

# INFORMATION TECHNOLOGY, PHD

**Banner Code: EC-PHD-INFT**

2400 Nguyen Engineering Building  
Fairfax Campus

Phone: 703-993-1504  
Email: [cecgsgmu.edu](mailto:cecgsgmu.edu)

The Information Technology (INFT) PhD is a signature degree of the College of Engineering and Computing. The program focuses on the science, engineering, and technology of information processing, an area of study ripe for innovation in a world driven more and more by data. It accommodates rigorous and cross-disciplinary PhD study that does not fit with PhD program requirements of a single CEC department. The PhD in INFT includes several concentrations to provide program focus.

## Admissions & Policies

### Admissions

Admission is competitive. An undergraduate degree in an information technology-related area, such as engineering, computer science, operations research, mathematics, or the physical sciences is typically required for admission. The undergraduate preparation should include, at a minimum, calculus, differential equations, linear algebra, discrete structures, probability, and statistics, in addition to computational proficiency, including experience with a variety of languages and computer hardware. Additional requirements depend on the selected concentration.

Most successful applicants complete their master's degree in a discipline related to their selected concentration before admission with a minimum GPA of 3.5 out of 4.0. Applicants can also be considered directly from their undergraduate studies with a minimum GPA of 3.25 out of 4.0.

Applicants are required to submit: an online application for admission, undergraduate and graduate transcripts from all previous colleges and universities, two letters of recommendation (preferably from college instructors), a résumé, the names at least two College of Engineering and Computing graduate faculty (<https://cec.gmu.edu/about/meet-our-faculty/graduate-faculty/>) with whom they wish to work and a goals statement of no more than 350 words describing the applicant's primary areas of interest and post-graduation career plans.

Admission for the Information Technology, PhD study will also depend on alignment with CEC faculty research expertise and capacity of the faculty to advise additional PhD students in the applicant's primary area of interest.

International applicants (<https://www.gmu.edu/admissions-aid/apply-now/how-apply/international/>) are referred to the university's English Proficiency Requirements (<https://www2.gmu.edu/admissions-aid/how-apply/international/english-proficiency-requirements/>). In addition, international transcripts must be translated and evaluated (course-by-course preferred) by a member of the National Association of Credential Evaluation Services (NACES). Transcripts can be evaluated by George Mason University at no extra cost to the applicant, but may take additional processing time. Please review George Mason University's

Policy on International Transcript Submission (<https://catalog.gmu.edu/admissions/international-students/>). Applications must be completed and submitted before an admission decision is made.

### Policies

The general doctoral requirements (<https://catalog.gmu.edu/policies/academic/graduate-policies/>) of Mason apply to this program. Current Information Technology (INFT) student resources can be found at: <https://cec.gmu.edu/academics/current-student-resources>.

Concentrations may have policies that complement the information found here. Furthermore, admitted students are assigned an initial Faculty Advisor. For more information about faculty advisement, please refer to the Faculty Advisement section below.

### Administration

Students are admitted to the Information Technology (INFT) PhD program with a concentration. The College of Engineering and Computing Office of Graduate Studies (CECGS) administers the INFT program. However, each concentration is overseen by a Concentration Director from the primary department of the students selected concentration.

## Requirements

### Degree Requirements

Total credits: minimum 72

Students must complete a minimum of 72 graduate credits. Of the 72 total credits required for degree completion, 48 credits must be coursework and 24 credits must be research.

### Coursework:

#### • Core Courses, 6 credits

- IT 700 Doctoral Seminar I: Intro to Research, completed with a grade of B or better.
- IT 701 Doctoral Seminar II: Research Experience, completed with a grade of B or better.
  - Students who fail to earn grades of B or better may be terminated from the program.

#### • Transfer Credit, 0-35 credits

- Relevant graduate credits earned from an institution accredited by a Mason-recognized accrediting agency, earned at another institution and recommended for graduate credit by the American Council on Education, or earned at Mason may be transferred toward the degree in accordance with AP.6.5.2. (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-5-2>)

#### • Plan of Study, 0-42 credits

- A prior concentration-relevant Master's Degree (with transfer credit) or an Embedded Master's Degree (AP.6.9.5 (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-9-5>)) is required of students in the Cyber Security Engineering, Digital Forensics, Information Sciences and Technology, and Information Systems concentrations. Students in the Mechanical Engineering concentration must plan their course of study with their Faculty Advisor.

