of Science degree program in Electrical Engineering is needed to provide graduate students the in-depth theoretical foundation and interdisciplinary skills required by the growing complexity of electronic systems.

The educational objectives of the MSEE degree program in Electrical Engineering are:

- a. To provide graduate students with up-to-date advanced training in selected marketable specialties of Electrical Engineering;
- b. To provide graduate students with research opportunities to solve real-world problems in Electrical Engineering;
- c. To prepare graduate students for leadership positions in Electrical Engineering.
- d. To prepare students to entry research-based doctoral studies in the discipline.

B. Admission Standards

To be considered for admission into the M.S. Degree Program in Electrical Engineering, a student (US and international) must satisfy the university-wide requirements for admission to graduate programs as established by the Graduate School of the university. However, The Electrical and Computer Engineering graduate committee may require higher academic standards for admitting students to the department's graduate program. In general, the applicant must have completed a Bachelor's degree in electrical engineering, computer engineering, or a closely-related technical field. The applicant must have an acceptable GRE scores. The applicant must submit all documents required by the graduate school the to the admission office of the graduate school. In addition, each applicant should also submit:

- Graduate Record Examination (GRE) basic test scores;
- A letter of intent describing his/her graduate studies goals and objectives.
- Three letters of reference from faculty, engineers or supervisors that can certify his/her ability to pursue studies at the Master of Science level.

International students from non-English speaking countries must satisfy the University

requirements for English language skills. Complete applications satisfying the university's general graduate admission criteria will be sent to the Electrical and Computer Engineering Department for consideration for admission to the graduate program of the Electrical and Computer Engineering department. It is the policy of the graduate committee in the Department of Electrical and Computer Engineering to carefully consider every applicant's previous academic and professional qualifications, test scores and achievements before an admission decision is made and sent to the graduate school.

The graduate school will inform in writing applicants accepted for graduate study whether they need to enroll in undergraduate courses and/or prerequisites requiring completion before commencing their graduate studies.

C. Degree Requirements

The Master of Science in Electrical Engineering is designed to offer the students the opportunity to prepare for leadership roles in careers with industry, government, or educational institutions.

The students enrolled in the M.S. Degree program in Electrical Engineering will have two different options to obtain their degree. They are:

- 1) Thesis option, and
- 2) Non-thesis option

A thesis option is offered for students who want the opportunity to obtain expertise in research and who may be interested in pursuing a doctoral degree in electrical engineering or computer engineering. A non-thesis option is offered for students who want a practical industrial applications-oriented degree. Thesis and project reports must be approved and signed by the graduate school.

MSEE General Requirements

- 1) Maximum of two graduate-level course units may be transferred from another institution to apply toward the MSEE degree. Transferred courses must logically fit into the student's graduate program. The student's graduate advisor decides which courses are acceptable. The UDC approval of transfer credit may also be required. These two courses should not have been used in fulfillment of any other degree(s).
- 2) At least half of the coursework credits, excluding thesis or technical report credits, must be taken with other than a single professor.
- 3) Any coursework more than six years old at the time of the final examination will not be used to fulfill any of the MSEE degree requirements.
- 4) All graduate credits must have letter grades of A, B, or C, or pass/fail grades of S (Satisfactory). No More than two graduate courses with letter grade C will be accepted.
- 5) A minimum grade point average (GPA) of 3.0 is required to remain in good standing and to graduate.

Degree Requirements for the Thesis Option

- 1) Plan of Study - the student must meet with his/her advisor to formulate a plan of study. The plan of study must be submitted to the student's advisory committee after completing at least 9 but no more than 18 semester credits.

2) Satisfactory completion of 30 hours of approved graduate credits including 6 hours of thesis.

3) At least 18 credits of course work, excluding thesis, must be at or above the 500 level.

Courses below the 500 level must be approved by the student's advisory committee.

4) Admission to Candidacy - the admission to candidacy form must be completed prior to the thesis defense. The student should consult the schedule of classes for deadlines on submitting this form for spring graduation.

5) Thesis Defense - a copy of the thesis should be distributed to each member of the advisory committee and to the graduate school at least two weeks prior to the defense. The student should make a public announcement of the defense within the department to allow

attendance by interested faculty, students, and the University Community.

