Stevens Institute of Technology

School of Business

**AACSB
ASSURANCE OF LEARNING PLAN**

**Doctor of Philosophy in Financial Engineering**

**(Ph.D.)**

April 2021

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# INTRODUCTION: FE PhD ASSURANCE OF LEARNING PLAN

The School of Business Financial Engineering Ph.D. program prepares students to become rigorous and thoughtful researchers who can think about creative applications of technology and quantitative methods in building innovative solutions and designing new mathematical models for asset pricing, risk management, portfolios optimization, etc. As a science/engineering discipline based out of a business school, the Ph.D. program in Financial Engineering is unique for its emphasis on preparing students to become leading researchers who bring a problem-solving perspective to the emerging challenges associated with financial industry.

The doctoral program is built around six areas of research expertise of School of Business faculty. Students who complete the program will be prepared to lead academic and corporate research efforts in the following areas:

**Algorithmic and high frequency trading**: Technology, computational intelligence/artificial intelligence, and the availability of high-frequency data in financial industry have forced traders to think differently about how to build effective strategies in digital financial markets. Research here is centered around execution quality of trading strategies, as well as how financial information can be combined and selected in generating effective trading rules.

**Asset pricing and behavioral finance**: Researchers here analyze technology’s impact on asset pricing, including the deployment of social network indicators to forecast pricing trends and success drivers in developing new derivative products.

**Portfolio optimization**: Faculty studying portfolio optimization consider how new methods and technologies can help investors create value while creating realistic assessments of risk.

**Systemic risk**: Financial markets and risks are systemic — events in one sector of the finance world are quickly felt in other sectors, crossing old boundaries with complex consequences that are difficult to predict. Research in this area explores the new regulatory, risk and technology management perspectives required to ensure successful outcomes in a global systemic framework.

**Mathematical finance**: Researchers here use quantitative methods to examine mathematical and numerical models and their applications in finance to better study concepts like pricing and value.

**Financial analytics and innovation**: Working with researchers in this area, students will be able to use massive data sets — from market prices to text messages — in discovering and extracting meaningful signals from data. This helps professionals in the industry improve decision-making through the development of new analytics and build more efficient and secure solutions.

Before graduating from the program, students become specialists in one or more of these areas through independent research and collaborative work with faculty, who provide one-on-one guidance to doctoral candidates. Each student is required to publish a minimum of two conference papers and one journal paper (ABS[[1]](#footnote-1) ranked) before completing the program; many exceed this requirement.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total Credits** | **Courses** | **Research** |
| **PhD Degree Requirements** | 54 | Min. 36 credits | Max. 18 credits |

There are two required courses. Every doctoral student at Stevens must complete PRV 961 Ph.D. Signature Course as part of their studies. In addition, Ph.D. students in the Financial Engineering program also must complete MGT 719 Research Methods (SYS 710 for the students admitted prior to 2017).

Working with their advisor, students choose from among the following courses to tailor their studies to their particular area of research interest. Additional courses may be substituted in with approval from the FE Ph.D. committee. The total number of credits required to graduate from the Ph.D. program after acquiring a Masters degree is 54, and there are maximum of 18 credits allocated for research leading toward the dissertation. The rest of the credits will be filled with the courses approved by the student’s academic advisor(s). The following courses are the recommended electives by the Financial Engineering Ph.D. Committee.

To improve the program’s competitiveness, we added several specific competencies, detailed the indirect measures to assess the competencies and specified how to track these when we outline the goals. Moreover, we incorporate more explicit focus on ethics and global threads so that our students will be better prepared for embracing global challenges we face today.

**Quantitative methods:**

FE 641 Advanced Multivariate Statistics

FE 646 Optimization Models and Methods in Finance

MA 611 Probability

MA 612 Mathematical Statistics

MA 623 Stochastic Processes

MA 629 Convex Analysis and Optimization

MA 630 Numerical Models of Optimization

MA 653 Numerical Solutions of Partial Differential Equations

MA 655 Optimal Control Theory

MA 661 Dynamic Programming and Stochastic Optimal Control

MA 662 Stochastic Programming

FE 710 Applied Stochastic Differential Equations

FE 720 Volatility Surface: Risk and Models

**Domain tools:**

FE 635 Financial Enterprise Risk Engineering

FE 655 Systemic Risk and Financial Regulation

FE 622 Simulation Methods in Computational Finance and Economics

FE 670 Algorithmic Trading Strategies

FE 672 Modern Market Structure and HFT Strategies

CS 541 Artificial Intelligence

CS 559 Machine Learning: Fundamentals and Applications

CS 590 Algorithms

CS 600 Advanced Algorithm Design and Implementation

BIA 658 Social Network Analysis

BIA 810 Cognitive Computing

**School of Business and FE PhD Vision Statements**

**School of Business Vision**
We will be leaders in the creation and dissemination of knowledge that drives successful innovation in products, processes and businesses.

**PhD in Financial Engineering (PhD) Vision**We aim to be a world leading academic program that produces academic leaders who focuses on creative applications of technology and quantitative methods in building innovative solutions for financial industry.

Ph.D. IN FINANCIAL ENGINEERING PROGRAM LEARNING GOALS

The program’s primary objective is to prepare students to pursue an academic career or a career in a research environment that is increasingly global in nature.

The course work introduces students to the foundations of research related to mathematical tools and analytical methods for financial economics and finance domain problems and will equip them with the knowledge required to conduct original research with ethical expectation in perspective. In today’s business and academic environment, global context and orientation have become more important than ever before as research is generating much broader impact in the society. Therefore, we aim to infuse research ethics and global perspectives as an integral part of our learning goals.

# FE PhD Learning Goals

The Learning Goals for the PhD program are listed in Table 1.