- The conferral time limit for an embedded master's degree derives from the doctoral admit term and coincides with the six-year time limit for master's degrees and the six-year time limit for advancement to candidacy of a doctoral degree (AP.6.9.5 (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-9-5>)).
- Doctoral course selections must be made under advisement of the student's Faculty Advisor.
  - At least 12 credits of doctoral-only coursework must be 600 level or higher.
  - The overall GPA presented for graduation must be 3.0 or higher.
- **Research:**
  - Successful completion of 24 research credits inclusive of:
    - IT 998 Doctoral Dissertation Proposal, 1-12 credits
    - IT 999 Doctoral Dissertation, a minimum of 12 credits
- **Formal establishment of a Dissertation Director and dissertation committee.**
- **Comprehensive exam (oral) after completion of coursework.**
- **Development and acceptance of a research proposal.**
- **Advancement to Candidacy**
- **Execution of the research, culminating in a written dissertation and public final oral defense successfully defended and approved by the student's dissertation committee.**

## Plan of Study

Each student is assigned an initial Faculty Advisor upon admission. The Faculty Advisor works with the student to develop a Plan of Study in consultation with, and subject to approval by CECGS. This Plan is a formal document that specifies coursework in support of the student's concentration and research interests, in addition to meeting degree requirements.

A student's area of research interest may shift during their studies. This may lead to revisions in the Plan of Study, subject to approval of the Faculty Advisor and CECGS. Revisions may also lead to a change in Faculty Advisor, subject to alignment with CEC faculty research expertise and capacity of the proposed faculty to advise additional PhD students. A shift in the Faculty Advisor requires formal agreement of the proposed faculty advisor and official approval by the Concentration Director and CECGS.

## Concentrations

### Available Concentrations

- Concentration in Cyber Security Engineering (CYSE)
- Concentration in Digital Forensics (DFOR)
- Concentration in Information Sciences and Technology (ISTC)
- Concentration in Information Systems (ISYS)
- Concentration in Mechanical Engineering (ME)

### Concentration in Cyber Security Engineering (CYSE)

Offered by the College of Engineering and Computing Office of Graduate Studies in conjunction with the Department of Cyber Security Engineering (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/cyber-security-engineering/>).

Students in the Cyber Security Engineering concentration must enter the program with a prior conferred concentration-specific Master's Degree or

elect an embedded Master's Degree. Embedded Master's Degree choices include:

- Cyber Security Engineering, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/cyber-security-engineering/cyber-security-engineering-ms/>)

Code	Title	Credits
Course selections must be made under the advisement of the student's Faculty Advisor:		
CYSE 650	Topics in Cyber Security Engineering	3
CYSE 684	Practical Side-Channel Exploitation and Defense	3
CYSE 698	Independent Study and Research	3
CYSE 700	Research Methodology and Pedagogy in Cyber Security Engineering	3
CYSE 710	Advanced Networks and Cyber Security	3
CYSE 731	Graphical Models for Cybersecurity	3
CYSE 750	Advanced Topics in Cyber Security Engineering	3
CYSE 757	Cyber Law	3
CYSE 760	Human Factors in Cyber Security	3
CYSE 765	Quantum Information Processing and Security	3
CYSE 770	Fundamentals of Operating Systems	3
CYSE 785	Advanced Unmanned Aerial Systems Security	3
CYSE 787	Cyber Security Systems Engineering	3
CYSE 789	Advanced Artificial Intelligence Methods for Cybersecurity	3
ISA 764	Security Experimentation	3
ISA 862	Models for Computer Security	3
ISA 863	Advanced Topics in Computer Security	3

Other CEC courses with the approval of a faculty advisor/dissertation director.

### Concentration in Digital Forensics (DFOR)

Offered by the College of Engineering and Computing Office of Graduate Studies in conjunction with the Digital Forensics Master's Program (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/digital-forensics-ms/>).

Students in the Digital Forensics concentration must enter the program with a prior conferred concentration-specific Master's Degree or elect an embedded Master's Degree. Embedded Master's Degree choices include:

- Computer Engineering, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/computer-engineering-ms/>)
- Cyber Security Engineering, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/cyber-security-engineering/cyber-security-engineering-ms/>)
- Computer Science, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/computer-science-ms/>)

- Digital Forensics, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/digital-forensics-ms/>)

Code	Title	Credits
Course selections must be made under the advisement of the student's Faculty Advisor.		
DFOR 637	Cloud Forensics	3
DFOR 673	Registry Forensics - Windows	3
DFOR 674	Mac Forensics	3
DFOR 675	Linux Forensics	3
DFOR 710	Memory Forensics	3
DFOR 720	Digital Audio Video Forensics	3
DFOR 730	Forensic Deep Packet Inspection	3
DFOR 761	Malware Reverse Engineering	3
DFOR 769	Anti-Forensics	3
DFOR 772	Forensic Artifact Extraction	3
DFOR 773	Mobile Application Forensics and Analysis	3
DFOR 775	Kernel Forensics and Analysis	3
ECE 611	Advanced Computer Architecture	3
ECE 612	Real-Time Embedded Systems	3
ISA 673	Operating Systems Security	3
ISA 764	Security Experimentation	3
ISA 785	Research in Digital Forensics	3

Other CEC courses with the approval of a faculty advisor/dissertation director.