6) Upon application for the thesis defense, students are required to submit a technical paper or abstract, based on some aspect of the thesis research, in a form suitable for submission to a regional technical conference.

Degree Requirements for the Non-Thesis Options

- 1) Plan of Study - the student must meet with his/her advisor to formulate a plan of study. The plan of study must be submitted after completing at least 9 but no more than 18 semester credits.
- 2) Satisfactory completion of 30 hours of approved graduate credits.
- 3) At least 24 credits of course work must be at or above the 500 level. Courses below the 500 level must be approved by the student's advisory committee.
- 4) Satisfactory passing of a written comprehensive exam. Students can take the comprehensive exam after completing the core courses in their area of study.
- 5) A 3-credit project report based on a current practical industry-type problem may be substituted for the comprehensive exam.

D. Curriculum

All MSEE students are required to take the following two core courses:

- 3531-571 Linear systems
- 3531-507 Probability and Random Processes

The course requirements for students majoring in the Communications and Signal Processing area are:

- i) Take the following two core courses
 - o 3531-458/558 Digital Signal Processing I
 - o 3531-469/569 Digital Communications
- ii) Select the rest of the courses from Groups A and C of suggested and free elective courses. Selected courses must be approved by the student's advisory committee.
- iii) Project option students must take 3531-599 Master's Project that counts for 3 credit hours.
- iv) Thesis option students must take 3531-699 Master's Thesis that counts for 6 credit hours.

The course requirements for students majoring in the Digital Systems Engineering area are:

- i) Take the following two core courses
 - o 3531-559 Computer Architecture
 - o 3531-584 Digital System-level Design
- i) Select the rest of the courses from Groups A and C of suggested and free elective courses. Selected courses must be approved by the student's advisory committee.
- ii) Project option students must take 3531-599 Master's Project that counts for 3 credit hours.
- iii) Thesis option students must take 3531-699 Master's Thesis that counts for 6 credit hours.

Group A list of Suggested Elective Courses

- 3531-455/555 Adaptive Filters
- 3531-460/560 Digital Image Processing
- 3531-468/568 Wireless Communications
- 3531-469/569 Digital Communications I
- 3531-478/578 Digital Integrated Circuit Design
- 3531-479/579 Digital Integrated Circuit Design Laboratory
- 3531-480/580 Introduction to Computer-Aided Digital Design
- 3531-483/583 Introduction to Computer Aided Digital Design Lab
- 3531-559 Computer Architecture
- 3531-574 Digital Information Theory
- 3531-575 Wireless Networks
- 3531-584 Digital System-level Design
- 3531-585 Design of a System on a Chip (SoC)
- 3531-586 Advanced Embedded System design
- 3531-658 Digital Signal Processing II
- 3531-659 Advanced Computer Architecture
- 3531-665 Multimedia Communications
- 3531-669 Digital Communications II
- 3531-673 Coding Theory and Applications
- 3531-678 Advanced Digital Integrated Circuit Design
- 3531-692 Advanced Topics in Signal and Image Processing
- 3531-693 Advanced Topics in Digital Communications
- 3531-599 Master's Project (3 credit hours)
- 3531-699 Master's Thesis (6 credit hours)

Group B list of Suggested Elective Courses

- 3531-455/555 Adaptive Filters
- 3531-458/558 Digital Signal Processing I
- 3531-460/560 Digital Image Processing
- 3531-468/568 Wireless Communications
- 3531-469/569 Digital Communications
- 3531-478/578 Digital Integrated Circuit Design
- 3531-479/579 Digital Integrated Circuit Design Laboratory
- 3531-480/580 Introduction to Computer-Aided Digital Design
- 3531-483/583 Introduction to Computer Aided Digital Design Lab
- 3531-574 Digital Information Theory
- 3531-575 Wireless Networks
- 3531-585 Design of a System on a Chip (SoC)
- 3531-586 Advanced Embedded System design
- 3531-592 Advanced Topics in Signal and Image Processing
- 3531-658 Digital Signal Processing II
- 3531-659 Advanced Computer Architecture
- 3531-665 Multimedia Communications

- 3531-669 Digital Communications
- 3531-673 Coding Theory and Applications
- 3531-678 Advanced Digital Integrated Circuit Design
- 3531-693 Advanced Topics in Digital Communications
- 3531-599 Master's Project (3 credit hours)
- 3531-699 Master's Thesis (6 credit hours)

Group C (Free Electives)

Courses in computer science, mathematics, or any other related courses that the student's advisory committee approves. Selected courses must logically fit within the student's plan of study.

