I. **PhD Qualifying Examination Process:**

A. **Requirement for the Examination:**
   
i. Full-time and part-time students entering UTD who already have an MSEE must pass the exam by the end of their third long semester on campus.
   
ii. Full-time and part-time students entering UTD, without an MSEE, should pass the exam before the end of their fourth long semester on campus.
   
iii. The exam must be passed in no more than two attempts.
   
iv. Each student must have completed graduate level coursework comparable to the MSEE degree at UTD.
   
v. Each student should be in good academic standing without any conditions or probation.

B. **Implementation of the Examination:**

i. Each student must choose one of the following research areas for the oral examination. (For each area there will be one QE committee of 3 faculty members + one alternate - appointed by the department chair.) The core knowledge topics that the student is expected to understand are listed below for each of the research areas.

   a) Analog and Mixed-Signal Circuits - Models of active devices, single-stage amplifiers, differential amplifiers, current sources, current mirrors, active loads, voltage and current references, opamp design, frequency response, stability and compensation, two-stage amplifiers.
   
b) Biomedical Applications - Anatomy and human physiology including: nervous system, muscular, circulatory and vascular, immune, and digestive systems. Modern molecular and cellular biology concepts including genes, protein structure and function, organization of cells and cellular trafficking.
   
c) Communications - Concepts in random processes and digital communications such as stationarity and independence, auto-correlation and cross-correlation functions, introduction to Markov Chain, linear systems with random inputs, spectral characteristics, low-pass equivalent representation of bandpass signals and systems, signaling schemes and performance of binary and M-ary modulated digital communications, MAP and ML detection, overall design considerations and performance evaluations of digital communications systems.
   
d) Control Systems - Systems and control theory: linear systems: state space, transfer functions, stability, controllability, observability, and feedback; stability of nonlinear systems, Lyapunov stability; differential geometric tools, feedback linearization, input-output linearization, output injection, output tracking.
e) Devices and Device Fabrication - Electromagnetic theory, principles of quantum physics, semiconductor physics, active devices, micro-electromechanical devices.

f) Digital Systems - Combinational and sequential logic design, basic logic minimization and time analysis techniques, basic arithmetic circuits, design for testability (scan and built-in self-test), quantitative analysis and evaluation of computer systems, pipelining, memory hierarchy, serial/parallel I/O.

g) Optics - Dielectric waveguides, waveguide modes, coupled-mode formalism, directional couplers, diffractive elements, switches, wavelength-tunable filters, polarization properties of devices and fibers, step and graded-index fibers, fiber measurements, fiber splices, fiber systems, polarized light; Jones and Mueller matrices; interference of polarized waves; interferometers, diffractive phenomena.


i) RF/Microwave - Impedance matching, network theory, S-parameters, transmission line media (waveguide, coax, microstrip, stripline, coplanar waveguide, etc.), passive component design (power dividers, couplers, switches, attenuators, phase shifters, etc.), narrow band and broadband matching circuits, low noise amplifiers, noise figure, noise parameters, stability criteria, and linearity.


k) VLSI Circuits and Systems- MOS transistor characteristics, CMOS technology, analysis, design and layout of static CMOS gates, the method of logical effort, clocking and timing issues, flip-flop design, other CMOS technologies including dynamic logic, SRAM design, design of adders and multipliers.

ii. Each student will be given a research paper (journal article and/or proceeding) to study, analyze and present to an examining committee. The
examine the committee may choose to use up to 2 research papers rather than just a single paper.

a) The paper(s) will be chosen by the committee and the same paper (or set of two papers) will be used by all students in a chosen area in a given semester.

b) The paper(s) does not have to be at the leading edge of research and should allow the committee to examine how the student applies core EE knowledge to understanding real research problems.

iii. Each student will be given a set of instructions for preparing for the examination. These instructions will describe the format of the oral presentation, the field of study to be covered by questions and the expectations of the Department for successful completion of the examination. In particular:

a) The student must demonstrate competency over core knowledge in their chosen research area (see B.i. above.)

b) The student must demonstrate the ability to understand the research article(s) chosen for the exam.

iv. Each student will present a concise overview of the paper(s) according the departmental instructions at the start of the oral examination period.

a) The student presentation is to be less than 15 minutes in duration.

1) Key results from the paper – demonstrating understanding of those results.

2) Connection to core knowledge in area.

v. After the presentation, the examination committee will ask questions related to the area core topics and the contents of the paper(s). The questions should probe the student’s level of ability to read, understand, analyze and apply the results in those articles. Questions should also probe the student’s ability to apply the area core topics to the subject of these articles.

vi. After the period of questioning; each committee member will grade the student’s readiness to conduct Ph.D. level research on a scale of 0 to 4 (0.5 increment):

a) 0 = Failing

b) 1 = Poor

c) 2 = Borderline

d) 3 = Passing

e) 4 = Exceptional

vii. The scores will be collected by the examination committee chair and averaged. This “average exam score” will be passed to the Department Chair for final decisions.
C. Composition of the examination committee (appointed by the Department Chair or his/her representative.)
   i. Three (3) tenure track faculty in the general field of the student’s research.
   ii. One (1) alternate in the general field of the student’s research.
   iii. A student’s research advisor shall not serve on the examination committee. However, the advisor’s input will become part of the overall assessment, in the case of a borderline exam result.

D. Timing of the examination process:
   i. Students will declare their intent to take the exam early in the semester (the deadline for application shall be advertised to graduate students as early as possible each semester).
   ii. Students will be assigned a committee as expeditiously as possible.
   iii. The committee will assign either 1 or 2 papers to the students in that area at least three (3) weeks prior to the examination date. The paper(s) should be in the general field of the students’ research.
   iv. The committee shall work to ensure that no examination is postponed beyond the 9th week of the semester.
   v. Exams in the same area are to be scheduled on the same day so that the scheduling time overhead is minimized.

E. Exam evaluation criteria and decision:
   i. The final evaluation will be based on two components:
      a) The “average exam score.” Each member of the examination committee will grade the student’s readiness to conduct research on a scale of 0 to 4 (0.5 increments). The average score of all committee members will be used as the “average exam score.”
      b) The “GPA score.” The student’s MSEE GPA or graduate level UTD core courses GPA will be used as the “GPA score.”
   ii. The final evaluation score shall be calculated by the examination committee chair as: final evaluation score = (average exam score)*2/3 + (GPA score)*1/3
   iii. Decisions shall be based upon the Final evaluation scores.
      a) Final evaluation scores ≥ 3.3 shall pass;
      b) 3.0 < Final evaluation scores < 3.3 are borderline. The committee shall take into account the written input of the advisor in making a pass/fail decision.
      c) Final evaluation scores ≤ 3.0 shall fail. Students with scores at or below 3.0 are allowed to retake the exam a second time.

F. Communication of examination results:
i. The final evaluation scores shall be communicated to the student and advisor by the Department Chair.