Colorado State University

Department of Systems Engineering

GRADUATE STUDENT HANDBOOK

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Department of Systems Engineering

This manual has been prepared to acquaint you with the policies and regulations that govern the graduate degrees and certificate in the Department of Systems Engineering. This document should be read in conjunction with the current Graduate and Professional Bulletin of Colorado State University. It has been written to emphasize certain information contained in the Bulletin and to outline specific department policies and procedures. These requirements supplement, but do not supersede, all statements in the Colorado State University Graduate and Professional Bulletin.

Additional Graduate School resources include:

- The Graduate School Handbook
- A quick-reference **timeline toward your degree**
- All Graduate School **forms and applications** for enrolled students
- All Graduate School **deadlines and important dates**

Systems Engineering Graduate Student Handbook

Introduction

The Colorado State University (CSU) Systems Engineering program and curriculum was created based on significant national and local industry input. Through an extensive industry survey conducted in 2007, over 600 responses helped identify the need for Systems Engineering and specifically what areas of focus should be addressed in a Systems Engineering program.

CSU's Systems Engineering program began in 2008 with the initial offering of a Master of Engineering (M.E.) with a specialization in Systems Engineering. The M.E. is offered on campus and at a distance. Since 2008, new courses have been offered every academic year and student enrollment has continued to increase.

In 2010, the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Systems Engineering were offered on-campus. Beginning August 2012, both of these degree programs began to also be offered at a distance.

The Graduate Certificate in Systems Engineering Practice was added as an option for both degree-seeking and non-degree seeking students in late 2016.

In 2019, Systems Engineering formally became an academic department and the Doctorate of Engineering (D.Eng.) was added as a new, applied doctoral option.

New certificates in Human System Integration, Systems Security, and Model-Based Systems Engineering were introduced as options in 2025.

This handbook provides guidance for prospective and current graduate students in Systems Engineering.

Program Offerings

All programs are offered at a distance and on-campus.

Description	Graduate School Classification	Program Code	Major	Specialization Code
Graduate Certificate	Certificate	SYEF-CT	Systems Engineering Practice	N/A
		SYEF-DD-CT	Systems Engineering Practice (Distance)	
		HSIF-CT	Human Systems Integration	
		HSIF-DD-CT	Human Systems Integration (Distance)	
		SYSF-CT	Systems Security	
		SYSF-DD-CT	Systems Security (Distance)	
		MBEF-CT	Model-Based Systems Engineering	
		MBEF-DD-CT	Model-Based Systems Engineering (Distance)	
Master of Engineering (M.E.)	Plan C	ENGR-SYEZ-ME	Engineering (Systems Engineering Specialization)	SYEZ
		ENGR-DSYZ-ME	Engineering (Systems Engineering Specialization - Distance)	DSYZ
Master of Science (M.S.)	Plan A -Thesis OR Plan B - Project	SYSE-MS	Systems Engineering	N/A
		SYSE-DD-MS	Systems Engineering (Distance)	
Doctor of Philosophy (Ph.D.)	Ph.D.	SYSE-PHD	PhD Systems Engineering	
		SYSE-DD-PHD	PhD Systems Engineering (Distance)	
Doctor of Engineering (D.Eng.)	Professional Doctorate	SYSE-DE	DEng Systems Engineering	
		SYSE-DD-DE	DEng Systems Engineering (Distance)	

Admission Requirements and Process

Detailed and necessary instructions are found in our Application Checklists for each program (located on our [Application Information page](#)).

Each of our programs has slightly different requirements and application steps. Failure to follow specified directions in your Application Checklist may lead to an incomplete and/or rejected application.

Required competencies may be demonstrated via coursework or if there is adequate professional/technical experience, via a career path. For admission into the program, the responsibility lies on the student to show that he/she has the foundation that is needed for programs in the Department of Systems Engineering.

Per University policy a student can enroll in introductory courses in Systems Engineering without being formally admitted into a degree program. However, successful completion and/or above average performance in these courses does not ensure admission into your chosen program, and there are limits on how many credits taken prior to admission may apply to an eventual degree. Any course taken prior to formal degree admission must have a grade of B or higher earned (B- is not accepted), and there are limits to how many classes taken prior to the student's formal admission term may apply toward a degree.

Admitted Students

Admitted students are directed to the [SE Department Orientation website](#), which details steps specific to on-campus or online students to get onboarded and enrolled in their program.

Graduate School and Systems Engineering Standards and Procedures

Scholastic Standards

By Graduate School regulations, students must maintain good academic standing by meeting two requirements, which are discussed in detail below:

- Maintain a cumulative GPA of at least a 3.0 **and**
- Maintain *satisfactory progress* within their department

GPA

Students must demonstrate acceptable performance in course work after being admitted to their graduate degree program, which requires a cumulative grade point average of at least 3.0 be maintained for each of the following four groups of courses:

1. Regular courses taken for a traditional grade and numbered 300 or above (regular courses have numbers ending with 00 through 79). Regular course work is defined as courses other than independent or group studies, research courses, open seminars, thesis/dissertation credits, study abroad, U.S. travel, supervised college teaching, student teaching, practicum, internship, field placement, unique title courses offered through the Division of Educational Outreach, and any courses graded pass/fail, and

2. All regular and non-regular courses graded traditionally and numbered 300 and above, and

3. All traditionally graded courses numbered 300 and above listed on the graduate program of study (see the GS6 Program of Study section), and

4. All regular and non-regular courses graded traditionally and numbered 300 and above that are listed on the graduate program of study.

Please note that any course taken prior to admission into a degree program does not count toward the above GPAs, per Graduate School policy. 300-level courses cannot be used to satisfy degree requirements for graduate degrees.

Failure to maintain GPA requirements results in being placed on academic probation. New regularly admitted students will not be placed on probation until they have completed 12 credits or two semesters of graduate work, whichever comes first. The probationary period extends for one semester beyond the one in which this status is acquired. Students on probation are subject to dismissal by the academic department or the Dean of the Graduate School at the end of the probationary semester unless good academic standing has been regained. This requires adequate improvement in cumulative grade point averages (3.00) and/or satisfactory progress as determined by the student's graduate advisory committee.

For all Master of Engineering and Master of Science students: in addition to the above requirements, you must earn a "C" or better in all coursework for it to apply to a Systems Engineering degree (see Graduate and Professional Bulletin E.1.3). A "C-" is not acceptable.

For PhD and DEng students: in addition to the above requirements, in order to pass the "Qualifying Process" you must pass all courses with a "B" or higher. A "B-" is not acceptable.

Satisfactory Progress

Per Graduate School policy, good academic standing also requires *satisfactory progress* in the overall graduate program. When a student's graduate advisory committee or an appropriate departmental graduate committee finds that a student is not making satisfactory progress toward the degree due to factors other than grade point average, and that satisfactory progress cannot be anticipated, a plan should be created and the following steps should be taken:

1. Inform the student of the concerns, create a progress plan with the student, develop a timeline and inform the student of the potential consequences (dismissal) if the progress is not satisfactory.
2. The committee should keep in contact with the student to give feedback during the progress plan timeline and document such contacts and their outcomes.
3. At the end of the timeline, if progress is not adequate, the committee may recommend dismissal from the department. The recommendation goes to the Department Head and the Dean of the Graduate School and should include documentation on the steps taken with justification for this action.

Systems Engineering encourages students to make steady progress toward their academic goals and wants to ensure students reach graduation in a timely manner. *A Systems Engineering student who meets one of the following conditions will be contacted to set up a progress plan and timeline:*

- The student has successfully completed (earned "C" or above/"S") less than 9 credits toward a Systems Engineering degree in two calendar years
- The student has received two or more unsatisfactory annual progress reports from their doctoral Advisor and/or Practicum Sponsor if applicable (relevant for Ph.D./D.Eng. students only)

Graduate Procedures and Required Paperwork

The following documents are distributed and regulated by the Graduate School, additional forms and information for enrolled students can be found at: https://graduateschool.colostate.edu/forms/

GS6 Program of Study

The Program of Study (GS6) must be filed with the Graduate School before the time of the fourth regular semester (fall and spring) registration. If the GS6 is not submitted by this time, the student will have a registration hold placed on their account until the GS6 has been received by the Graduate School. The purpose of the GS6 is to ensure the graduate student is working toward well-defined goals approved by his/her advisory committee while meeting department and Graduate School standards. The Graduate School reviews each GS6 and determines whether or not the program of study conforms to University policy. Problems are reported to the student and department so that they can be corrected. Assistance in completing the GS6 form is available on the Graduate School website.

Changes in the Program of Study Coursework
After the approval of the GS6, changes to the Program of Study are recorded on the GS Form 25 which is filed during the semester of graduation and prior to the published deadline (approximately 6 weeks after the beginning of the semester). For more information about the GS25 see below section.

Courses listed on the GS6 that have been taken and for which a grade has been received (A through F, I, S or U) may not be removed from the Program of Study. All courses listed on the GS6 must have been passed with a C or higher to qualify for graduation. **Any coursework changes on the GS25 must be approved by the student's faculty advisor (if applicable) and the department advisor. Failure to do so may result in courses not being used toward degree requirements.**

Changes in Advisor and Advisory Committee
After the GS6 has been approved, permanent committee replacements are arranged by filing a GS form 9A. Signatures are required for any member(s) dropped from the committee; additionally, advisor/co-advisor changes require the signatures(s) of the individual(s) added. This form also requires the signatures of the student, faculty advisor, Systems Engineering representation, and graduate school representative.

Whenever a member will be absent for an important function of the committee, or when a member will be absent for a semester or more, a replacement will be designated by the Department Head with concurrence of the faculty member being replaced. The Department Head shall designate any eligible replacement by letter to the Graduate School indicating the time period during which the replacement shall serve. At the expiration of the designated time period, the original member shall resume membership.

GS25 Application for Graduation

Near the beginning of the semester in which the student plans to graduate, a GS25 must be filed with the Graduate School. Any changes to the original GS6 (courses added or dropped) are to be made on this form and approved by the student's faculty advisor and the department advisor. *Please leave Section 3 (Departmental Requirements) blank.*

Please note that the department deadline for receipt of the form is 10 business days PRIOR to the Graduate School deadline. Refer to the Graduate School website at http://www.graduateschool.colostate.edu for a complete listing of Graduation Requirements and Deadline Dates.

Changes in the GS25

If you do not graduate in the semester you intended, you will fill out the online "Reapplication for Graduation" by the graduation application deadline of the next semester in which you plan to graduate. This does not generate a new GS25, and there is no paper form required for the reapplication.

If you need to change courses after you have submitted a GS25, you will use the GS52.