Detailed Catalog Descriptions for Courses in the Program

3531-455/555 Adaptive Filters

The theory and design techniques of finite-impulse response filters. Stationary discrete-time stochastic processes, Wiener filter theory, the method of steepest descent, adaptive transverse filters using gradient-vector estimation, analysis of the LMS and RLS algorithm. Adaptive filters design and software/hardware implementations. Application examples in noise canceling, channel equalization, and array processing. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lec. 3 hrs., Prerequisite: 3531-458/558, Graduate standing or consent of instructor.

3531-458/558 Digital Signal Processing I

Time and frequency analysis of discrete-time signals and systems. Fast implementations of the DFT and its relatives. IIR and FIR digital filter design, implementation, and quantization error analysis. Decimation, interpolation and introduction to multirate digital signal processing. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lec. 3 hrs., Prerequisite: 3531-371 or consent of instructor.

3531-460/560 Digital Image Processing

Fundamental principles and algorithms for digital image processing. Two-dimensional spatial

frequency transforms. Image enhancement, histogram equalization, smoothing and sharpening. Image encoding, analysis, and segmentation. Feature extraction, and object and pattern recognition. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lec. 3 hrs., Prerequisite: 3531-458/558 or consent of instructor.

3531-468/568 Wireless Communications

Cellular radio concepts: frequency reuse and handoff strategies. Large scale path loss models; fading and multipath: flat fading versus frequency selective fading; modulation schemes for mobile communication: narrowband versus spread spectrum; equalization; RAKE receiver; multiple access techniques; FDMA, CDMA; and co-channel interference and channel capacity. Common wireless standards. Students enrolled in the 500-level course will be required to

complete additional work as stated in the syllabus. Lec. 3 hrs.,
Prerequisite.: 3531-307 and 3531-371, graduate standing or consent of instructor.

3531-469/569 Digital Communications I

Basis functions, orthogonalization of signals, vector representation of signals, optimal detection in noise, matched filters, pulse shaping, intersymbol interference, maximum likelihood detection, channel cutoff rates, error probabilities, bandwidth, and power-limited signaling. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lec. 3 hrs., Prerequisite: 3531-467, graduate standing or consent of instructor.

3531-478/578 Digital Integrated Circuit Design Lecture

Studies the design process of VLSI CMOS circuits. Also covers all the major steps of the design process, including logic, circuit, and layout design. A variety of computer-aided tools are discussed and used to provide VLSI design experience that includes design of basic VLSI CMOS functional blocks, and verification of the design, testing, and debugging procedures. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lec. 3 hrs., Prerequisite: 3531 312, 352. Co-requisite: 3531-479.

3531-479/579 Digital Integrated Circuit Design Laboratory

Provides VLSI design experience that includes design of basic VLSI CMOS functional blocks, verification of the design, testing, and debugging. Several complex VLSI projects will be submitted for fabrication. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lab. 1 hrs., Co-requisite: 3531-478/578.

3531-480/580 Introduction to Computer-Aided Digital Design

Introduces the techniques of modeling digital systems at various levels of abstraction and computer-aided design algorithms applied to these models to support design and analysis tasks. Covers modeling through the use of a modern hardware description language (VHDL/Verilog), test generation, event-driven simulation algorithms, and physical design used to map the

synthesized logic design onto physical IC area. This is not a how-to course on using CAD tools; it is a study of the algorithms used by CAD tools. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Prerequisite: 3531-312, graduate standing or consent of instructor.