### Concentration in Information Sciences and Technology (ISTC)

Offered by the College of Engineering and Computing Office of Graduate Studies in conjunction with the Department of Information Sciences and Technology (<https://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/>).

Students in the Information Sciences and Technology concentration must enter the program with a prior conferred concentration-specific Master's Degree or elect an embedded Master's Degree. Embedded Master's Degree choices include:

- Applied Information Technology, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/applied-information-technology-ms/>)
- Information Systems, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-systems-ms/>)

Code	Title	Credits
Course selections must be made under the advisement of the student's Faculty Advisor.		
AIT 602	Introduction to Research in Applied Information Technology	3
AIT 614	AI-Driven Big Data Essentials	3
AIT 624	Knowledge Mining from Big-Data	3
AIT 681	Secure Software Development	3
AIT 682	Network and Systems Security	3

AIT 690	Advanced Topics in Applied Information Technology	3
AIT 701	Cyber Security: Emerging Threats and Countermeasures	3
AIT 702	Incident Handling and Penetration Testing	3
AIT 712	Applied Biometric Technologies	3
AIT 716	Advanced Human Computer Interaction	3
AIT 724	Data Analytics in Social Media	3
AIT 726	Natural Language Processing with Deep Learning	3
AIT 736	Applied Machine Learning	3

Other CEC courses with the approval of a faculty advisor/dissertation director.

### Concentration in Information Systems (ISYS)

Offered by the College of Engineering and Computing Office of Graduate Studies in conjunction with the Information Systems Master's Program (<https://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-systems-ms/>).

Students in the Information Systems concentration must enter the program with a prior conferred concentration-specific Master's Degree or elect an embedded Master's Degree. Embedded Master's Degree choices include:

- Information Systems, MS (<https://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-systems-ms/>)

Code	Title	Credits
Course selections must be made under the advisement of the student's Faculty Advisor.		
INFS 623	Web Search Engines and Recommender Systems	3
INFS 640	Introduction to Electronic Commerce	3
INFS 697	Topics in Information Systems	1-6
INFS 740	Database Programming for the World Wide Web	3
INFS 760	Advanced Database Management	3
INFS 770	Knowledge Management for E-Business	3
INFS 772	Intelligent Agents and the Semantic Web	3
INFS 774	Enterprise Architecture	3
INFS 796	Directed Readings in Information Systems	3
INFS 797	Advanced Topics in Information Systems	1-6
AIT 716	Advanced Human Computer Interaction	3
AIT 724	Data Analytics in Social Media	3
AIT 726	Natural Language Processing with Deep Learning	3
AIT 736	Applied Machine Learning	3
CS 650	Advanced Database Management	3
CS 688	Machine Learning	3
CS 777	Human-Computer Intelligent Interaction	3
CS 782	Advanced Machine Learning	3
CS 787	Decision Guidance Systems	3
OR 681	Decision and Risk Analysis	3

OR 690	Optimization of Supply Chains	3
SWE 632	User Interface Design and Development	3
SWE 642	Software Engineering for the World Wide Web	3
SWE 645	Component-Based Software Development	3
Other CEC courses with the approval of a faculty advisor/dissertation director.		

### Concentration in Mechanical Engineering (ME)

Offered by the College of Engineering and Computing Office of Graduate Studies in conjunction with the Department of Mechanical Engineering (<https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/>).

Students in the Mechanical Engineering concentration must plan their course of study carefully with their Faculty Advisor.

Code	Title	Credits
600/700-level courses outside the ME department (typically physics, mathematics, etc.)		
700-level courses within the ME department in subjects within the student's area of specialization		
700-level courses within the ME department in subjects outside the student's area of specialization		
Available courses include:		
ME 620	Mechanical Engineering Decision Making	3
ME 621	Foundations of Fluid Mechanics	3
ME 631	Advanced Dynamics of Mechanical Systems	3
ME 714	Fracture Mechanics	3
ME 715	Impact Dynamics	3
ME 721	Advanced Fluid Mechanics	3
ME 722	Introduction to Turbulence	3
ME 723	Compressible Flow	3
ME 724	Viscoelastic Flow	3
ME 728	Foundations of Heat Transfer	3
ME 732	Advanced Thermodynamics	3
ME 740	Introduction to Continuum Mechanics	3
ME 741	Theory of Elasticity	3
ME 742	Finite Element Analysis for Solids	3
ME 745	Mechanics and Properties of Materials	3
ME 750	Nanomaterials Enabled Renewable Energy	3
ME 751	Advanced Materials for Water Treatment	3
ME 753	Tribology and Surface Engineering	3
ME 754	Introduction to Nano-Materials	3
ME 755	Optofluidics	3
ME 762	Nano Bio Sensors	3
Other 600 level or higher courses with the approval of a student's faculty advisor/dissertation director.		