Enrollment Requirements in Graduation Semester

Graduate degree candidates must be either enrolled for at least one credit or must register for "CR," *Continuous Registration*, (see below for an explanation of "CR") during the term (fall, spring, or summer) in which they file for graduation. Students who fail to register for CR or a credit-bearing course in the semester in which they apply to graduate will not be allowed to graduate that semester and will be required to apply for readmission ($150.00), register for CR ($150.00), and reapply for graduation.

Continuous Registration ("CR")

All graduate students at Colorado State University are required to be continuously registered in the fall and spring semesters throughout their degree programs. This policy applies from the time of the first enrollment through the graduation term. Registration is also required during the summer term if it is the student's graduating semester.

Students may fulfill this requirement by registering for any graduate credit-bearing course **or** Continuous Registration (CR), which is non-credit-bearing and carries a $150 fee. Registration for CR status is accomplished in the same way as registration for courses. The course reference numbers (CRN) for Continuous Registration appears in the class schedule under the subject CR.

Students may register for CR instead of credit-bearing coursework for the following reasons:
1. They will not be working on their degree requirements, but will be leaving the University temporarily for professional or personal reasons (mission service, medical or parental leave, work, etc.).
2. They are done with all credit-bearing course requirements and are applying to graduate that semester (applies to summer, fall, and spring semesters).
3. They are done with all credit-bearing course requirements and will be actively working on degree requirements, but do <u>not</u> require the use of University resources. (Students utilizing CSU facilities to conduct their research must not enroll in CR; they must enroll in the appropriate number of research, thesis, or dissertation credits.)

Students enrolled in CR have access to library and campus computing services; they pay a mandatory University Technology Fee. On-campus students may choose to purchase CSU student health insurance and/or access CSU Health Network for an additional fee.

Students are limited to a maximum of 10 semesters total of CR
- Students in their 1st, 4th, and 8th semesters of CR are required to submit a student plan to their Advisors for review by their Advisory Committees. The plans should state their intention and progress toward degree completion with academic expectations and timelines.
- A registration hold will be placed on a student with more than 10 semesters of CR. This may be petitioned. The petition must include the student plan.

Program Time Limit

There is a ten-year time limit for completion of the master's or doctoral degrees. Courses to be applied toward fulfilling the requirements for the master's and doctoral degrees, including any which may have been transferred from another institution, must have been registered for and completed within the ten years immediately preceding the date of completion of requirements for the degrees. If you are applying a 30-credit master's degree to the Ph.D. or D.Eng., this master's degree can be older than 10 years.

Certificate Requirements and Restrictions

Applications: Students may apply for a certificate whether or not they are degree-seeking. Each certificate or degree program requires a separate application.

Application timing: Certificates cannot be awarded retroactively. This means you **must** have applied for and be enrolled in the certificate program no later than the semester you complete the final course. If you complete all courses prior to applying for admission to the certificate program, you are ineligible to earn that certificate.

GPA & grade requirement: To earn the certificate, you must maintain a cumulative GPA of at least 3.0 in all certificate courses. A grade of C or higher must be earned in each individual certificate course.

Course requirements overlap: A graduate course may apply toward one certificate and one degree, but not two certificates.

Courses while taken as a CSU undergraduate: No graduate courses completed while enrolled in a CSU undergraduate degree program may be used toward the certificate, unless they were not used toward degree requirements and are specifically excluded on the undergraduate transcript through the Registrar's Office.

Certificates awarded: When students enrolled in a certificate program complete their final required course, they will be awarded the certificate, which appears on their transcript. The paper certificate is mailed 8-10 weeks after it has been awarded on the transcript.

If you intend to pursue a degree at CSU after a certificate

Program timing overlap: You may apply for and begin a degree program while you are part way through one or more certificates. This may be advantageous to avoid limitations described below:

- **Grade requirement for courses prior to degree admission:** Any course taken before admission to a degree program must be completed with a B or higher for it to count toward the degree (B- not accepted).
- **Credit limit on courses prior to degree admission:** No more than one 9- or 12-credit certificate, if taken prior to degree admission, may apply toward degree requirements. Credits beyond or outside of one 9- or 12-credit certificate cannot apply toward a degree if taken prior to that degree's formal admission term.

Transfer Credit

Because Graduate Certificates reflect a specific skill set, no transfer credits or course substitutions are permitted outside of the posted requirements.

Graduate Certificate: Systems Engineering Practice
12 credits required

The Graduate Certificate in Systems Engineering Practice will provide you with key competencies needed to skillfully practice within complex systems that involve hardware and embedded software. This certificate prepares engineers or other professionals in aerospace technology, energy, biosciences, environmental resources, and other fields to lead systems engineering development from concept creation through the system lifecycle. Those who finish SYSE 501 with at least a B+ (87%) in the course can bypass the INCOSE knowledge exam for either ASEP certification or CSEP certification.

This program is designed to be completed in as little as one four-month semester if you wish to take all 12 credits at once. More commonly, it takes two or more semesters as a part-time student. Select certificate courses may be offered during summer sessions; please check with SE Department for details.

Program Course Requirements
Effective for certificate completion term of Fall 2024 or later

Required:

SYSE 501 (3 cr.) Foundations of Systems Engineering

Choose 9 credits from:
        ENGR 502* (3 cr.) Project and Program Management
        SYSE 505 (3 cr.) Systems Thinking for the Real World
        SYSE 530 (3 cr.) Overview of Systems Engineering Processes
        ENGR 531 (3 cr.) Engineering Risk Analysis

* CIS 600A *Information Technology and Project Management* or CIS 670 *Advanced IT Project Management* may be taken in place of ENGR 502

Graduate Certificate: Human Systems Integration
12 credits required

All complex technical systems must contend with the human element. The Graduate Certificate in Human Systems Integration is an interdisciplinary program focused on the intricate relationships among people, technology, and the environment. Gain the skills necessary to create efficient, user-friendly, and safe systems with a mind toward human users and stakeholders. Choose a data-centric or AR/VR course path to tailor your expertise. You will be prepared to tackle the evolving challenges of technology-driven industries, becoming an asset in systems engineering, design, and human-computer interaction.

This certificate is designed to be completed in as little as two semesters as a part-time student. Select certificate courses may be offered during summer sessions; please check with SE Department for details.

Program Course Requirements

Required:
        SYSE 534 (3 cr) Human Systems Integration
        ENGR 535 (3 cr) Modeling Human Systems Behavior
Choose 6 credits from:
        ENGR 520 (3 cr) Engineering Decision Support/Expert Systems
        SYSE 541 (3 cr) Engineering Data Design and Visualization
        SYSE 544 (3 cr) Systems-Based AR/VR Environmental Realism
        SYSE 545 (3 cr) Augmented/Virtual Reality Systems Development

Graduate Certificate: Systems Security
9 credits required

Learn to enhance the security of complex systems with the Systems Security Certificate. You'll gain the skills to analyze, implement, measure, validate, and verify security properties. Key topics include threat analysis, risk assessment, networking, physical security, information system security, and operational technology security. This program combines cybersecurity for systems engineers with networking concepts, manufacturing, supply chains, system modeling, and policy development. It emphasizes attention to cyber-physical systems, such as Controller Area Networks (CAN bus) as seen in vehicles and industrial systems. Completing this certificate makes you a vital resource for companies needing robust security programs and innovative approaches to modern threats. This graduate certificate provides a solid educational foundation to sit for the CISSP certification exam.

This certificate is designed to be completed in as little as two semesters as a part-time student, **provided students begin their coursework in summer or fall of even years** (i.e. Summer 2026 or Fall 2026 terms). Beginning the certificate in another semester will result in semester breaks for the student, where no courses toward certificate completion are offered.

Program Course Requirements

Required:
        SYSE 548 (3 cr) Security Engineering for Systems Engineers
        SYSE 549 (3 cr) Secure Vehicle and Industrial Networking
        SYSE 569 (3 cr) Cybersecurity Awareness for Systems Engineers

Graduate Certificate: Model-Based Systems Engineering
9 credits required

Elevate your approach to systems engineering with the Graduate Certificate in Model-Based Systems Engineering (MBSE). Learn how to apply formalized computer modeling to support systems engineering activities such as requirements identification, design, analysis, and verification & validation. Work directly with key software tools like Magic Systems of Systems Architect, Vensim, MATLAB, and Simulink. You will build competency in both systems modeling and technical system architecting, aligning with the INCOSE Systems Engineering Competency Framework.

This certificate is designed to be completed in as little as one fall semester as a full-time student, or more commonly, two semesters as a part-time student.

Program Course Requirements

Required:
> SYSE 567 (3 cr) Systems Engineering Architecture

Choose 6 credits from:
> SYSE 530 (3 cr) Overview of Systems Engineering Processes
> SYSE 532 (3 cr) Dynamics of Complex Engineering Systems
> SYSE 602 (3 cr) Systems Requirements Engineering
> SYSE 667 (3 cr) Advanced Model-Based Systems Engineering
> MECH 513 (3 cr) Simulation Modeling and Experimentation

Master of Engineering
Specialization in Systems Engineering
https://www.engr.colostate.edu/se/me/

You can expect the Master of Engineering program to take one to two years as a full-time student (9+ credits per semester) and three to five years if you are a part-time student (3-6 credits per semester). Summer courses are not required, but are offered on a limited basis. A thesis is not required to complete the degree, but you can complete a significant capstone project (SYSE 695).

Systems Engineering is a specialization of the College of Engineering Master of Engineering degree, therefore the Systems Engineering title only appears on the student's transcript and not on the final diploma.

Program of Study

1) Minimum of 30 semester credits of graduate work in approved course of study (see below for Plan A vs Plan B guidelines)
2) Minimum of 24 credits semester credits earned at Colorado State (21 while in graduate program). For any courses taken prior to admission, a grade of B or higher must be earned (B- and below not accepted).
3) No more than 6 credits at the 400 level are permitted, and these must be taken at Colorado State University. No more than two 500-level (graduate) courses may be transferred from another regionally-accredited University.

Courses are intended to be taken in progression; core courses first, then courses in depth (choose 3 from a list of Systems courses), followed by electives and culminating in the final project.

Program Course Requirements

Core Courses – 12 credits

SYSE 501 (3 cr.)	Foundations of Systems Engineering
SYSE 530 (3 cr.)	Overview of Systems Engineering Processes
ENGR 531 (3 cr.)	Engineering Risk Analysis

One from:

ENGR 502 (3 cr.)	Project and Program Management
CIS 600A (3 cr.)	Information Technology and Project Management
CIS 670 (3 cr.)	Advanced IT Project Management

Courses In-Depth – Select 9 credits

Choose Systems Engineering coursework from those appearing on the SE Courses website (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

Electives – Select 6 credits

Courses consistent with the student's program of study and professional goals. A suggested elective list is available on the Systems Engineering website linked to above; *any courses not on the list must be approved by the SE Department*.
Please contact sys_engr_info@engr.colostate.edu with questions.