3531-483/583 Introduction to Computer Aided Digital Design Lab

The course emphasizes the use of computer-aided design (CAD) tools in the description, modeling, simulation, verification and testing of digital systems. Alternative coding styles and methodology used for combinational and sequential digital logic designs are evaluated. The use of Field Programmable gate arrays is integrated into the course as the target physical domain. Students enrolled in the 500-level course will be required to complete additional work as stated in the syllabus. Lab 3 hrs., Prerequisite: 3531-312, Co-requisite: 3531-480, graduate standing or consent of instructor.

3531-507 Probability and Random Processes

Foundations for the engineering analysis of random processes: Review of probability theory, Introduction to stochastic processes, Continuous time and discrete time processes, Mean functions, correlation functions, covariance functions, noise, Strict- and wide-sense stationarity, ergodicity, Gaussian processes, power spectral densities, mean square estimation, Markov processes. Prerequisite: Graduate standing and understanding of probability at the level of 3531-307 or consent of instructor.

3531-559 Computer Architecture

Advanced computer architectures with emphasis on multiprocessor systems and the principles of their design and cost/performance factors. Instruction set design and implementation, RISC vs. CISC instruction sets; datapath and controller design, pipeline design; fixed and floating-point arithmetic; memory hierarchy designs, caches, memory systems; I/O systems and their interconnect. Interrupt and exception. Prerequisite: 3531-459, graduate standing or consent of instructor.

3531-571 Linear systems

Methods of linear-system analysis, in both time and frequency domains, are studied. Techniques used in the study of continuous and discrete systems include state-variable representation, matrices, Fourier transforms, Laplace transforms, inversion theorems, sampling theory, discrete and fast Fourier transforms, and Z-transforms. Computer simulation, analysis, and design software packages are used. Graduate standing and understanding of Signal & Systems at the level of 3531-371 or consent of instructor.

3531-574 Digital Information Theory

Entropy and mutual information, Huffman coding, Shannon's source coding theorem, channel coding theorems, channel capacity, block coding error bounds, random coding bounds, cutoff rate, multi-user information theory, random access channels and protocols, multi-access coding methods. Lec. 3 hrs., Prerequisite: 3531-458/558, graduate standing or consent of instructor.

3531-575 Wireless Networks

Fundamental concepts of wireless networks: network architecture for personal communications systems, wireless LANs, radio, tactical and other wireless networks, and design and analysis of protocols on a regular basis. Lec. 3 hrs., Prerequisite: 3531-468/568, graduate standing or consent of instructor.

3531-584 Digital System-level Design

Digital system designs for Digital System Processors and Communications systems:
Applications include matched filters, FFT, QAM Modulators, Raised Cosine Filter, Reed-Solomon and hamming code decoders, error detection and correction circuits, demodulation, and soft and hard decision decoders. Extensive use of hardware and software system-level design tools and packages. Prerequisite: 3531-480/580, graduate standing and understanding of computer organization at the level of 3531-459 or consent of instructor.

3531-585 Design of a System on a Chip (SoC)

System-level design and optimization of multiprocessor systems on a reconfigurable chip. System-level design methodologies. System level design representations and modeling languages. System level modeling. System specification, algorithm modeling, decomposition, IP selection. Synthesis and co-verification of system components. Extensive use of state-of-the-art of CAD tools and FPGA boards. Lab 3 hrs., Prereq: 3531-480/580, graduate standing or consent of instructor.

3531-586 Advanced Embedded System design

Advanced embedded system design principles and practices. Emphasizes formal design methodologies such as hardware-software co-design and co-verification, performance optimization, distributed embedded systems. Soft core and hard core embedded microprocessors. Prerequisite: 3531-480/580, graduate standing or consent of instructor.

3531-658 Digital Signal Processing II

Overview of z-transform, FFT, IIR and FIR filters. Multirate digital signal processing. Optimum filtering of noisy signals. Adaptive digital filters. Power spectrum estimation. Wavelet transform. Interference canceling. Selected applications of DSP techniques in speech, communications and image processing. Lec. 3 hrs., Prerequisite 3531-458/558, graduate standing or consent of instructor.