**Table 1: FE Ph.D. Program Learning Goals**

Table 1: PhD Learning Goals

|  |
| --- |
| Learning Goals/ Skill Sets |
| PhD-1: FE Ph.D. graduates can effectively communicate research in oral presentations. |
| PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.  |
| PhD-3: FE Ph.D. graduates are able to effectively deliver academic courses in a university environment.  |

While achieving the learning goals defined above, we also aim to incorporate ethical discussions and the global perspective of the learning into different aspects of the program activities. These efforts are manifested through ethics training in course content, exams and academic activities, and at the same time all the learning activities have also considered with a global perspective so that our students will be equipped to address global problems and be ready to engage global academic community. We considered them as the “Ethics Thread” and the “Global Thread” on top of the explicitly defined learning goals.

# FE PhD ASSURANCE OF LEARNING ASSESSMENT PLAN

**Table 2: FE PhD ASSURANCE OF LEARNING ASSESSMENT PLAN - GOALS 1 through 3**

|  |  |  |  |
| --- | --- | --- | --- |
| **PhD LEARNING GOAL** | **Where and when measured?** | **How measured?** | **Criterion** |
| **PhD-1: FE Ph.D. graduates can effectively communicate research** **in both written and oral forms.**   | Students must present once either their own research or review of others’ research as part of the FE Ph.D. Colloquium every semester in the school.The qualifying exam early in fall of 2rd year requires students to pass both a written exam and an oral exam. Students who fail either part of the exam will be automatically removed from the program. | Students will be evaluated and given feedback immediately during the colloquium presentation by the leading faculty members for both presentation and content.The qualifying exams by an examining faculty committee will evaluate both the written quality of the research statements and the presentation quality of the oral exam.Sampling: All PhD students | FE Ph.D. Colloquium presentations will be judged by clarity of the presentation, and correctness of the technical content. Summary will be reported in the Ph.D. Activity Report each semester.For the qualifying exams, the examination committee members will vote on both the written and oral exams. A vote can be either a Pass or a Fail. If there are more than one Fail votes in either part, the student automatically fails the entire exam.  |

|  |  |  |  |
| --- | --- | --- | --- |
| PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.  | Students must complete 54 credits (with maximum of 18 research credits) after receiving a Masters’ degree.Students must pass a three-part exam as part of the preliminary exam early in fall of 2nd year. It has to be taken in the school.Students must pass a two-part exam as part of the qualifying exam early in fall of the 3rd year.Students must pass dissertation proposal defense before the end of 4 years of full-time study. | Students must maintain a good standing of their academic courses at the end of each semester, otherwise the students will be put on probation to improve. There is a preliminary examination committee to conduct the exam that includes three parts: a) Mathematical foundations; b) Practical finance problems; c) Subject area test. The qualifying exam will be evaluated by a qualifying exam committee. Students must pass both the written and oral parts with maximum of two attempts.Dissertation proposal will be evaluated by a dissertation committee.Sampling: All PhD students. | By the Institute policy, a student who meets at least one of the following criteria will be placed on probation: a) Has received an F in a course; b) Has less than a B (3.0) average after earning 10 or more credits; c) Has received three or more C’s.The preliminary exam will be graded by the examination committee members. Each of the three parts will be given a letter grade (A/B/C). Students must receive an average of B without more than one Cs.For the qualifying exams, the examination committee members will vote on both the written and oral exams. A vote can be either a Pass or a Fail. If there are more than one Fail votes in either part, the student automatically fails the entire exam.Each paper must be evaluated as at least satisfactory.Proposal must be accepted by dissertation committee without more than one dissatisfaction ratings from the committee members. |
| PhD-3: FE Ph.D. graduates are able to effectively deliver academic courses in a university environment.  | Students must take at least one semester TA assignment. Students must teach or co-teach one course before graduation. | Course/teacher evaluations.Sampling: All PhD students. | Achieve a mean course & instructor evaluation score of at least 3.0 out of max 4.0 |

**Table 3: FE PhD Relation of Learning GOALS to Curriculum**

Table 3: Ph.D. Curriculum Alignment Map

|  |  |
| --- | --- |
| Learning Goals/ Skill Sets | Corresponding Educational Experiences |
| PhD-1: FE Ph.D. graduates can effectively communicate research in oral presentations.  | Most courses involve individual and team presentations and require students to write research papers involving critical evaluations of literature. Ph.D. colloquium, preliminary and qualifying exams require research papers and their oral presentation. |
| PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner. | All required and recommended Ph.D. courses address specific research methods or specific research areas related to financial engineering research topics. Preliminary and qualifying exams require original research papers and their oral presentation. Students are required to publish two peer-reviewed conference papers or one journal paper (ABS ranked), and submit one paper to a journal (ABS ranked). |
| PhD-3: FE Ph.D. graduates are able to effectively deliver academic courses in a university environment.  | A teaching policy defining the different steps of teaching training is implemented. Specific TA training and teaching seminars are integrated into the process. |