Independent Study – 3 credits

SYSE 695 (3 cr.)   Independent Study (must have project faculty advisor before enrolling)
        OR another course from the In-Depth section

Timeline of Important Steps to M.E.

What	When
File GS6 (program of study & committee selection)	Before registration of fourth regular semester
File GS25 (application to graduate) *reapply online if don't graduate during expected term	See published deadlines on graduate school website; generally in the first three weeks of the intended graduation term
Pay student account balance	Before leaving campus
Graduation	Ceremonies in Fall and Spring only
Receive Diploma	Mailed 10-12 weeks after end of term

Important Steps in Detail

You may access instructions for forms on the [Graduate School website](#); forms available on RAMweb.

Advisor
For the M.E. program, only one committee member is required: the advisor. The Systems Engineering Department Head, Thomas Bradley, should be listed as the advisor on the GS6 form. This form must be filed with the Graduate School as outlined below.

GS6 Form
The GS6 is intended to draft all courses (taken, in-progress, or expected) that will fulfill program requirements and to finalize the student's advisory committee. It is required before registration for the fourth regular semester in the program. Students will work with the Systems Engineering graduate advisor to lay out a proposed plan of study and list of committee members before submitting the GS6 to the Graduate School. For more information, please see section "GS6" under the "Graduate School Standards" section above.

GS25 Form
The GS25 Application for Graduation must be submitted to the Graduate School in the first few weeks of the semester in which you plan to graduate. You must be enrolled in credit-bearing courses or CR during your graduation semester. For more information, please see section "GS25" under the "Graduate School Standards" section above.

Transfer Credit

For the Master of Engineering degree, a minimum of 24 credits must be earned at Colorado State University, 21 of which must be earned after admission to the Graduate School. No more than 6 credits from an institution other than Colorado State may be applied toward the M.E. degree. Credits may be accepted for transfer provided all Graduate School requirements are met, including:
- The credit was earned at a regionally-accredited institution (credit earned at institutions outside of the U.S. may require additional documentation)
- The course(s) must have a B or higher earned ('B-' is not accepted)
- It must be a 'regular' course (meaning it cannot be a seminar, special topic, independent study, research credit, or similar)
- It must not have been used toward any previous awarded degree
- It must be 500-level equivalent or higher
- It must be approved by the SE Department as relevant to your program of study
- There is a 10-year time requirement on individual courses counting toward any graduate degree. If a transfer course will be at least 10 years old at the time the student applies to graduate, it may not count toward your degree.

Students petitioning for acceptance of transfer credit must submit a **syllabus** of the course(s) taken to the SE Department advisor and an **official transcript** showing the course(s) must be on-file when the GS6 is submitted so that an effective evaluation can be made. Please note that grades in courses accepted for transfer will not be included in calculation of the grade point average.

Master of Science

You can expect the Master of Science program to take one to two years as a full-time student (9+ credits per semester) and three to five years if you are a part-time student (3-6 credits per semester). Summer courses are not required, but are offered on a limited basis.

Program of Study

Master of Science
4) Minimum of 30 semester credits of graduate work in approved course of study (see below for Plan A vs Plan B guidelines)
5) Minimum of 24 credits semester credits earned at Colorado State (21 while in graduate program). For any courses taken prior to admission, a grade of B or higher must be earned (B- and below not accepted).
6) No more than 6 credits at the 400 level are permitted, and these must be taken at Colorado State University. No more than two 500-level (graduate) courses may be transferred from another regionally-accredited University.

Plan A requires a thesis and completion of a minimum of 30 credits. Of this 30, 21 credits must be in regular course work other than independent study or research. This plan involves a final examination as described below (see the "Final Examination" section).

Plan B requires 27 credits of regular courses (other than independent study) and 3 credits of independent study with the submission of a report. This plan involves a final examination as described below (see the "Final Examination" section).

Students who enter as Plan B students have the option to change to Plan A if, during their time in the program, they find a faculty member that agrees to be their thesis faculty advisor.

Program Course Requirements

Plan A – Thesis Required
    Systems Engineering Courses – Select 15 credits
    Choose Systems Engineering coursework from those appearing on the SE Courses website (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

    Technical Electives – Select 6 credits
    Courses consistent with the student's program of study and professional goals. A suggested elective list is available on the Systems Engineering website linked to above; *any courses not on the list must be approved by the SE Department*.
    Please contact sys_engr_info@engr.colostate.edu for questions.

    Research - 9 credits total
    SYSE 699 (1-9 cr./semester)   Thesis

Plan B – Project Option
    Systems Engineering Courses – Select 15 credits
    Choose Systems Engineering coursework from those appearing on the SE Courses website (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

    Technical Electives – Select 12 credits
    Courses consistent with the student's program of study and professional goals. A suggested elective list is available on the Systems Engineering website linked to above; *any courses not on*

the list must be approved by the SE Department.
Please contact sys_engr_info@engr.colostate.edu for questions.

Project - 3 credits
SYSE 695 (3 cr.) Independent Study (must have project faculty advisor before enrolling)

Timeline of Important Steps to M.S.

Plan A		Plan B	
What	When	What	When
Secure Faculty Advisor	Before Program Start		
Secure Advisory Committee	Before Filing GS6		
File GS6 (program of study & committee selection)	Before registration of fourth regular semester	File GS6 (program of study & committee selection)	Before registration of fourth regular semester
Discussions and progress reports with faculty advisor	Frequency determined between student and advisor	Secure 695 Project Advisor/GS9A to update committee	2-3 months prior to the intended SYSE 695 semester
File GS25 (application to graduate) *reapply online if don't graduate during expected term	See published deadlines on graduate school website; generally in the first three weeks of the intended graduation term	File GS25 (application to graduate) *reapply online if don't graduate during expected term	See published deadlines on graduate school website; generally in the first three weeks of the intended graduation term
Final Thesis Exam	See published deadlines; schedule with committee at least two weeks in advance	Evaluation of 695 Project	According to department guidance; during graduation semester
File GS24 (report of final exam)	Within 2 days of Thesis Exam Results	File GS24 (report of final exam)	According to department guidance
Submit thesis/GS30	See published deadlines on graduate school website	Submit project/GS40	See published deadlines on graduate school website
Pay student account balance	Before leaving campus	Pay student account balance	Before leaving campus
Graduation	Ceremonies in Fall and Spring only	Graduation	Ceremonies in Fall and Spring only
Receive Diploma	Mailed 10-12 weeks after end of term	Receive Diploma	Mailed 10-12 weeks after end of term

Important Steps in Detail

You may access instructions for forms on the Graduate School website; forms available on RAMweb.

Advisor and Advisory Committee

An M.S. Plan A student must have a primary faculty advisor before beginning the program; Plan B students have a predetermined committee provided for them. The Plan A advisor must hold academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the Systems Engineering Department. Our faculty list can be found at: https://www.engr.colostate.edu/se/faculty/.

An M.S. advisory committee consists of at least three faculty members. This committee is formalized by completion of the GS6 form as outlined below. Industrial participation is encouraged if appropriate; however, only formal committee members may vote at the final examination.

The committee is comprised of the following members:
1. The faculty advisor who serves as chairperson of the committee that holds academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the Systems Engineering Department
2. One or more additional members from the Systems Engineering Department;
3. One outside member that must hold a regular, special, transitional, joint, or emeritus/emerita faculty appointment at CSU in a department other than SE <u>and</u> the advisor's primary department, if it is not SE.
4. (Optional) Additional members from any department may be added

Because the '*outside member*' should serve as an impartial external evaluator on the committee, it is best to avoid situations where the outside member has association with the advisor's departments (i.e. joint appointments). If potential conflicts of interest arise, they should be disclosed to the Dean of the Graduate School as soon as possible.

A 'co-advisor' is optional and must be arranged with your primary advisor and the proposed co-advisor before listing anybody in the co-advisor spot on the GS6. The 'co-advisor' may take the spot of committee member number 2 above, provided they are in SE, or may be added as an additional member.

<u>M.S. Plan A</u> students are responsible for locating and gaining committee member approval before listing them on their GS6. Many Plan A students work with their faculty advisor to plan this committee.

<u>M.S. Plan B</u> students will list the following default committee on their GS6:
Advisor: Thomas Bradley
Committee Member: Steve Simske
Outside Committee Member: Matthew Kipper

MS Plan B students who wish to locate their own committee members, either before or after the GS6 is filed, may do so, but the above guidelines for the MS committee members must be followed. Committee members may be changed using the Graduate School's GS9A form through RAMweb.

GS6 Form

The GS6 is intended to draft all courses (taken, in-progress, or expected) that will fulfill program requirements and to finalize the student's advisory committee. It is required before registration for the fourth regular semester in the program. Students will work with the Systems Engineering graduate advisor to lay out a proposed plan of study and list of committee members before submitting the GS6 to the Graduate School. For more information, please see section "GS6" under the "Graduate School Standards" section above.

SYSE 695 (Plan B) and 699 (Plan A)

SYSE 695 is a 3-credit project course required for all MS Plan B students, typically in their last semester. MS Plan B students must secure a faculty project advisor to guide them in this course. SYSE 699 are credits MS Plan A students use to work on their thesis requirement with the faculty advisor they secured prior to program admission. Registration for and grading of SYSE 695 and 699 credits is based upon agreement between the student and their faculty research advisor. For SYSE 699, the number of credits to take each semester may be determined using guidance located in the Graduate and Professional Bulletin:

For thesis, dissertation, research, and independent study graduate courses, the number of student credit hours earned will be determined using a base rate of 48 hours of student effort per credit hour. The faculty advisor, or other department official, shall estimate the total number of hours of student effort required over the length of the semester. This effort shall include consultation with the advisor, as well as library, laboratory, field, or studio work. The total number of hours shall be divided by 48 and

the resultant quotient (rounded off to a whole number) shall define the number of credits to be awarded.

To register for 695 or 699 credits, the student must discuss with their faculty advisor their plan, including the expectations and deliverables for the semester. Written permission from the advisor (or the student forwarding advisor permission with advisor Cc'd) is required **only** for the first semester's registration. The department then allows subsequent registration (in the case of SYSE 699 credits) with the expectation that student and advisor are in regular communication. The faculty advisor assigns a grade (satisfactory or unsatisfactory) for the credits each semester, so it is important for the student to ensure they are working closely with their advisor.