3531-659 Advanced Computer Architecture

High performance computer architectures: instruction set principles, pipelining, multiprocessing systems, parallel processing, instruction level parallelism, fine-grain and coarse grain parallelism, SIMD, MIMD, multiple instruction issue, data coherency, memory hierarchy design, interconnection networks, vector processors. Prerequisite: 3531-559, graduate standing or consent of instructor.

3531-665 Multimedia Communications

Comprehensive coverage of media compression, synthesis and recognition, media communications and networking, and standards for audiovisual communications over wired and wireless networks. Lec. 3 hrs., Prerequisite: 3531-469/569, graduate standing or consent of

instructor.

3531-669 Digital Communications II

The theory and practice of efficient digital modulations over linear dispersive channels, including adaptive equalization and synchronization. Lec. 3 hrs., Prerequisite: 3531-469/569, graduate standing or consent of instructor.

3531-673 Coding Theory and Applications

The theory and practice of error control coding with emphasis on linear, cyclic, convolutional, and parallel concatenated codes (Hamming codes, Repetition codes, polynomial codes, Reed Solomon Codes). Turbo codes, Viterbi decoding and applications. Lec. 3 hrs., Prerequisite: 3531-469/569, graduate standing or consent of instructor.

3531-678 Advanced Digital Integrated Circuit Design Lecture

Design and implementation of very-large-scale-integrated systems (VLSI) with emphasis on full-custom chip design. Topics will include device and interconnect modeling, static and dynamic logic families, latch and flop design, RAM design, ALU design, low power techniques, power supply and clock distribution, signal integrity, and I/O design. Extensive use of CAD tools for IC design, simulation, and layout verification. Lec. 3 hrs., Prerequisite: 3531-478/578 and 3531-478/578, graduate standing or consent of instructor.

3531-692 Advanced Topics in Signal and Image Processing

Topics of current interest in signal and image processing. Content may vary from offering to offering. Lec. 3 hrs., Prerequisite: Graduate Standing or consent of instructor.

3531-693 Advanced Topics in Digital Communications

Topics of current interest in digital communications. Content may vary from offering to offering. Lec. 3 hrs., Prerequisite: Graduate Standing or consent of instructor.

3531-599 Master's Project. Lab 3 hrs, Prerequisite: Graduate Standing or consent of instructor.

3531-699 Master's Thesis. Lab 6 hrs, Prerequisite: Graduate Standing or consent of instructor

Proposal Supporting Information

1. Demonstration of need

The Department of Electrical and Computer Engineering has a critical need to establish a Master of Science in Electrical Engineering (MSEE) degree program for the following reasons:

- a) The National Council of Examiners for Engineering and Surveying (NCEES) is in the process of requiring 30 credit hours of graduate studies for applicants applying for professional engineering license. This is expected to significantly increase the number of engineers applying for a Master's degree. The proposed MSEE will provide a competitive program of study for those engineers.
- b) A Master of Science in Electrical Engineering (MSEE) is offered by five universities in the greater Washington area: George Washington University, Howard University, The Catholic University of America, the University of Maryland, and George Mason University. However, the availability of similar programs to the proposed program should not deter us from establishing an MSEE in our department. The qualification of our faculty, their expertise, and the quality of their teaching will allow our program to be compatible with other similar programs in the region.
- c) The proposed MSEE is focused in two areas of emphasis: Communications and Signal Processing, and Digital Systems Engineering. These two niche areas of emphasis have numerous applications in national security, defense, and high-tech consumer products. There is a great demand for highly qualified engineers in these two areas in the Nation in general and in the Washington metropolitan area in particular. The proposed program will help meet the demands for competent professionals who can translate the most complex theories of signal processing and communication protocols into state-of-the-art, real-time digital systems. Our MSEE program will provide our graduates with such highly-competitive education at a much lower cost than any of other schools in the region.
- d) The availability of graduate programs in the department will enhance the visibility of the

department and improve its academic ranking in the nation. This will help attract more and better qualified undergraduate students to the department.

e) Most qualified faculty will not accept to work in a department without a graduate program. The establishment of the MSEE program will help attract more qualified faculty to the department.

f) Graduate students are the main workforce in research activities. The graduate students admitted to the program will help enhance the quality of the research conducted by the faculty. This is essential for applying to research grants from sources such as the National Science Foundation (NSF), The Department of Education (DOE), the Department of Defense (DoD) to list a few.