# FE Ph.D. CURRICULUM ALIGNMENT MAP

**Table 4: FE Ph.D. Financial Engineering Curriculum Alignment Map**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Goals/** | **PhD-1: FE Ph.D. graduates can effectively communicate research in oral presentations.** | **PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.** | **PhD-3: FE Ph.D. graduates are able to effectively deliver academic courses in a university environment.** | **Ethics Thread** | **Global Thread** |
| **CORE COURSES** |  |  |
| MGT719 Research Design Prof. Lee | Students present a research design that is related to their dissertation research. And a course report will be submitted and evaluated. | Students work on specific problems and learn the different methods of research design. |  | Research ethics is important part of the training. Issues such as, plagiarism, social responsibility, etc. will be discussed. | Significant part of the content is global. |
| FE801 Independent Study | Students learn to present their research paper, and write critics. | Students work with advisor on specific research paper. |  | Ethics in academic research will be reinforced through writing and critics. | Significant part of the content is global. |
| PRV 961 | Students learn how to communicate and give presentations. |  |  | Cases related to innovation and entrepreneurship involve ethical issue. | Significant part of the content is global. |
|  |  |  |  |  |  |
| FE PhD Colloquium | Students learn to present their research paper, and give critics. | Students present their own or others’ research. Students are required to provide critique of others’ presentations. |  | Some ethical issues will be discussed in performing financial research, such as fraud, social responsibility, climate impact, etc. | Significant part of the content is global. |
| Goals/Quantitative Courses  | PhD-1: FE Ph.D. graduates can effectively communicate research in oral presentations. | PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner. | PhD-3: FE Ph.D. graduates are able to effectively deliver academic courses in a university environment. | **Ethics thread** | **Global thread** |
| FE641 Advanced Multivariate Statistics | Students are required to learn to write mathematical report and analysis. | Students learn advanced topics in time series such as Granger causality, vector auto regressive models, co-integration, and error corrected models, VARMA models and multivariate volatility models will be presented. |  | Not relevant | Significant part of the content is global. |
| FE646 Opt. Models & Methods in Finance | Students are required to learn to write mathematical report and analysis. | Students learn the main classes of optimization problems encountered in financial engineering: linear and nonlinear programming, integer programming, dynamic programming, stochastic programming, and robust optimization.  |  | Not relevant | Significant part of the content is global. |
| MA611 Probability | Students are required to learn to write mathematical report and analysis. | Students learn foundations of probability, random variables and their distributions, discrete and continuous random variables, independence, expectation and conditioning, generating functions, multivariate distributions, convergence of random variables, and classical limit theorems. |  | Not relevant | The entire content is global. |
| MA612 Mathematical Statistics | Students are required to learn to write mathematical report and analysis. | Students learn point estimation, method of moments, maximum likelihood, and properties of point estimators; confidence intervals and hypothesis testing; sufficiency; Neyman-Pearson theorem, uniformly most powerful tests, and likelihood ratio tests; and Fisher information and the Cramer-Rao inequality. |  | Not relevant | The entire content is global. |
| MA623 Stochastic Processes | Students are required to learn to write mathematical report and analysis. | Students learn random walks and Markov chains; Brownian motions and Markov processes; and applications, stationary (wide sense) processes, infinite divisibility, and spectral decomposition. |  | Not relevant | The entire content is global. |
| MA629 Convex Analysis and Optimization | Students are required to learn to write mathematical report and analysis. | Students learn the main numerical methods of optimization and their convergence constitute the second portion of the class, along with the theoretical results and methods, optimization models in management, finance, and other practical situations. |  | Not relevant | The entire content is global. |
| MA630 Numerical Methods of Optimization | Students are required to learn to write mathematical report and analysis. | Students learn several advanced topics in the theory and methods of optimization including subgradient calculus for non-smooth convex functions, optimality conditions for non-smooth optimization problems, conjugate and Lagrangian convex duality, numerical methods for non-smooth optimization, approaches to large-scale optimization problems. |  | Not relevant | The entire content is global. |
| MA653 Numerical Solutions of Partial Differential Equations | Students are required to learn to write mathematical report and analysis, and present their results. | Students learn the finite difference and pseudo-spectral methods to solve partial differential equations, including parabolic, hyperbolic, and elliptic equations in one or higher dimensional space. The theory on consistency, convergence, and Von Neumann stability analysis of numerical schemes will be emphasized. |  | Not relevant | The entire content is global. |
| MA655 Optimal Control Theory | Students are required to learn to write mathematical report and analysis. | Students will learn proportional derivative control, state-space and spectrum assignment, outputs and dynamic feedback, reachability, controllability, feedback and stability, Lyapunov theory, linearization principle of observability, dynamic programming algorithm, multipliers for unconstrained and constrained controls, and Pontryagin maximum principle. |  | Not relevant | The entire content is global. |
| MA661 Dynamic Programming & Stochastic Optimal Control | Students are required to learn to write mathematical report and analysis. | Students will learn basic concepts of control theory for stochastic dynamic systems, controlled Markov chains, dynamic programming for finite horizon problems, infinite horizon discounted problems, numerical methods for infinite horizon problems, linear stochastic dynamic systems in discrete time, tracking and Kalman filtering, linear quadratic models, controlled Markov processes in continuous time, and elements of stochastic control theory in continuous time and state space. |  | Not relevant | The entire content is global. |
| MA662 Stochastic Programming | Students are required to learn to write mathematical report and analysis. | Students will learn generalized concavity of measures, optimization problems with probabilistic constraints (convexity, differentiability, optimality, and duality), numerical methods for solving problems with probabilistic constraints, two-stage and multi-stage models (structure, optimality, duality), decomposition methods for two-stage and multi-stage models, risk averse optimization models. |  | Not relevant | The entire content is global. |
| FE710 Applied Stochastic Diff Equation | Students are required to learn to write mathematical report and analysis and give oral presentations. | Students learn Ito calculus review, linear stochastic differential equations (SDE’s), examples of solvable SDE’s, weak and strong solutions, existence and uniqueness of strong solutions, Ito-Taylor expansions, SDE for Markov processes with jumps, Levy processes, forward and backward equations and the Feynman-Kac representation formula, and introduction to stochastic control. |  | Not relevant | Significant part of the content is global. |
| FE720 Volatility Surface - Risk & Models | Students are required to learn to write mathematical report and analysis. | Students learn Black-Scholes implied volatility, empirical statics and dynamics of the volatility surface, volatility risk premium, stochastic volatility models, Dupire’s local volatility model, Heston-Nandi GARCH model, arbitrage-free properties of the volatility surface, volatility surface parameterization and calibration, simulation of the Heston model, stochastic volatility model with jumps, option pricing based on fast Fourier transforms, and volatility derivatives. |  | Financial cases will be discussed to illustrate social responsibility of financial institutions. | Significant part of the content is global. |
| **Goals/****Domain Tools Courses** | **PhD-1: FE Ph.D. graduates can effectively communicate research in oral presentations.** | **PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.** | **FE PhD-3: Ph.D. graduates are able to effectively deliver academic courses in a university environment.** | **Ethics thread** | **Global thread** |