GS25 Form
The GS25 Application for Graduation must be submitted to the Graduate School in the first few weeks of the semester in which you plan to graduate. You must be enrolled in credit-bearing courses or CR during your graduation semester. For more information, please see section "GS25" under the "Graduate School Standards" section above.

Examinations
Plan A Thesis Students: The examination will be an oral defense of the M.S. thesis.
> This is the final evaluation of the student's research activity; see below for M.S. Thesis Guidelines. The thesis must be submitted to the student's committee no less than 14 days before the defense date.

> All examinations are held on the Colorado State University campus or via appropriate video-tele-conferencing (vtc) equipment and software. To facilitate ease of scheduling, the exam should be scheduled with committees **at least** **one month** before the exam is to be held. It is the student's responsibility to coordinate a time/place with his/her committee members, send an Outlook calendar invitation from their CSU email address, and send reminders as needed.

> Students must contact sys_engr_info@engr.colostate.edu to provide their scheduled exam time and for necessary logistical information regarding exam paperwork. Exams may be open-attendance for the University community and announcement of all exams is made on the Systems Engineering website.

> The report of the results of the final examination (GS24) must be submitted to the Graduate School within required time frames to record the result of the final exam. *It is the student's responsibility to ensure this paperwork is completed on time*—please contact the SE Department for questions about this process.

Plan B Project Students:
> MS Plan B students are required to complete SYSE 695 and their project will be evaluated by their committee to determine their result on their GS24 Result of Final Exam form, required by the Graduate School. MS Plan B students are expected to have a working draft of their project (not final, but enough information to evaluate scope, planning, and progress) by about mid-semester of the semester they take SYSE 695 credits. The student, SE Department, and committee members will coordinate to obtain required signatures for the GS24 by the deadline set by the Graduate School.

Thesis/Project Submission
Plan A Thesis Students:
> The GS30 Thesis/Dissertation Submission Form is signed by the members of your committee when your thesis is approved and ready for electronic submission. Forms must be submitted to the Graduate School by the deadline date of the semester that you intend to complete your degree requirements.

> Once your thesis is approved you will submit it electronically to ProQuest/UMI. Please see Graduate School website for details. Note that you must follow Graduate School formatting requirements and gain approval before your final thesis is submitted. Leave time for the thesis format to be approved by the Graduate School before the final submission deadline listed.

Plan B Project students:

School Thesis and Dissertation Formatting Guide. When in doubt, always follow the Graduate School Thesis and Dissertation Formatting Guide.

8. Appendices. Include any appendices necessary to detail methods/materials used (e.g., procedures and questionnaires).

Doctor of Philosophy
https://www.engr.colostate.edu/se/phd/

The Ph.D. timeline can vary depending on credits taken and overall progress toward a complete dissertation made each semester. Full-time Ph.D. students (9+ credits per semester) often graduate in three to four years, and part-time students (3-6 credits per semester) average five to eight years.

Please see Appendix A for more detailed information on the purpose and goals of the Ph.D. process, preliminary exam, and final exams.

Program of Study

If an appropriate technical master's degree has been successfully completed there is the possibility that up to 30 hours of that degree could be counted toward the 72 credit hour requirement for the Ph.D. The process to determine if your Master's can count toward the Ph.D. is as follows:

1. Your faculty advisor must agree that your Master's is considered applicable to your Systems Engineering Ph.D. program of study.
2. If your advisor agrees, you will submit the Master's degree as part of your Program of Study (GS6) in the second or third semester of classes at CSU. The GS6 is required to be submitted to the Graduate School before you can register for your fourth semester. I*f your master's degree is from an institution outside of the U.S., additional documentation may be required.*
3. The Graduate School has final say if the master's degree credits are transferrable. Upon the approval of your GS6 Program of Study, up to 30 credits from your master's degree will be finalized into your degree plan.

For the 42-credit option, a minimum of 32 credits must be earned at Colorado State University after admission to a doctoral program. Courses at the 400 level and below will not be accepted towards the 42-credit Ph.D.

Students who have not yet received a master's degree may be admitted to the 72-credit Ph.D. program and will be required to meet the "Program of Study" requirements for both the Ph.D. and M.S. programs. This includes 39 credits of regular graduate course work other than independent study and research. No more than 6 of these credits are allowed at the 400 level. The remaining 33 credits are in dissertation/research.

Program Course Requirements

42 Credit Ph.D.
SYSE 701 Research Methods in SE – 3 credits
Introduction to the systems engineering research field. Students will learn about the academic research process, norms, and techniques, with emphasis on the PhD program and expectations.

Systems Engineering Courses – Select 18 credits
Choose Systems Engineering coursework from those appearing on the SE Courses website (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

Research – 21 credits minimum, will be split across multiple semesters
SYSE 799A Dissertation: PhD

*- Please note the 42-credit Ph.D. option does **not** include space for electives -*

72 Credit Ph.D.
SYSE 701 Research Methods in SE – 3 credits
Introduction to the systems engineering research field. Students will learn about the academic research process, norms, and techniques, with emphasis on the PhD program and expectations.

Systems Engineering Courses – Select 21 credits
Choose Systems Engineering coursework from those appearing on the [SE Courses website](https://www.engr.colostate.edu/se/courses/) (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

Technical Electives – Select 18 credits
Courses consistent with the student's program of study and professional goals. A suggested elective list is available on the Systems Engineering website linked to above; *any courses not on the list must be approved by the SE Department*.
Please contact sys_engr_info@engr.colostate.edu for questions.

Research – 30 credits minimum, will be split across multiple semesters
SYSE 799A Dissertation: PhD

For both the 42-credit option and the 72-credit option, three credit hours of SYSE 795 (Independent Study) may be used towards the total of dissertation credits OR as one 3-credit course. If you have had your Ph.D. research, which was performed while enrolled at CSU, accepted for publication (completely or with minor revisions) in at least two peer-reviewed journal or conference proceedings, then you may be eligible for Independent Study credit. You must be first author on at least one of the papers accepted. Please work with your faculty advisor when planning publications to meet this requirement. To register for these credits, you will complete an SYSE 795 Independent Study form, with faculty advisor approval, and submit to the Systems Engineering Department.

Timeline of Important Steps to Ph.D.

What	When
Secure Faculty Advisor	Before application to Ph.D. program is reviewed
Complete qualifying process (coursework done with B grades or higher)	Suggested within 2-3 years of start date
Begin work on research/dissertation (SYSE 799A)	Whenever advisor and student are ready; coursework does not have to be done prior to SYSE 799A credits
Discussions and progress reports with faculty advisor/committee	Annual Evaluation each fall semester, more frequent discussion is encouraged
Secure Advisory Committee	Before filing your GS6
File GS6 (program of study & committee selection)	Before registration of fourth regular semester
Preliminary Exams	At least 2 terms prior to final exam; Schedule with committee *at least* one month in advance
File GS16 (report of prelim results) with the Graduate School	Within 2 working days of prelim exam
File GS25 (application to graduate) *reapply online if don't graduate during expected term	See published deadlines on graduate school website; generally in the first three weeks of the intended graduation term
Submit dissertation to committee	2 weeks before final exam
Final oral exam	See published deadlines; schedule with committee *at least* one month in advance
File GS24 (report of final exam)	Within 2 working days of final exam
Submit final dissertation online with GS30 and Survey of Earned Doctorate	After final exam; see published deadlines on graduate school website
Pay publishing fee (if applicable)	When submitting thesis/dissertation
Pay student account balance	Before leaving campus
Graduation	Ceremonies in Fall and Spring only
Receive diploma	Mailed 10-12 weeks after end of term

Important Steps in Detail

You may access instructions for forms on the Graduate School website; forms available on RAMweb.

Advisor and Advisory Committee

A Ph.D. student must have a primary faculty advisor before beginning the program. The advisor must hold academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the Systems Engineering Department. Our faculty list can be found at https://www.engr.colostate.edu/se/faculty/.

A Ph.D. graduate committee consists of at least four academic faculty members from CSU. This committee is formalized by completion of the GS6 form as outlined below. The makeup of a graduate committee must be agreed to by the potential members themselves, and *it is the student's responsibility to secure these agreements before submitting their GS6*. It is recommended that a student's committee have several members with expertise in his/her proposed research field. Industrial participation is encouraged if appropriate; however, only formal committee members may vote at the final examination.

The committee is comprised of the following members:
1. The faculty advisor who serves as chairperson of the committee that holds academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the Systems Engineering Department
2. One or more additional members from the Systems Engineering Department;
3. Any departmental or non-departmental faculty member who may be appropriate; and
4. One outside member that must hold a regular, special, transitional, joint, or emeritus/emerita faculty appointment at CSU in a department other than SE (i.e. they cannot be listed on the SE faculty list at https://www.engr.colostate.edu/se/faculty/).

Because the '*outside member*' should serve as an impartial external evaluator on the committee, it is best to avoid situations where the outside member has association with the advisor's departments (i.e. joint appointments). If potential conflicts of interest arise, they should be disclosed to the Dean of the Graduate School as soon as possible.

A 'co-advisor' is optional and must be arranged with your primary advisor and the proposed co-advisor before listing anybody in the co-advisor spot on the GS6. The 'co-advisor' may take the spot of committee member number 2 or 3 above, or may be added as a fifth member.

You may review the Graduate and Professional Bulletin for more information:
http://catalog.colostate.edu/general-catalog/graduate-bulletin/graduate-study/procedures-requirements-all-degrees/#advisory-system

Ph.D. Qualifying Process

Every Ph.D. student must pass all course requirements with a "B" or higher ("B-" and below not accepted). If a student does not achieve this grade, they will be given one opportunity to repeat the course.

SYSE 799A

Work done toward the dissertation is to be done under 799A credits. Registration for and grading of these credits is based upon agreement between the student and faculty advisor. There is no SE requirement that coursework credits must be complete prior to SYSE 799A registration, as this is at the faculty advisor's discretion. The number of credits to take each semester may be determined using guidance located in the Graduate and Professional Bulletin:

> *For thesis, dissertation, research, and independent study graduate courses, the number of student credit hours earned will be determined using a base rate of 48 hours of student effort per credit hour. The faculty advisor, or other department official, shall estimate the total number of hours of student effort required over the length of the semester. This effort shall include consultation with the advisor, as well as library, laboratory, field, or studio work. The total number of hours shall be divided by 48 and the resultant quotient (rounded off to a whole number) shall define the number of credits to be awarded.*

The number of listed SYSE 799A credits on the degree curriculum are a minimum. Students who complete the minimum listed but are not finished with their dissertation are still expected to continue registering for an appropriate amount of dissertation credits each semester until they are done.