2. Congruence with academic unit objectives and university mission

The establishment of the MSEE is in line with the objectives of the Department of Electrical and Computer Engineering (ECE) in particular, and the mission of the School of Engineering and Applied Sciences, and the University of the District of Columbia. The proposed MSEE will help provide quality graduate studies, in areas of critical importance and great demands, to the citizens of the District of Columbia in particular, and the nation in general.

3. Avoidance of duplication or overlap with existing courses or programs

The proposed MSEE is not a duplicate of any existing program at the University of the District of Columbia.

4. Relationship with other programs/departments/schools/colleges

The proposed MSEE program will complement and help strengthen other graduate programs in the university such as the Master of Science in Computer Science, among others, through collaboration in multidisciplinary research activities.

5. Standards of relevant accrediting agencies and/or professional societies

The Undergraduate program of the ECE department is accredited by ABET, Inc. ABET can either accredit the undergraduate program or the graduate program of any particular department. In our case, no outside accreditation is required for the graduate program.

6. Number of students immediately affected if relevant

In its initial offering, the program expects to admit between 15-20 graduate students. The number

of admitted students is expected to double in the next five years depending on the availability of faculty and resources. The program is expected to have a major impact on the undergraduate enrolment in the department. Judging by the successful offering of the graduate program in the Computer Science Department and its effect on increasing their undergraduate student, The ECE department expects to double its undergraduate enrolment in the next five years. We also expect faculty to increase their scholarship and to provide research assistantships to the students.

7. Effect on student development, employment or program effectiveness

The MSEE program will produce graduates with the state-of-the art knowledge and standard practices in the Electrical Engineering profession. Such program is in great demand across the nation. Many industries encourage their employees to pursue graduate studies through tuition assistance and flexible work programs. The licensing board for professional engineers is in the process of requiring graduate studies for all professional engineering applicants. The establishment of the MSEE degree program will have extremely positive impact on the quality of teaching, course offering, and research in the ECE undergraduate program. The availability of more qualified faculty and research laboratory will help provide better teaching environment, facilities, and more research opportunities for undergraduate students. This will help produce highly qualified, highly employable engineers.

8. Adequacy and appropriate qualification of current faculty and support staff.

The faculty of the ECE department has the highest qualifications needed for their profession. Each faculty has a PhD degree in his/her field and with many years of teaching and research experience. The majorities of the faculty have worked in other universities and have supervised many Master theses and PhD dissertations. However, to ensure maximum success for the proposed MSEE degree program, the hiring of 2-4 additional faculty may be needed in the next five years as per the School' draft Strategic Plan.

9. Adequacy of current facilities

The proposed program will not require additional space for its facilities. However, research laboratories in the two program areas of emphasis need to be established. The Dean has agreed to reassign current space as needed by the faculty and programs.

10. Adequacy of supplies and equipment. Identify additional needs, if any.

The expected increase of enrollment will require the acquisition of more software licenses, hardware design and test equipments, and more office supplies and teaching and research materials. The establishment of research laboratories will require substantial amounts of funding to purchase design and test equipment as well as their necessary supplies.

11. Estimated costs, available funds and probable funding sources.

The Department of Electrical and Computer Engineering expects substantial increases in external funding, from the NSF and other government funding organizations, after the successful implementation of the MSEE program. The program will also seek funding from other relevant

industries. However, institutional resources in the amount of \$200,000 on average per year in the first three years may be needed to help jumpstart the program. Part of this funding will be used to establish the laboratories and some of its research activities, and some to support research and teaching assistants in the program.

12. Adequacy of supportive library and technical resources.

The UDC subscription to digital libraries is not adequate in its current state. Institutional subscription to the Institute of Electrical and Electrical Engineering (IEEE) digital library (IEEE Xplore) and the Association of Computing machinery (ACM) digital library are essential to provide access to the state-of-the art research activities and development in the electrical engineering field. We have worked collaboratively with the LRD on these acquisitions.