| FE635 Financial Enterprise Risk Engineering | Students work on a course project and present the analysis and results. | Students learn classical measures of risk such as VaR, methods for monitoring volatilities and correlations, copulas, credit derivatives, the calculation of economic capital, and risk-adjusted return on capital (RAROC). The nature of bank regulation and the Basel II capital requirements for banks are examined. |  | Cases will be discussed in terms of financial firms’ social responsivity and decision dilemmas faced with financial institutions.  | Significant part of the content is global. |
| FE655 Systemic Risk and Financial Regulation | Students work on a course project and present the analysis and results. | Students learn the study of financial systems as a system of complex adaptive systems, agent-based modeling, history and analysis of bubble formations as a systemic risk, the role of rating agencies, the financial systems ecosystem, risk and regulatory environment, risk and the socio-political environment. |  | The boundaries between ethics and law in risk regulation will be discussed. | Significant part of the content is global. |
| FE622 Simulation Methods in Comp. Finance and Economics | Students work on a course project and present the analysis and results. | Students learn basic philosophy and methodology behind simulation in computational finance and economics, students will learn advanced topics such as Markov Chain Monte Carlo, Bayesian Monte Carlo, Zero Intelligent Agent Model and Utility Optimization Agent Model. |  | Ethical decisions and choice in financial decision modeling will be discussed and illustrated in some cases, such 2008-09 financial crisis induced by mortgage backed securities, etc. | Significant part of the content is global. |
| FE670 Algorithmic Trading Strategies | Students work on a course project and present the analysis and results. | Students learn high-frequency finance, markets and data, time series, microscopic operators, and micro-patterns. Methodologies include, but not limited to, Bayesian classifiers, weak classifiers, boosting and general meta algorithmic emerging methods of machine learning applied to trading strategies. Back-testing and assessment of model riskare explored. |  | Algorithmic decision and its social responsibility will be discussed. | Significant part of the content is global. |
| FE672 Modern Market Structure and HFT Strategies | Students work on a course project and present the analysis and results. | Students learn modern microstructure theory, order types, limit-order book, dark pool trading, market-making strategies, arbitrage strategies, directional strategies, performance and risk assessment, as well as related market regulations. Half of the course is in the Hanlon Financial Systems Lab, where theoretical models are illustrated with real scenarios. |  | Modern trading technology and its impact to social stability and welfare will be discussed. HFT’s role in the past market crashes will be used to illustrate how the application new technology in financial market will impact the society. | Significant part of the content is global. |
| CS541 Artificial Intelligence | Students work on a course project and present the analysis and results. | Students learn problem-solving by search and constraint satisfaction; alpha-beta search for two-player games; and logic and knowledge representation, planning, learning, decision. |  | Social responsibility of use of AI will be discussed. | The entire content is global. |
| CS559 Machine Learning: Fundamentals and Applications | Students work on a course project and present the analysis and results. | Students learn supervised (Bayesian) and unsupervised learning, non-parametric methods, graphical models (Bayes Nets and Markov Random Fields) and dimensionality reduction, as well as recent developments in learning algorithms, including boosting, Support Vector Machines and kernel methods, etc. |  | Social responsibility of use of machine learning will be discussed. | The entire content is global. |
| CS590 Algorithms | Students work on a course project and present the analysis and results. | Students learn advanced and/or balanced search trees; hashing; further asymptoticcomplexity analysis; standard algorithm design techniques; graph algorithms; complex sort algorithms; and other “classic” algorithms that serve as examples of design techniques. |  | Not relevant | The entire content is global. |
| CS600 Advanced Algorithm Design and Implementation | Students work on a course project and present the analysis and results. | CS 600 Students learn design, implementation, and asymptotic time and space analysis of advanced algorithms, as well as analyzing worst-case and average-case complexity of algorithms. |  | Not relevant | The entire content is global. |
| BIA658 Social Network Analysis | Students work on a course project and present the analysis and results. | Students learn concepts and theories of social networks as well as techniques to conduct marketing research from a network perspective including network concepts (graph-theoretic fundamentals, centrality, cohesion, affiliations, equivalence, and roles), network theories (embeddedness, social capital, homophile, and models of network growth) and design issues (data sampling and hypothesis testing). |  | Social media is the background of the course. Use cases related to social impact and responsibility of these platforms will be discussed. | Significant part of the content is global. |
| BIA810 Cognitive Computing | Students work on a course project and present the analysis and results. | Students learn machine learning, reasoning, natural language processing, speech recognition and vision (object recognition), human–computer interaction, dialog and narrative generation, among other technologies. |  | Use cases related to social impact and responsibility of these technologies will be discussed. | Significant part of the content is global. |
| **Goals/****Quantitative Courses** | **PhD-1: FE Ph.D. graduates can effectively communicate research in oral presentations.** | **PhD-2: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.** | **PhD-3: FE Ph.D. graduates are able to effectively deliver academic courses in a university environment.** | **Ethics thread** | **Global thread** |
| Ph.D. Preliminary Exam | No focus on oral communication skill. | This exam is required for all students at the end of their first year in the program. The goal of the exam is to make sure students have mastered the key knowledge in the domain area to move on to the next phase of their study. It consists of three parts: a) mathematical foundation; b) financial applications; c) mini research project. It is a week-long exam that is administered by an preliminary examination committee each year. | No focus on teaching. | Not relevant | The entire content is global. |
| Ph.D. Qualifying Exam | The oral communication was particularly emphasized in this exam. The student will give a two-hour long presentation session where the student needs to clearly communicate the research objectives and methodology, and then answer any questions from the examination committee. | This exam is required for all students to pass at the end of their second year in the program. The exam consists of both written and oral parts. The examination committee consists of 3-4 faculty members based on the FE Ph.D. Student Handbook. The goal is to test whether the student can effectively apply the knowledge acquired to solve a challenging problem that the student is proposing to address. | No focus on teaching. | Ethical conduct of academic research will be reinforced. | Significant part of the content is global. |
| Ph.D. Proposal Defense | Oral presentation and its effectiveness are emphasized in this exam. The student will be treated as a scholar who is able to defend the proposed research topic and methodology. The new knowledge generated from the proposed research needs to be validated.  | This exam is required when the student is ready to pursue a dissertation research. The dissertation committee will be formed at this point to make sure the proposed research is on the right track and it has potential to generate new knowledge in the targeted field. | Teaching skills will be assessed as part of the program. In general, the student will be assigned as a teaching assistant to one or more courses related the student’s field. | Ethical conduct of academic research will be reinforced. | Significant part of the content is global. |
| Ph.D. Dissertation Defense | Oral presentation and its effectiveness are the important part of this exam. The student will be judged a scholar who can communicate the research objectives, methodology used, significant new contributions generated from the dissertation research. Failure to demonstrate such capability will prevent the student to be awarded the degree at a result. | This exam is the final exercise of measuring whether the student has mastered the knowledge and is capable of apply the existing knowledge to generated new knowledge in the chosen field. Any indication of inadequacy in the domain knowledge will be assessed by the committee members as part of the final assessment of the candidate’s quality. | Teaching skills will be assessed as part of the exam. Before a student can graduate from the program, sufficient teaching skills will be assessed for the final assessment of the candidate’s quality. | Ethical conduct of academic research will be reinforced. | Significant part of the content is global. |