To register for the first semester of 799A credits, a PhD student must discuss with their faculty advisor their plan, including how many credits to begin with and the expectations and deliverables for the semester. Written permission from the advisor (or the student forwarding advisor permission with advisor Cc'd) is required **only** for the first semester's registration. The department then allows subsequent registration with the expectation that student and advisor are in regular communication. The faculty advisor assigns a grade (satisfactory or unsatisfactory) for the credits each semester, so it is important for the student to ensure they are working closely with their advisor.

Annual Evaluation Process
Each fall, every PhD student must complete an Annual Evaluation form and meet with their faculty advisor to have a discussion regarding their progress over the last year and goals for the future. Following each discussion, the student will submit the completed Annual Evaluation form to the Systems Engineering Department as part of their progression portfolio. **Students who do not submit this evaluation by the December 1 deadline each year will have a registration hold placed on their account until it is submitted.**

GS6 Form
The GS6 is intended to draft all courses (taken, in-progress, or expected) that will fulfill program requirements and to finalize the student's advisory committee. It is required before registration for the fourth regular semester in the program. Ph.D. students should work with their faculty advisors to lay out a proposed Program of Study. Students and their advisors will coordinate with the Systems Engineering department advisor to formalize the GS6 Program of Study, ensure that Systems Engineering department requirements are being met, and verify appropriate committee members are listed before the GS6 is submitted to the Graduate School. It is the student's responsibility to ensure faculty members agree to serve on their committee before submitting their GS6. For more information, please see section "GS6" under the "Graduate School Standards" section above.
Please note that if you are submitting a master's degree or transfer courses from an institution outside of the U.S., additional documentation may be required.

Ph.D. Preliminary Examination
This exam will provide the student's PhD committee an opportunity to examine his/her planned research activity, determine the student's knowledge of the fundamental scientific and engineering principles involved with their dissertation topic, and to determine the adequacy of the current research plan to develop a satisfactory dissertation. The Preliminary Exam **must** be taken at least two semesters before the Final Exam/Dissertation Defense, and is generally taken after the student has completed some SYSE 799A credits and has a grasp of their intended project. The student has a maximum of two opportunities to pass the preliminary exam.

Please see Appendix A for more detailed information on the purpose and goals of the PhD process, preliminary exam, and final exams.

All examinations are held on the Colorado State University campus or via appropriate video-tele-conferencing (vtc) equipment and software. To facilitate ease of scheduling, the exam should be scheduled with committees **at least** **one month** before the exam is to be held. It is the student's responsibility to coordinate a time/place with his/her committee members, send an Outlook calendar invitation from their CSU email address, and send reminders as needed.

Students <u>must</u> contact sys_engr_info@engr.colostate.edu to provide their scheduled exam time and for necessary logistical information regarding exam paperwork. Exams may be open-attendance for the University community and announcement of all exams is made on the Systems Engineering website.

<u>Students should work with their faculty advisor and committee members to understand the deliverables required.</u> The student must at a minimum provide a written report or presentation of background, significance and theoretical basis of the planned research, the experimental design, and any preliminary data. All deliverables required by the faculty advisor and committee should be sent to the full committee no less than 10 business days before the student's Preliminary Examination. The exam will involve a 30-45 minute presentation by the student, followed by an oral examination from the student's PhD committee. Based on the examination results, the student's committee will recommend one of the following courses of action:
        (A)   That he/she be endorsed as a Ph.D. candidate,

(B) That he/she submit to another preliminary examination no sooner than 2 months and no later than 12 months after the first exam, or

(C) That he/she withdraw from the Ph.D. program.

A report of the results of the preliminary examination (GS16) must be submitted to the Graduate School within required time frames to record the result of the preliminary exam. *It is the student's responsibility to ensure this paperwork is completed on time*—please contact the SE Department for questions about this process.

GS25 Form
The GS25 Application for Graduation must be submitted to the Graduate School in the first few weeks of the semester in which you plan to graduate. You must be enrolled in credit-bearing courses or CR during your graduation semester. For more information, please see section "GS25" under the "Graduate School Standards" section above.

Ph.D. Final Examination/Dissertation Defense
The Ph.D. dissertation is a major effort in which the doctoral candidate undertakes a program of work that will result in a significant contribution to the student's major field of study. This exam is the final evaluation of the student's research activity and must be taken at least two semesters after the Preliminary Exam. The dissertation and any other supporting materials (if required by advisor or committee) must be submitted to the full advisory committee no less than 10 business days before the defense date.

All examinations are held on the Colorado State University campus or via appropriate video-tele- All examinations are held on the Colorado State University campus or via appropriate video-tele-conferencing (vtc) equipment and software. To facilitate ease of scheduling, the exam should be scheduled with committees **at least** one month before the exam is to be held. It is the student's responsibility to coordinate a time/place with his/her committee members, send an Outlook calendar invitation from their CSU email address, and send reminders as needed.

Students <u>must</u> contact sys_engr_info@engr.colostate.edu to provide their scheduled exam time and for necessary logistical information regarding exam paperwork. Exams may be open-attendance for the University community and announcement of all exams is made on the Systems Engineering website.

In addition, the following metrics will also be used to assess student learning and professional development:
- Research presentations at national and international conferences.
- Evaluation scores from the preliminary exam that includes scoring on the following sections: background, significance and theoretical basis of the planned research, the experimental design, and any preliminary data.

The report of the results of the final examination (GS24) must be submitted to the Graduate School within required time frames to record the result of the final exam. *It is the student's responsibility to ensure this paperwork is completed on time*—please contact the SE Department for questions about this process.

Dissertation Submission
The GS30 Thesis/Dissertation Submission Form is signed by the members of your committee when your dissertation is approved and ready for electronic submission. Ph.D. students must also submit a Survey of Earned Doctorates (SED) Certificate with the GS30 (steps for the SED can be found on the Graduate School website). Forms must be submitted to the Graduate School by the deadline date of the semester that you intend to complete your degree requirements.

Once your dissertation is approved you will submit it electronically to ProQuest/UMI. Please see Graduate School website for details. Note that you must follow Graduate School formatting requirements and gain approval before your final dissertation is submitted. ***Leave time for the dissertation format to be approved by the Graduate School before the final submission deadline listed.***

Transfer Credit

A minimum of 32 credits must be earned at CSU after admission to the 42-credit doctoral program (for those with an applicable master's degree) <u>or</u> a minimum of 62 credits must be earned at CSU after

admission to the 72-credit doctoral program (for those without an applicable master's degree).

For Ph.D. students, up to 10 credits in courses earned after the date on which the master's degree was awarded may be accepted in transfer provided all Graduate School requirements are met, including:

- The credit was earned at a regionally-accredited institution (credit earned at institutions outside of the U.S. may require additional documentation)
- The course(s) must have a B or higher earned ('B-' is not accepted)
- It must be a 'regular' course (meaning it cannot be a seminar, special topic, independent study, research credit, or similar)
- It must not have been used toward any previous awarded degree
- It must be 500-level equivalent or higher
- It must be approved by your faculty advisor and the SE Department as relevant to your program of study
- There is a 10-year time requirement on individual courses counting toward any graduate degree. If a transfer course will be at least 10 years old at the time the student applies to graduate, it may not count toward your degree.

Students petitioning for acceptance of transfer credit must submit a **syllabus** of the course(s) taken to the SE Department advisor and an **official transcript** showing the course(s) must be on-file when the GS6 is submitted so that an effective evaluation can be made. Please note that grades in courses accepted for transfer will not be included in calculation of the grade point average.

Doctor of Engineering
https://www.engr.colostate.edu/se/deng/

The D.Eng. timeline can vary depending on credits taken and overall progress toward a complete practicum project made each semester. Full-time D.Eng. students (9+ credits per semester) often graduate in three to four years, and part-time students (3-6 credits per semester) average five to seven years.

Please see Appendix B for more detailed information on the purpose and goals of the D.Eng. process, preliminary exam, and final exams.

Program of Study

If an appropriate technical master's degree has been successfully completed there is the possibility that up to 30 hours of that degree could be counted toward the 72 credit hour requirement for the D.Eng. The process to determine if your Master's can count toward the D.Eng. is as follows:

a. Your academic credentials will be evaluated by the admissions committee and you will be informed upon admission if the Systems Engineering Department supports your master's degree as applicable toward the D.Eng.
b. If you receive this notice, you will submit the Master's degree as part of your Program of Study (GS6) in the second or third semester of classes at CSU. The GS6 is required to be submitted to the Graduate School before you can register for your fourth semester. I*f your master's degree is from an institution outside of the U.S., additional documentation may be required.*
c. The Graduate School has final say if the master's degree credits are transferrable. Upon the approval of your GS6 Program of Study, up to 30 credits from your master's degree will be finalized into your degree plan.

For the 42-credit option, a minimum of 32 credits must be earned at Colorado State University after admission to a doctoral program. Courses at the 400 level and below will not be accepted towards the 42-credit D.Eng.

Students who have not yet received a master's degree may be admitted to the 72-credit D.Eng. program and will be required to meet the "Program of Study" requirements for both the D.Eng. and M.E. programs. This includes 54 credits of regular graduate course work other than independent study and research. No more than 6 of these credits are allowed at the 400 level. The remaining 18 credits are in practicum/dissertation.

Program Course Requirements

42 Credit D.Eng.
    Required – 3 credits
      SYSE 710 (3 cr.)   Leadership/Innovation in Systems Engineering
        Must be completed in first year

    Systems Engineering Depth Courses – Select 15 credits
    Choose Systems Engineering coursework from those appearing on the SE Courses website (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

    Applied Electives – 3 credits minimum
    Choose 1-2 courses from the following (no substitutions permitted):
      BUS 500 (2 cr.)   Business Systems and Processes
      BUS 601 (2 cr.)   Quantitative Business Analysis
      CIS 570 (3 cr.)   Business Intelligence
      CIS 575 (3 cr.)   Applied Data Mining and Analytics in Business

    Professional Electives – 3 credits minimum
    Choose 1-2 courses from the following (no substitutions permitted):

BUS 620 (2 cr.)	Leadership and Teams
BUS 630 (2 cr.)	Information Management
CIS 676 (3 cr.)	Information Technology Management
SYSE 711 (1 cr.)	Ethics in Systems Engineering
PSY 647 (3 cr.)	Applied Industrial Psychology
PSY 648 (3 cr.)	Applied Organizational Psychology

Practicum – 9 credits minimum, may be split across multiple semesters
    SYSE 786   Applied Systems Engineering Practicum
First ~3 credits for Prelim Exam prep. Preliminary exam must be complete before <u>any</u> on-site practicum activity begins.

Dissertation – 9 credits minimum, may be split across multiple semesters
    SYSE 799B   Dissertation: Professional Doctorate
Most SYSE 786 requirements are expected to be completed before enrolling

72 Credit D.Eng.

Required – 15 credits
| SYSE 710 (3 cr.) | Leadership/Innovation in Systems Engineering |
Must be completed in first year
| SYSE 501 (3 cr.) | Foundations of Systems Engineering |
Must be completed in first year
SYSE 530 (3 cr.)	Overview of Systems Engineering Processes
ENGR 502 (3 cr.)	Project and Program Management
or CIS 600A (3 cr.)	Information Technology and Project Management
or CIS 670 (3 cr.)	Advanced IT Project Management
ENGR 531 (3 cr.)	Engineering Risk Analysis

Systems Engineering Depth Courses – Select 21 credits
Choose Systems Engineering coursework from those appearing on the [SE Courses website](https://www.engr.colostate.edu/se/courses/) (https://www.engr.colostate.edu/se/courses/), with exceptions as indicated. Includes non-independent study and non-research courses in subject codes SYSE, most ENGR, and limited ECE, MECH, CIS courses.

Applied Electives – 3 credits minimum
Choose 1-2 courses from the following (no substitutions permitted):
BUS 500 (2 cr.)	Business Systems and Processes
BUS 601 (2 cr.)	Quantitative Business Analysis
CIS 570 (3 cr.)	Business Intelligence
CIS 575 (3 cr.)	Applied Data Mining and Analytics in Business

Professional Electives – 3 credits minimum
Choose 1-2 courses from the following (no substitutions permitted):
BUS 620 (2 cr.)	Leadership and Teams
BUS 630 (2 cr.)	Information Management
CIS 676 (3 cr.)	Information Technology Management
SYSE 711 (1 cr.)	Ethics in Systems Engineering
PSY 647 (3 cr.)	Applied Industrial Psychology
PSY 648 (3 cr.)	Applied Organizational Psychology

Technical Electives – Select 12 credits
Courses consistent with the student's program of study and professional goals. A suggested elective list is available on the Systems Engineering website; *any courses not on the list must be approved by the SE Department*. Please contact sys_engr_info@engr.colostate.edu for questions.

Practicum – 9 credits minimum, may be split across multiple semesters
    SYSE 786   Applied Systems Engineering Practicum
First ~3 credits for Prelim Exam prep. Preliminary exam must be complete before <u>any</u> on-site practicum activity begins.

Dissertation – 9 credits minimum, may be split across multiple semesters

SYSE 799B   Dissertation: Professional Doctorate

Most SYSE 786 requirements are expected to be completed before enrolling

Timeline of Important Steps to D.Eng.

What	When
Secure Practicum Sponsor within your organization/company	Before application to D.Eng. program is reviewed
Complete qualifying process (coursework done with B grades or higher)	Suggested within 2-4 years of start date
Discussions and progress reports with committee & Practicum Sponsor	Annual Evaluation each fall semester, more frequent discussion is encouraged
Secure/Finalize Advisory Committee through SE Department	Before filing your GS6
File GS6 (program of study & committee selection, including industry member)	Before registration of fourth regular semester
Begin initial practicum credits & prep work	After 710 complete, committee is finalized, and Practicum Sponsor approves to start 786 credits
Preliminary Exam	After filing GS6 and before on-site practicum activity; Schedule with committee *at least* one month in advance
File GS16 (report of prelim results) with the Graduate School	Within 2 working days of prelim exam
Begin on-site practicum work	After preliminary exam is passed
Begin dissertation credits	After all practicum credits and requirements are completed
File GS25 (application to graduate) *reapply online if don't graduate during expected term	See published deadlines on graduate school website; generally in the first three weeks of the intended graduation term
Submit dissertation to committee	2 weeks before final exam
Final Oral Exam	See published deadlines; schedule with committee *at least* one month in advance
File GS24 (report of final exam)	Within 2 working days of final exam
Submit final dissertation online with GS30 and Survey of Earned Doctorate	After final exam; see published deadlines on graduate school website
Pay publishing fee (if applicable)	When submitting thesis/dissertation
Pay student account balance	Before leaving campus
Graduation	Ceremonies in Fall and Spring only
Receive diploma	Mailed 10-12 weeks after end of term

Important Steps in Detail

You may access instructions for forms on the [Graduate School website](); forms available on RAMweb.

Advisor and Advisory Committee

A D.Eng. student will be assigned a faculty advisor upon entry into the program and suggestions for committee members when they work on completing their GS6. The student may change advisors and/or committee members if their project interests change and/or they locate a different faculty member with a better fit. The advisor must hold academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the Systems Engineering Department. Our faculty list can be found at: https://www.engr.colostate.edu/se/faculty/.

A D.Eng. graduate committee consists of at least four academic faculty members from CSU and one industry member, typically the student's practicum sponsor from within the student's organization or company. This committee is formalized by completion of the GS6 form as outlined below. The makeup of a graduate committee must be agreed to by the potential members themselves. For any faculty beyond the suggested committee, *it is the student's responsibility to secure agreement to serve before submitting their GS6*. It is strongly encouraged that a student's committee have several members with industry expertise in the area in which they are doing their practicum.

The committee is comprised of the following members:
1. The faculty advisor who serves as chairperson of the committee that holds academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the Systems Engineering Department
2. One or more additional members from the Systems Engineering Department;
3. Any departmental or non-departmental faculty member who may be appropriate
4. One outside member that must hold a regular, special, transitional, joint, or emeritus/emerita faculty appointment **at CSU** in a department other than SE (i.e. they <u>cannot</u> be listed on the SE faculty list at https://www.engr.colostate.edu/se/faculty/).
5. One non-CSU "practicum sponsor," from within their practicum organization, who holds either a doctoral degree or a master's degree alongside significant professional experience in the SE field. This person's role will be noted as a "committee member" on the electronic GS6 form.

Because the "outside member" (above number 4) should serve as an impartial external evaluator on the committee, it is best to avoid situations where the outside member has association with the advisor's department (i.e. joint appointments). If potential conflicts of interest arise, they should be disclosed to the Dean of the Graduate School as soon as possible.

A 'co-advisor' is optional and must be arranged with your primary advisor and the proposed co-advisor before listing anybody in the co-advisor spot on the GS6. The 'co-advisor' may take the spot of committee member number 2 or 3 above, but may not be the practicum sponsor (number 5).

The "practicum sponsor" must be appointed to the committee using the following procedure:
1. The practicum sponsor completes an affiliate hire form in the semester in which the student is completing their GS6 (form available from SE Dept). This form can take up to two weeks to process and will provide an affiliate appointment within the SE Department for the purposes of serving on the student's committee.
2. Once the appointment is finalized, the student may list the practicum sponsor's name as a "committee member" on the GS6 form (**not** <u>"outside member" or "co-advisor"</u>). The P.S. must be listed in addition to a minimum of four CSU faculty members.

Advisory Committee Changes and/or Changes of Practicum Sponsor

After completion of the GS6, a student may change their committee members using the GS9A form. The Systems Engineering Department encourages students to make any changes necessary prior to their preliminary exam, so their committee is finalized when beginning the practicum project.

If a change of practicum sponsor is required, it is the student's responsibility to alert the Systems Engineering Department that their old sponsor is no longer valid, and to submit a letter/memo from their new sponsor stating their expected support for the student along with the sponsor's resume. **Students who do not have an active practicum sponsor may not be permitted to continue in the program.**

D.Eng. Qualifying Process
Every D.Eng. student must pass all course requirements with a "B" or higher ("B-" and below not accepted). If a student does not achieve this grade, they will be given one opportunity to repeat the course.

SYSE 786 and SYSE 799B
Work done toward the practicum project is completed under SYSE 786 credits and work done toward completing/writing the dissertation is to be done under 799B credits. Registration for and grading of these credits is based upon agreement between the student, advisory committee, and practicum sponsor. The number of credits to take each semester may be determined using guidance located in the Graduate and Professional Bulletin:

> *For thesis, dissertation, research, and independent study graduate courses, the number of student credit hours earned will be determined using a base rate of 48 hours of student effort per credit hour. The faculty advisor, or other department official, shall estimate the total number of hours of student effort required over the length of the semester. This effort shall include consultation with the advisor, as well as library, laboratory, field, or studio work. The total number of hours shall be divided by 48 and the resultant quotient (rounded off to a whole number) shall define the number of credits to be awarded.*

The number of listed SYSE 786 and 799B credits on the degree curriculum are a minimum. Students who complete the minimum listed but are not finished with their project or dissertation are still expected to continue registering for an appropriate amount of credits each semester until they are done.

Students who have completed SYSE 710 and have committee and practicum sponsor agreement to begin practicum credits will contact the Systems Engineering Department for registration assistance. The first approximately 3 credits of SYSE 786 is for the student's practicum planning and Preliminary Exam preparation. Once the preliminary exam is passed, the student can then begin on-site practicum work (generally two semesters of 3 SYSE 786 credits each).

Once practicum activities are complete, the student moves into the writing stage, which are dissertation credits (799B). A student must pass their preliminary exam and have permission/confirmation from their committee and practicum sponsor to begin SYSE 799B credits. Overlap of 786 and 799B credits is possible, but generally would not occur for more than one semester.

Annual Evaluation Process
Each fall, every D.Eng. student must complete an Annual Evaluation form and meet with at least one representative of their advisory committee and practicum sponsor to have a discussion regarding their progress over the last year and goals for the future. Following each discussion, the student will submit the completed Annual Evaluation form to the Systems Engineering Department as part of their progression portfolio. **Students who do not submit this evaluation by the December 1 deadline each year will have a registration hold placed on their account until it is submitted.**

GS6 Form
The GS6 is intended to draft all courses (taken, in-progress, or expected) that will fulfill program requirements and to finalize the student's advisory committee. It is required before registration for the fourth regular semester in the program.
D.Eng. students should compose a 1-2 page project proposal following SYSE 710 completion and submit to the SE Department, so that a suggested advisory committee can be provided to them. Students should then work with their committee members and/or practicum sponsor to lay out a proposed Program of Study. Students and their committee will coordinate with the Systems Engineering department advisor to formalize the GS6 Program of Study, ensure that Systems Engineering department requirements are being met, and verify appropriate committee members are listed before the GS6 is submitted to the Graduate School. For any faculty beyond the assigned/suggested committee, *it is the student's responsibility to ensure faculty members agree to serve on their committee before submitting their GS6*. For more information, please see section "GS6" under the "Graduate School Standards" section above.
Please note that if you are submitting a master's degree or transfer courses from an institution outside of the U.S., additional documentation may be required.