# FE PhD LEARNING GOALS, OBJECTIVES AND RUBRICS

**PhD Goal-1:** *FE* *Ph.D. graduates can effectively communicate research in oral presentation.*

Oral presentation skills will be assessed as part of an on-going process through the mandatory FE PhD Colloquium each semester (or its equivalent for part-time students), at the qualifying examination taken after the second year of full-time study (or its equivalent, for part-time students) and at the dissertation defense.

**Table 4: FE PhD Learning Goal 1, Objectives and Rubrics**

|  |  |
| --- | --- |
| **PhD-1** | **Learning Goal, Objectives and Traits** |
| **GOAL[Yang]** | FE Ph.D. graduates can effectively communicate research in oral presentations.  |
| **Objective 1:** | *Students will be able to deliver oral presentations effectively* |
| Trait 1: | Organization and logic |
| Trait 2: | Voice quality and body language |
| Trait 3: | Use of slides to enhance communication |
| Trait 4: | Ability to answer questions |

**Explanation for indirect measurements:**

Indirect measurements will be taken at periodic intervals. Depending on the measurement chosen a diagnostic tool will be selected for analysis. There are two indirect measures we can use to measure this learning goal:

a). Outside conference and workshop presentation acceptance;

b). School organized seminar/workshop presentations.

Both activities are neither required nor managed by the program, but they are outcomes of this learning goal that can be observed. We will collect the number of outside presentations done by our current students through periodic surveys as an indirect measure of this learning goal.

|  |
| --- |
| **Presentation Rubric***Students will be able to deliver oral presentations effectively.* |
| **Trait** | **Poor (0)** | **Good (3)** | **Excellent (5)** | **Score** |
| **Trait 1: Organization & Logic** | Fails to introduce topic; no evidence of or poor logical flow of topic. | Prepares listeners for sequence and flow of topic. Loses place occasionally but flow and structure are still clear. | Engages listeners with overview, guides listeners through connections between sections, and alerts audience to key details and concepts.  |  |
| **Trait 2:Voice Quality & Body Language** | Cannot be heard or understood well due to volume, mumbling, speed, monotone delivery, and/or heavily accented English.  | Clear delivery with well-modulated voice. Displays some confidence and enthusiasm, but may also contain flatter periods or sound overly rehearsed. | Exemplary delivery, with a voice that sounds fully engaged, conveys enthusiasm and confidence, and relates to the audience well.  |  |
| **Trait 2:** | Turns away from audience or uses distracting gestures, such as pacing or tugging clothing. Speaker seems stiff, awkward or uncomfortable. Little eye contact. | Speaker is relaxed in front of the room and keeps distracting movements and gestures to a minimum. Generally faces audience and makes eye contact. | Speaker’s body language is superb and fully engages the room. Strong, consistent eye contact to the entire audience. Uses confident gestures to underscore key verbal points. |  |
| **Trait 3****Use of slides to enhance communication** | Misspelled, too busy, too much text, too many slides for allotted time, and/or poor use of graphics like charts.  | Slides are readable, containing a reasonable amount of material per slide. Good use of graphics or illustrations. | Slides are well written/designed, engaging to the audience, and used as support to verbal content presentation. |  |
| **Trait 4****Ability to answer questions** | Transitions are awkward or non-existent. Speakers go over time limits. Answers are disorganized or non-responsive. | Transitions are smooth. Speakers generally stay within time limits. Speakers respond to questions well and provide sufficient response. | Transitions are professional and very smooth. Speakers respond convincingly and address all aspects of question. |  |
| **Does not meet expectations: 0 – 12; Meets: 12-18; Exceeds: 18-20 Total Score:** |  |

**PhD-2:** *FE**Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.*

The goal is to ensure that students will have the skills necessary to complete high-quality, original dissertations within 4 years of full-time study (the max. allowed time span to finish a dissertation is 6 years). There is not a specific timeline when the students should finish their proposal but a delay of a proposal correlates highly with a delay of the dissertation defense and extends the doctoral studies.

The first objective is that the students are able to write competitive research papers. The second objective is that students will successfully defend their dissertation proposal before the end of 3 years of full-time study.

Appendix C contains a copy of the “Doctoral Activity Report,” which is administered annually and is used to collect data relevant to the assessment of Ph.D. goal 2. Appendices B, D and E contain the template used to gather information for the assessment of this goal.

**Table 5: FE PhD Learning Goal 2, Objectives and Rubrics**

|  |  |
| --- | --- |
| **PhD - 2** | **Learning Goal, Objectives and Traits** |
| **GOAL[Yang]** | FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner. |
| **Objective 1:** | *Students are able to write high quality, original research papers* |
| Trait 1: | Satisfactory research papers as evaluated by the examining committee submitted as part of the preliminary and qualifying examinations |
| Trait 2: | Number of papers presented and/or published in academic outlets |
| **Objective 2:** | *Students will defend their dissertations at or about the end of the fourth year of full-time study.* |
| Trait 1: | Elapsed time to proposal defense |
| Trait 2: | Elapsed time to dissertation defense |

|  |  |
| --- | --- |
| **Objective 1** | *Students are able to write competitive research papers.* |
|   | **Trait** | **Poor** | **Good** | **Excellent** | **Score** |
|   | **Value** | **0** | **3** | **>3** |  |
| **Trait 1:** | Satisfactory research papers as evaluated by the examining committee submitted as part of the preliminary and qualifying examinations (\*see rubric below) |  |  |  |   |
| **Total** | **Does not meet expectations: 0; Meets: 3; Exceeds: 4** |   |   |   |   |
|  |
|  |  | **Poor** | **Good** | **Excellent** | **Score** |
|  | **Value** | **0** | **2** | **>2** |  |
| **Trait 2:** | Number of papers presented and/or published in academic outlets |  |  |  |   |
| **Total** | Does not meet expectations: 0; Meets: 2; Exceeds: 3 |   |   |   |   |

**Explanation for indirect measurements:**

Indirect measurements will be taken at periodic intervals. Depending on the measurement chosen a diagnostic tool will be selected for analysis. We have two indirect measures to gauge the students’ progress in their mastering key knowledge in a timely manner.

The first indirect measure of this learning goal is to count the number of working papers or seminar presentations after passing qualifying exam. If a student can finish working papers to be submitted to peer-reviewed conferences or journals, it is a good indication that the student has mastered sufficient knowledge in the field and is able to make contributions to the field.

The second indirect measure is to conduct periodic surveys on student colloquium presentation topics. As a requirement, all the FE PhD students who passed the qualifying exam are required to present their research at the FE colloquium every semester. A brief survey on research topics and findings will help us to assess the depth of their knowledge and progress they make in a timely manner.

Rubric for Trait 1:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CRITERIA** | **0** | **1** | **2** | **3** | **4** |
| **Originality and novelty** | The work completely lacks originality | Repeats work of others with only minor changes | Work has not been done before, but is an obvious extension of previous work | Work incrementally improves on previous approaches | Work is cleverly designed and/or represents a significantly new direction or approach |
| **Advances the State of the Art** | No advance is evident | Results are obvious or easily anticipated | Incrementally advanced the knowledge in the field | Significantly advanced the knowledge in the field | Greatly advanced the knowledge in the field |
| **Literature survey** | Lacking | Cursory | Extensive but either not complete or not critical | Complete and concise, but not adequately critical | Comprehensive and critical |
| **Uses new or advanced techniques** | Uses only primitive methods | Uses only simple and long-established methods and techniques | Uses standard methods commonly known in the field | Uses the most advanced established methods | Uses or develops leading-edge methods not applied before in this field  |
| **Has elements of theory** | Does not involve any theoretical development or predictions | Incorporates standard theory in the field | Incrementally advances theory currently used in the field | Significantly extends existing theory in the field | Involves theory that represents a break with the state-of-the-art |
| **Has empirical elements** | There is no data collection or usage | Few data are collected or relies on data from others | Data collection is a minor part of this work | Data collection is a major part of this work | Employs sophisticated and novel empirical methods |
| **Written presentation (Paper)** | Missing significant details or very difficult to read | Disorganized or lacking in some details | All details are present, but requires some effort by reader | All details are present, organization is adequate | Comprehensive, elegantly and clearly written |

|  |  |
| --- | --- |
| **Objective 2** | *Students will defend their dissertations at or about the end of the fourth year of fulltime study.* |
|   | **Trait** | **Poor** | **Good** | **Excellent** | **Score** |
|   | **Value** | **0** | **1** | **2** |  |
| **Trait 1** | Elapsed time to proposal defense. |  |  |  |   |
| **Total** | **Does not meet expectations: >3 years; Meets: 3 years; Exceeds: less than 3 years** |   |   |   |   |
|  |
|  | **Value** | **Poor** | **Good** | **Excellent** | **Score** |
|   |  | **0** | **1** | **2** |  |
| **Trait 2** | Elapsed time to dissertation defense. |  |  |  |   |
| **Total:** | **Does not meet expectations: Does not meet expectations: >4 years; Meets: 4 years; Exceeds: less than 3 years** |   |   |   |   |

**PhD Goal 3:** *FE* *Ph.D. graduates are able to effectively deliver academic courses in a university environment.*

The goal is to prepare students for an academic career. The process for preparing the students to teach effectively is organized in several steps to assure a seamless transition. It is manifested in the teaching policy of the Ph.D. program.

**Table 6: FE PhD Learning Goal 3, Objectives and Rubrics**

|  |  |
| --- | --- |
| **PhD - 3** | **Learning Goal, Objectives and Traits** |
| **GOAL[Yang]** | *FE Ph.D. graduates are able to effectively deliver academic courses in a university environment.* |
| **Objective 1:** | *Students will be able to effectively deliver a course in their area of expertise.* |
| **Trait 1:** | Course Evaluation (Mean value of at least 3) |
| **Trait 2:** | Teacher Evaluation (Mean value of at least 3) |

**Explanation for indirect measurements:**

Indirect measurements will be taken at periodic intervals. Depending on the measurement chosen a diagnostic tool will be selected for analysis.