D.Eng. Preliminary Examination
This exam will provide the student's D.Eng. committee an opportunity to examine his/her planned practicum

activity, determine the student's knowledge of the fundamental scientific and engineering principles involved with their project topic, and to determine the adequacy of the current project plan to develop a satisfactory dissertation and final project outcome. The Preliminary Exam **must** be taken at least two semesters before the Final Exam/Dissertation Defense, and is taken after the student has completed at least one semester of practicum credits (SYSE 786) to prepare for this exam. The student has a maximum of two opportunities to pass the preliminary exam.

All examinations are held on the Colorado State University campus or via appropriate video-tele-conferencing (vtc) equipment and software. To facilitate ease of scheduling, the exam should be scheduled with committees **at least one month** before the exam is to be held. It is the student's responsibility to coordinate a time/place with his/her committee members, send an Outlook calendar invitation from their CSU email address, and send reminders as needed.

Students <u>must</u> contact sys_engr_info@engr.colostate.edu to provide their scheduled exam time and for necessary logistical information regarding exam paperwork. Exams may be open-attendance for the University community and announcement of all exams is made on the Systems Engineering website.

<u>Students should work with their faculty advisor, practicum sponsor, and committee members to understand the deliverables required.</u> The student must at a minimum provide a written report or presentation of background, significance and theoretical basis of the planned research, the experimental design, and any preliminary data. All deliverables required by the faculty advisor and committee should be sent to the full committee no less than 10 business days before the student's Preliminary Examination. The exam will involve a 30-45 minute presentation by the student, followed by an oral examination from the student's D.Eng. committee. Based on the examination results, the student's committee will recommend one of the following courses of action:

(D) That he/she be endorsed as a D.Eng. candidate,
(E) That he/she submit to another preliminary examination no sooner than 2 months and no later than 12 months after the first exam, or
(F) That he/she withdraw from the D.Eng. program.

A report of the results of the preliminary examination (GS16) must be submitted to the Graduate School within required time frames to record the result of the preliminary exam. *It is the student's responsibility to ensure this paperwork is completed on time*—please contact the SE Department for questions about this process.

GS25 Form
The GS25 Application for Graduation must be submitted to the Graduate School in the first few weeks of the semester in which you plan to graduate. You must be enrolled in credit-bearing courses or CR during your graduation semester. For more information, please see section "GS25" under the "Graduate School Standards" section above.

D.Eng. Final Examination/Dissertation Defense
The D.Eng. dissertation is a major effort in which the doctoral candidate undertakes a project and written report that will result in a significant contribution to the student's professional area. This exam is the final evaluation of the student's project and must be taken at least two semesters after the Preliminary Exam. The dissertation and any other supporting materials (if required by advisor, practicum sponsor, or committee) must be submitted to the full advisory committee no less than 10 business days before the defense date.

All examinations are held on the Colorado State University campus or via appropriate video-tele-conferencing (vtc) equipment and software. To facilitate ease of scheduling, the exam should be scheduled with committees **at least one month** before the exam is to be held. It is the student's responsibility to coordinate a time/place with his/her committee members, send an Outlook calendar invitation from their CSU email address, and send reminders as needed.

Students <u>must</u> contact sys_engr_info@engr.colostate.edu to provide their scheduled exam time and for necessary logistical information regarding exam paperwork. Exams may be open-attendance for the University community and announcement of all exams is made on the Systems Engineering website.

The report of the results of the final examination (GS24) must be submitted to the Graduate School within

required time frames to record the result of the final exam. *It is the student's responsibility to ensure this paperwork is completed on time*—please contact the SE Department for questions about this process.

Dissertation Submission
The GS30 Thesis/Dissertation Submission Form is signed by the members of your committee when your dissertation is approved and ready for electronic submission. D.Eng. students must also submit a Survey of Earned Doctorates (SED) Certificate with the GS30 (steps for the SED can be found on the Graduate School website). Forms must be submitted to the Graduate School by the deadline date of the semester that you intend to complete your degree requirements.

Once your dissertation is approved you will submit it electronically to ProQuest/UMI. Please see Graduate School website for details. Note that you must follow Graduate School formatting requirements and gain approval before your final dissertation is submitted. ***Leave time for the dissertation format to be approved by the Graduate School before the final submission deadline listed.***

Transfer Credit

Transfers between the Systems Engineering Ph.D. and Systems Engineering D.Eng. are not permitted.

For those with credit from a different institution, a minimum of 32 credits must be earned at CSU after admission to the 42-credit doctoral program (for those with an applicable master's degree) or a minimum of 62 credits must be earned at CSU after admission to the 72-credit doctoral program (for those without an applicable master's degree).

For D.Eng. students, up to 6 credits in courses earned after the date on which the master's degree was awarded may be accepted in transfer provided all Graduate School requirements are met, including:
- The credit was earned at a regionally-accredited institution (credit earned at institutions outside of the U.S. may require additional documentation)
- The course(s) must have a B or higher earned ('B-' is not accepted)
- It must be a 'regular' course (meaning it cannot be a seminar, special topic, independent study, research credit, or similar)
- It must not have been used toward any previous awarded degree
- It must be 500-level equivalent or higher
- It must be approved by your faculty advisor and the SE Department as relevant to your program of study
- There is a 10-year time requirement on individual courses counting toward any graduate degree. If a transfer course will be at least 10 years old at the time the student applies to graduate, it may not count toward your degree.

Students petitioning for acceptance of transfer credit must submit a **syllabus** of the course(s) taken to the SE Department advisor and an **official transcript** showing the course(s) must be on-file when the GS6 is submitted so that an effective evaluation can be made. Please note that grades in courses accepted for transfer will not be included in calculation of the grade point average.

Graduate Student Responsibilities

Graduate students are responsible for knowing any special expectations and requirements of their program and are expected to remain in good academic standing by making satisfactory degree progress and must at all times have an advisor. In the event that an advisor resigns from that position, it is the student's responsibility to obtain a replacement.

Students judged to be making unsatisfactory progress toward a degree or whose work is not of the quality expected by the student's advisor and/or graduate committee may be recommended for academic probation or immediate dismissal from the graduate program (see "Scholastic Standards" in the Graduate and Professional Bulletin) and/or termination of assistantship (see "Assistantships" in the Graduate and Professional Bulletin).

The Dean of the Graduate School will be informed of students who are making unsatisfactory progress.

With regard to meeting graduate school deadlines, ultimate responsibility for a graduate student's program lies with the student. The graduate student's advisor, committee, the graduate school office, and the Systems Engineering Department office are all available to help and advise. Several deadlines are critical; for example, failure to file the GS6 before the end of the third semester will prevent the student from registering for further courses. Each semester the Graduate School publishes a list of deadlines which must be met in order to graduate during that term. It is also important that the graduate student provide his/her committee with ample time (at least 2 weeks) to read the student's thesis or dissertation before the final examination.

CSU Student Conduct Code

https://resolutioncenter.colostate.edu/wp-content/uploads/sites/32/2018/08/Student-Conduct-Code-v2018.pdf

The Student Conduct Code exists to notify students, faculty, and staff of the specific expectations Colorado State University holds related to student behavior and the rights and responsibilities that accompany being a student and participating in student clubs or organizations.

Graduate Student Appeals Procedure

Graduate students may appeal decisions concerning unsatisfactory performance on graduate preliminary or final examinations, academic probation for reasons of unsatisfactory progress toward the degree other than insufficient grade point average, termination of an assistantship for reasons of unsatisfactory performance, or dismissal from the graduate program.

- The Dean of the Graduate School and the Judicial Affairs Officer shall examine the appeal and determine whether the actions are disciplinary or academic.
- If deemed to be disciplinary, the Dean of the Graduate School shall refer the complainant to the University Discipline Process.
- If deemed to be an academic matter other than a grading decision, the Dean of the Graduate School shall implement the Appeals Procedures as outlined below:
  - A review panel, composed of two faculty members and a graduate student, will be appointed;
  - The Review Panel will consider the case in detail;
  - The Panel will make appropriate recommendations to the Dean of the Graduate School;
  - The Dean of the Graduate School and the dean of the college involved shall jointly review the case;
  - Following consultation with the Provost/Academic Vice President, the Dean of the Graduate school shall make the final decision.

Graduate Student Representation

The Graduate Student Council represents and advocates for Colorado State University graduate and professional students within CSU and beyond. The goal of the council is to improve the experience of graduate education at CSU, through:

- **Representing graduate and professional students within the Associated Students of CSU (ASCSU), the campus-wide student government,**
- **Representing graduate and professional students on committees of Faculty Council, boards overseeing student fee areas, and other university committees,**

- Advocating for the concerns of graduate and professional students beyond the university, to the state legislature and other bodies,
- Spending fee money allocated to the Graduate Student Council by ASCSU and other entities for the benefit of graduate students,
- Building relationships with university administrators to advocate for changes to policies, procedures, and programs that benefit graduate and professional students,
- **Bringing students from diverse graduate and professional programs together for the purposes of networking, collaboration, and advocacy on issues of common concern.**

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How to become involved:
- Attend the next GSC regular meeting – they usually meet once each month during the semester, on the first Monday.
- Represent the department - being a representative for a department doesn't require a heavy time commitment -- just attending monthly GSC meetings and being generally available as a conduit for students in this department to communicate with the GSC. Are we represented?
- Represent graduate and professional students on a university committee - committees on which grad students get a vote do everything from approve academic standards to deciding how student fee money is spent; serve as a representative or alternate to a committee that interests you.
- Join one of the GSC's email discussion groups where students are working together on issues affecting grad students:
- Academics discussion group
- Health Insurance discussion group
- Legislative lobbying discussion group
- Email your suggestions to the GSC President

Graduate Student Funding

The Systems Engineering Department offers a select number of Graduate Teaching Assistantships (GTAs) and Graduate Research Assistantships (GRAs), available only to students in our on-campus programs. GTA positions are coordinated through the department staff advisor and GRA positions are coordinated with individual faculty members. Most positions require 20 hours of work per week, are supervised by a faculty member either teaching the course or running the research lab, and provide full tuition coverage and a monthly stipend.

More information about the policies and benefits of Graduate Assistantship positions can be found on the Graduate School Assistantships webpage.

The Goals and Content of the Doctor of Philosophy (PhD) Process in Systems Engineering

Thomas H. Bradley, Department Head for Systems Engineering

Systems Engineering (SE) is a discipline of Engineering which develops an inter-disciplinary and systems-level viewpoint to enable the research and design of large-scale, complex, socio-technical systems. SE scholarship requires interdisciplinary training in disciplines as diverse as engineering, management, organizational sociology, behavioral economics, information theory, statistics, and computing. A core strength of the SE Department at CSU is that it has foundations as an interdisciplinary graduate program where faculty from various disciplines and departments advise SE graduate students towards a SE graduate degree. This document seeks to develop and communicate a common understanding of the goals of each aspect of the SE PhD graduate program so that faculty and students can work to achieve these goals.