One method we plan to use interviews. The interview will be structured, and the subjects will be the students in the sessions taught by the PhD students. The structured interview will gather information about the key competencies. The responses will be subjected to a content analysis. Other options include surveys and focus group discussions.

# RESULTS OF AACSB LEARNING GOAL ASSESSMENTS

Each learning goal has a number of learning objectives and performance on each objective is measured using a rubric that in turn contains a number of desired “traits”. Students are scored individually on each trait.

The grading sheets for each student are used to develop a Summary Results Sheet for each learning goal objective. A selection of these Summaries is included below.

The first table in the Summary Results Sheet for a learning objective and trait gives the counts of students falling in each of the three categories:

- Does not meet expectations
- Meets expectations
- Exceeds expectations

A typical table for recording results is shown on the next page.

The right-hand column in the table is used to record the average score of the students on each trait. This table provides an indication of the relative performance of students on each trait.

The second table on each sheet provides the counts of students who fall in each of the above three categories for the overall learning objective.

The person undertaking the assessment provides explanatory comments and recommendations on the bottom of the Results Summary Sheet. The recommendations suggest content or pedagogy changes for the next time the course is given.

# APPENDIX A

**School of Business**

**TEMPLATE OF AACSB Ph.D. LEARNING GOAL 1 ASSESSMENT**

**PROGRAM: FE PhD Program**

**PhD-1 GOAL: FE Ph.D. graduates can effectively communicate research in oral presentations.**

**LEARNING OBJECTIVE #1: Graduates will be able to deliver oral presentations effectively.**

**ASSESSMENT DATE: ASSESSOR:**

**NO. OF STUDENTS TESTED: COURSE:**

|  |  |  |
| --- | --- | --- |
|  | **Number of Students** |  |
| **Learning Objective 1 Traits** | **Not Meet Expectat-ons****1** | **Meet Expectat-ions****2** | **Exceed Expectat-ions****3** | **Avg. Grade on Trait** |
| 1: Organization and logic |  |  |  |  |
| 2: Voice and body language |  |  |  |  |
| 3: Use of slides to enhance communication  |  |  |  |  |
| 4: Ability to answer questions  |  |  |  |  |
|  |  |  |  |  |
| **Average Grade (Maximum 20)** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Total Students by Category****Objective 1**(Based on Average score across all traits) | **Not meet expectations****Below 2** | **Meet Expectations****Mean: 2** | **Exceed Expectations****Above 2** |
|  |  |  |  |

**COMMENTS:**

**REMEDIAL ACTIONS:**

# APPENDIX B

**School of Business**

**TEMPLATES OF AACSB FE Ph.D. LEARNING GOAL 2 ASSESSMENT**

**PROGRAM: FE PhD Program**

**PhD-2 GOAL: FE Ph.D. graduates will have sufficiently mastered the core knowledge and tools needed to conduct original research in a timely manner.**

**LEARNING OBJECTIVE #1: Students are able to write high quality, original research papers.**

**Trait # 1: Satisfactory research papers as evaluated by the examining committee submitted as part of qualifying examinations or dissertation proposal.**

**ASSESSMENT DATE: ASSESSOR:**

**PRELIMINARY EXAMINATION/ QUALIFYING EXAMINATION:**

**Candidate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Examination Committee Members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EVALUATION****CRITERIA** | **0** | **1** | **2** | **3** | **4** |
| **Originality and novelty** | The work completely lacks originality | Repeats work of others with only minor changes | Work has not been done before, but is an obvious extension of previous work | Work incrementally improves on previous approaches | Work is cleverly designed and/or represents a significantly new direction or approach |
| **Advances the State of the Art** | No advance is evident | Results are obvious or easily anticipated | Incrementally advanced the knowledge in the field | Significantly advanced the knowledge in the field | Greatly advanced the knowledge in the field |
| **Literature survey** | Lacking | Cursory | Extensive but either not complete or not critical | Complete and concise, but not adequately critical | Comprehensive and critical |
| **Uses new or advanced techniques** | Uses only primitive methods | Uses only simple and long-established methods and techniques | Uses standard methods commonly known in the field | Uses the most advanced established methods | Uses or develops leading-edge methods not applied before in this field  |
| **Has elements of theory** | Does not involve any theoretical development or predictions | Incorporates standard theory in the field | Incrementally advances theory currently used in the field | Significantly extends existing theory in the field | Involves theory that represents a break with the state-of-the-art |
| **Has empirical elements** | There is no data collection or usage | Few data are collected or relies on data from others | Data collection is a minor part of this work | Data collection is a major part of this work | Employs sophisticated and novel empirical methods |
| **Written presentation (Paper)** | Missing significant details or very difficult to read | Disorganized or lacking in some details | All details are present, but requires some effort by reader | All details are present, organization is adequate | Comprehensive, elegantly and clearly written |

# APPENDIX C

**Ph.D. student activity report: This report is submitted every semester to the Ph.D. program director and serves as a basis for assessing goal 2.**

|  |  |
| --- | --- |
| official-logo-clear-bkg | Stevens Institute of TechnologyCastle Point on HudsonHoboken, NJ 07030-5991 |

**Doctoral Activity Report**

|  |  |
| --- | --- |
| Student Name:  | Advisor Name:  |
| Student Identification No.: \_\_\_\_\_\_-\_\_\_\_-\_\_\_\_\_\_\_\_ |
| Major/Concentration:  |

AREA OF DOCTORAL RESEARCH/ WORKING TITLE OF DISSERTATION:

Activity for: Fall Spring Summer 20 \_\_\_\_

Please list your learning and research activities of the current semester, include preparations for research papers and conferences, passed exams, meetings with the Dissertation Advisory Committee etc.:

|  |  |
| --- | --- |
| Courses taken this period | Grade |
|  |  |
|  |  |
|  |  |
| Prelim/Qualifying Exams: |  |  |  |
| Dissertation: | Proposal | Defense |
| Papers: | Working Papers | Conference | Proceedings | Journal |
| Research Plan for next semester: |  |
| Overall Self-Evaluation(Satisfied with progress) |  |

Other comments:

Please list your learning and research objectives for the coming semester: include preparations for research papers and conferences, exams etc.:

Please attach your updated CV

STUDENT SIGNATURE DATE

|  |  |  |
| --- | --- | --- |
| Advisor Evaluation: | Satisfactory | Unsatisfactory |

ADVISOR SIGNATURE DATE

(OVER)

INSTRUCTIONS

TO THE STUDENT:

Please list in the activity report all learning and research activities.

1. Which courses have you finished?
2. Have you passed any exams?
3. Have you started to work on your dissertation topic? What have you accomplished?
4. Have you prepared a conference paper or a journal article? To which conference or journal have you submitted?
5. What are your learning and research objectives for the coming semester? Which courses do you plan to take? Do you plan to write a research paper? Do you plan to finish your dissertation proposal?
6. Have you met with members of your dissertation advisory committee?
7. If you have the status of “doctoral candidate” you need to fill out the DAR (Doctoral Activity Report) form. Please use your progress report as the basis for the DAR.
8. Please sign your report and discuss it with your advisor.

TO THE RESEARCH ADVISOR:

Please discuss the activity report with your advisee.

1. Please specify with the student the objectives for the next semester.
2. Please co-sign the report and give a final evaluation.
3. If your advisee has the status of doctoral candidate please sign the Doctoral Activity Report form.
4. Please submit the progress report and if applicable the DAR to the School’s Ph.D. program director.
5. You will be invited to a review meeting with the Ph.D. program committee.

# APPENDIX D

**School of Business**

**TEMPLATE OF AACSB PhD-2 LEARNING GOAL ASSESSMENT**

**PROGRAM: FE Ph.D. Program**

**PhD-2 GOAL: FE Ph.D. graduates master the core knowledge and tools needed to conduct original research sufficiently to identify and develop a dissertation research project in a timely manner.**

**LEARNING OBJECTIVE #1: Students are able to write competitive, original research papers.**

**NO. OF STUDENTS ASSESSED:**

|  |  |  |  |
| --- | --- | --- | --- |
| **PhD Students** | **Count of:** |  |  |
| **Name** | **PRJ** | **Procs** **Bk Chap Books** | **Other** | **Average on Trait** |
|  |  |  |  |  |

**PRJ: Peer Reviewed Journal [5]**

**Procs: Conference Proceedings, Bk Chap: Book Chapters and Books [3]**

**Other: Working papers etc. [1]**

|  |  |  |  |
| --- | --- | --- | --- |
| **Total Students by Category****Objective 1**(Based on Average score across all traits) | **Not meet expectations****0 Pubs.** | **Meet Expectations****1 PRJ** | **Exceed Expectations****2 or more PRJs** |
|  | **0** | **1** | **2** |

**COMMENTS:**

**REMEDIAL ACTIONS:**

**COMMENTS:**

**REMEDIAL ACTIONS:**

# APPENDIX E

**School of Business**

**TEMPLATE OF AACSB PhD-2 LEARNING GOAL ASSESSMENT**

**PROGRAM: FE Ph.D. Program**

**LEARNING OBJECTIVE #2: Students will defend thesis in a timely manner.**

**Trait # 1: Elapsed time to proposal defense.**

**Trait # 2: Elapsed time to dissertation defense.**

|  |  |  |
| --- | --- | --- |
|  | **Number of Students** |  |
| **Learning Objective 2****Trait # 1** | **Not Meet Expectations****(More 3 years)** | **Meet Expectations****(3 years)** | **Exceed Expectations****(Less 3 years)** | **Avg. Grade on Trait** |
| Elapsed time to proposal defense  | **0** | **1** | **2** |  |
| **Average Grade (Maximum 4)** |  |

|  |  |  |
| --- | --- | --- |
|  | **Number of Students** |  |
| **Learning Objective 2****Trait # 2** | **Not Meet Expectations****(6 years)** | **Meet Expectations****(4 years)** | **Exceed Expectations****(Less 4 years)** | **Avg. Grade on Trait** |
| Elapsed time to dissertation defense  | **0** | **1** | **2** |  |
| **Average Grade (Maximum 4)** |  |

# APPENDIX F

**School of Business**

**TEMPLATE OF AACSB PhD-3 LEARNING GOAL ASSESSMENT**

**PROGRAM: FE Ph.D. Program**

**PhD-3 GOAL:** **FE** **Ph.D. graduates are able to effectively deliver academic courses in a university environment.**

**LEARNING OBJECTIVE #1: Students will be able to effectively deliver a course in their area of expertise.**

|  |  |  |
| --- | --- | --- |
|  | **Number of Students** |  |
| **Learning Objective 1 Traits** | **Not Meet Expectations** | **Meet Expectations** | **Exceed Expectations** | **Avg. Grade on Trait** |
| Course Evaluation (Mean value of at least 3) | **0** | **3** | **4** |  |
| **Average Grade (Maximum 4)** |  |

|  |  |  |
| --- | --- | --- |
|  | **Number of Students** |  |
| **Learning Objective 1 Traits** | **Not Meet Expectations** | **Meet Expectations** | **Exceed Expectations** | **Avg. Grade on Trait** |
| Teacher Evaluation (Mean value of at least 3) | **0** | **3** | **4** |  |
| **Average Grade (Maximum 4)** |  |

**NO. OF STUDENTS ASSESSED:**

**COMMENTS:**

**REMEDIAL ACTIONS:**

1. Association of Business Schools - Rankings in the ABS list were standardized as 4\* (a world elite journal); 4 (a top journal); 3 (a highly regarded journal); 2 (a well-regarded journal); and 1 (a recognized journal). [↑](#footnote-ref-1)