Graduate research training for the PhD in SE consists of three primary activities: (1) coursework, (2) completion of the preliminary examination, and (3) completion of the dissertation. Each of these student-led activities should be advised and monitored by the faculty advisor and the dissertation advising committee.

Each fall semester before Dec. 1, every PhD student must meet with their faculty advisor and have a discussion regarding their progress over the last year (this is the PhD Student Annual Evaluation). Following each discussion, the student will submit the completed Annual Evaluation form to the Systems Engineering program as part of a progression portfolio.

1. Qualifying Process (Coursework):

The goals of the coursework activity are to develop the student's skillset in SE, to develop the student's analytical, evaluation, and creative mindset, and to instill a Systems Thinking capability. Mastering the SE body of knowledge involves mastering subjects with various multi-disciplinary content.

In CSU's SE curriculum, the student is expected to develop deep expertise in technical and mathematical subjects (defined in the INCOSE SE Handbook as technical processes), as well as in qualitative analysis and soft-skills (defined in the INCOSE SE Handbook as project, enterprise, and agreement processes). While foundational SE courses are broad in disciplinary scope, later courses build the depth and quality of the student's skillset in core SE disciplines. Throughout the curriculum, the courses emphasize aspects of Systems Thinking including feedback, design, emergence, mental models, uncertainty, learning systems and more.

PhD students are required to earn no less than a grade of "B" in their coursework to pass the Qualifying Process (B- and below are not accepted toward the degree). If a student does not earn at least a B, they will be given one opportunity to repeat the course.

2. Completion of the Preliminary Examination:

The next stage of research education at the PhD graduate level is preparation for and completion of the preliminary examination. Preparation for this examination includes advising tasks that would include development of in-depth learning and recall (for example, publication of literature review, verification of previous work), but also one-on-one and group mentorship (for example, research advising, lab group meetings, conference attendance), and the development of students' intrinsic motivation for research

tasks (for example, publication, and presentation at conferences).   The form of the preliminary examination (whether presented in a dissertation draft form, presentation form, NSF-type proposal form, etc.) is up to the advisor. The objective of the preliminary examination is to evaluate the student's research readiness in terms of:

- *Student's depth of knowledge within the specifics of their research topic*. Students should document and defend their understanding of the fundamentals and context of the field in which their research is sited. In engineering research, the research effort must be referenced to the current actors, processes, and engineering practice in human-designed systems.
- *The scholarly value and intellectual rigor of their research objectives, research questions, and proposed findings*. Students must demonstrate philosophically disciplined and logical thinking in their development of the research topic. The components of the research topic must be logically connected, and the hypothesized outcomes of the research effort must be complementary to the development of new knowledge.
- *The scope and timeline of the proposed research effort*. The student must demonstrate their understanding of their research process by presenting their work-to-date, proposed tasks, resource requirements (including data, funding, equipment, support personnel) , and timeline. During the period of the examination, the committee and student should come to a shared understanding of the remaining and required content for the dissertation. This should lead to a consensus on the scope, task content, remaining tasks, and proposed timeline.

3. Completion and defense of the dissertation:

In preparation to defend the dissertation, the student should compose a dissertation document (aligned with the formatting of the CSU Graduate College, and the content guidelines of the advisor), and a defense presentation. The goals of the completion and defense of the dissertation is that the student:

- *Demonstrate a great breadth and depth of knowledge in their field of research*. The student must again describe their research context, and must be able to defend their processes and conclusions in the context of new developments or reasoned challenges from within or outside their field.
- *Demonstrate a philosophically consistent and logical approach to the development of new knowledge*. The student should describe the model of knowledge generation (scientific method, hypothesis testing, observation, critique, etc.) that they have used to develop the new knowledge asserted in their dissertation. This method of knowledge generation should be consistent and justified throughout a particular research effort.
- *Demonstrate a significant and recognized scholarly achievement*. The student must justify the results of the dissertation research effort as a significant and recognized unit of scholarship. The dissertation research effort must represent a significant contribution to the field, and should be recognized by the dissertation advising committee as an increment in new knowledge. Although the justification can take different forms for dissertations that include controlled information, in general, the student must author, guide through peer review, and publish the research results of the dissertation multiple times as they move through the dissertation research process.
- *Demonstrate the utility and continued value of this knowledge to the field of Systems Engineering*. Research in Systems Engineering seeks to inform and advance the practice of Systems Engineering. The value of the research results of a dissertation must be placed into the context of the practice.

Concluding Statement
The program will place these goals and activities for the PhD in SysEng into the website and graduate handbook for faculty, student, and public discourse and revision.

Appendix B

The Goals and Content of the Doctorate of Engineering (DEng) Process in Systems Engineering

Thomas H. Bradley, Department Head for Systems Engineering

Systems Engineering (SE) is a discipline of Engineering which develops an inter-disciplinary and systems-level viewpoint to enable the research and design of large-scale, complex, socio-technical systems. SE scholarship requires interdisciplinary training in disciplines as diverse as engineering, management, organizational sociology, behavioral economics, information theory, statistics, and computing. This document seeks to develop and communicate a common understanding of the goals of each aspect of the Doctorate of Engineering in Systems Engineering (D. Eng. in SE) program so that faculty and students can work to achieve these goals. The objectives of the D. Eng. in SE program is to train students in a comprehensive and applied mastery skillset in SE, and to develop new knowledge in SE through an applied and translational research process.

Graduate research training for the D. Eng. in SE consists of four primary activities: (1) SE and Applied/Translational coursework, (2) completion of the preliminary examination, (3) Practicum, and (4) completion and defense of the dissertation. Each of these student-led activities is advised and monitored by the D. Eng. advising committee.

Each fall semester before Dec. 1, every D. Eng. student must meet with their faculty advising committee and have a discussion regarding their progress over the last year (this is the D. Eng. Student Annual Evaluation). Following each discussion, the student will submit the completed Annual Evaluation form to the Systems Engineering Department as part of a progression portfolio.

1. Qualifying Process (Coursework):

The goals of the coursework activity are to develop the student's applied mastery of SE and applied research. The objectives of this activity are developing the student's analytical, evaluation, and creative mindset, instilling a Systems Thinking capability, and developing the skillset to enable enterprise change. Mastering the SE body of knowledge involves mastering subjects with various multi-disciplinary content. In CSU's SE curriculum, the student is expected to develop deep expertise in technical and mathematical subjects (defined in the INCOSE SE Handbook as technical processes), as well as in qualitative analysis and soft-skills (defined in the INCOSE SE Handbook as project, enterprise, and agreement processes). The foundational SE courses will seek to build a breadth, depth and quality of the student's skillset in core SE disciplines, while applied/translational and professional courses will build a broad knowledge base in disciplines including leadership, organizational change, organizational psychology, and management.

2. Completion of the Preliminary Examination:

The next stage of research education at the doctoral level is preparation for and completion of the preliminary examination. The preliminary examination should be completed before the first 3 units of the Practicum are completed. Preparation for the preliminary examination includes advising and practicum-related tasks that would include development of in-depth learning (for example, the development of a practical knowledge-base and expertise), but also one-on-one and group mentorship (for example, research practice, innovation), and the development of students' intrinsic motivation for research tasks (for example, in-person collaboration, preparation for and presentation at conferences). The form of the preliminary examination will be defined by the advising committee. The objective of the preliminary examination is to evaluate the student's research readiness in terms of:

- *The student's depth of knowledge within the specifics of their practicum research topic.* Students should document and defend their understanding of their applied knowledge of SE, and context of the enterprise in which their practicum research is sited, which must be defined as a subset of government, industry, services sector, or entrepreneurship. In the applied and/or clinical research that is appropriate for the D. Eng., the research effort must motivated by and responsive to the needs of the subject enterprise.
- *The logical coherence and practical utility of the student's research objectives, research questions, and proposed findings.* The components of the research program must be logically connected, and the hypothesized outcomes of the research effort must be complementary to the development of new knowledge.
- *The scope and timeline of the proposed research effort.* The student must demonstrate their understanding of their research process by presenting their work-to-date, proposed tasks, resource requirements (including data, funding, equipment, support personnel), and timeline. During the period of the examination, the committee and student should come to a shared understanding of the remaining and required content for the dissertation. This should lead to a consensus on the scope, task content, remaining tasks, and proposed timeline.

3. Completion of the practicum:

The applied and translational research tasks within the Doctorate of Engineering should be primarily performed during the practicum phase of the degree. The practicum itself provides students, enterprise stakeholders, and academic advisors with the opportunity and justification to perform sited research at the enterprise or system under study. The research tasks such as problem definition, planning, testing, evaluation, reflection/review and action should be performed in the period leading up to and including the practicum. Upon completion of the practicum, the student should be able to demonstrate near-completion of the enterprise-specific research tasks in preparation for the development of the dissertation.

4. Completion and defense of the dissertation:

In preparation to defend the dissertation, the student should compose a dissertation document (aligned with the formatting of the CSU Graduate College, and the content guidelines of the advisor), and a defense presentation. The dissertation itself can take many forms that might serve to document, evaluate and communicate the research effort, its artifacts, and assertions. The goals of the completion and defense of the dissertation is that the student:

- *Demonstrate a great breadth and depth of practical knowledge in their field of research.* The student must again describe their research context, and must be able to defend their processes and conclusions in the context of new developments or reasoned challenges from within or outside their enterprise.
- *Demonstrate a philosophically consistent and systematic approach to the development of new knowledge.* The student should describe the model of knowledge generation (induction, action research, program evaluation, etc.) that they have used to develop the new knowledge asserted in their dissertation. This method of knowledge generation should be consistent and justified throughout a particular research effort.
- *Demonstrate a significant and recognized research achievement.* The student must justify the results of the dissertation research effort as a significant and recognized unit of new knowledge. The dissertation research effort must represent an actionable contribution to the advancement of the enterprise, and should be recognized by the dissertation advising committee and other stakeholders as an increment in new knowledge. Although the justification can take different forms for

dissertations that include controlled information, in general, the student must author, guide through peer review, and communicate the research results of the dissertation for public consumption.

- *Demonstrate the general utility and continued value of this knowledge to the field of Systems Engineering.* Translational research in Systems Engineering seeks to inform and advance the practice of Systems Engineering. The value of the research results of a dissertation must be placed into the context of the practice.

Concluding Statement
The department will place these goals and activities for the D. Eng. in SE into the website and graduate handbook for faculty, student, and public discourse and revision.