### Dissertation Proposal

The PhD dissertation research is the signature accomplishment for the PhD, and represents a definitive contribution to knowledge in a field of research. The research is conducted under the supervision of the student's Dissertation Director, which may or may not be a students'

initial Faculty Advisor. Procedures for identifying a Dissertation Director are outlined below under Faculty Advisement.

After a student completes the core and concentration coursework, and their Embedded Master's Degree, if applicable, and has the approval of their Dissertation Director, they are required to submit the Dissertation Progress Report form every semester to obtain the appropriate CRN of IT 998 Doctoral Dissertation Proposal. During this stage, students must formalize their dissertation committee with the approval of their Dissertation Director and Concentration Director.

### Comprehensive Exam

The Comprehensive Exam is an oral exam, typically two hours in length, to allow the student's dissertation committee to assess the student's readiness to complete doctoral research in the chosen area of research. The Exam must be attempted for the first time no later than one year after starting the IT 998 Doctoral Dissertation Proposal sequence. The student must meet with their Dissertation Director to discuss the exam and to prepare and submit a Comprehensive Exam Request form. This Request must be approved by their entire dissertation committee and Concentration Director. The request form must be submitted with:

- a one page description of the intended area of research; and
- a reading list on which the student will be examined.

The reading list should include articles and/or books that cover the fundamentals, state-of-the-art, and tools needed to perform research in the intended area.

Failure to attempt the Comprehensive Exam within one year of initial IT 998 Doctoral Dissertation Proposal registration may result in termination from the program. Students who fail the exam are permitted to retake it once. Failure in the second attempt will result in termination from the program.

### Dissertation Proposal Presentation

After successful completion of the Comprehensive Exam, doctoral students prepare a written dissertation proposal to present to the dissertation committee. Once the Dissertation Director, dissertation committee and Concentration Director have approved of the dissertation proposal, formal paperwork is submitted and the student can be advanced to candidacy.

### Advancement to Candidacy

After successful completion of the comprehensive exam and dissertation proposal presentation, the student is formally advanced to candidacy for the PhD degree, pending submission to CECGS on a standard Registrar Form. (<https://registrar.gmu.edu/forms/graduate/>)

Advancement to Candidacy Time Limits can be found in AP6.10.1. (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-1>)

### Dissertation Sequence

Once advanced to candidacy, the student must register for IT 999 Doctoral Dissertation and maintain continuous registration in IT 999 through to completion of the program and all graduation requirements. This includes completion of the dissertation and its successful defense with approval by the dissertation committee, Associate Dean for Graduate Studies and submission to the university library meeting all their requirements.



Failure to maintain continuous registration in IT 999 every semester (fall/spring) will result in termination. Continuous registration does not include summers, except for when degree conferral occurs in August. For more information see AP.6.10.6 (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-6>).

## Faculty Advisement

On admission to the INFT PhD program, students are assigned an initial Faculty Advisor whose research area aligns with the student's, as identified in their application. The initial Faculty Advisor advises on and approves the student's Plan of Study with final approval from CECGS.

Ultimately, all INFT students require a Dissertation Director who will direct their PhD studies, including their dissertation research. The Dissertation Director may or may not be the Faculty Advisor assigned to the student at the time of admission to the program. This arrangement, by mutual consent of the student and Dissertation Director, should be agreed on well before the student begins their research. INFT PhD Dissertation Directors must be members of the Mason graduate faculty with an academic appointment of at least 50% within CEC.

Topics of potential research are determined by the expertise and interests of the faculty. The student is responsible to identify, communicate and offer proof of their research skills to the faculty under whom they wish to work. A student's engagement, excitement, commitment, relevant academic and non-academic background, and initiative are all attributes a potential Dissertation Director will consider before making the decision to formally commit. The Concentration Director may be helpful in identifying faculty who are actively looking for doctoral students. However, the university does not manage this matching process, nor can it compel any faculty member to undertake this role for a student.

Dissertation Directors and their students should arrive at an understanding of the Dissertation Director's expectations, which may be dictated by specific concentration policy. This must include a clear understanding of the research topic and the courses the student must complete in support of that research. It should also include, at a minimum, a timeline for the overall planned program of study, expectations regarding technical publications and presentations arising from the research, availability of graduate student support, advising style, and the location where the student will conduct the research and when. A successful dissertation depends on shared understanding.

Students wishing to change Dissertation Directors are required to recruit a new Dissertation Director to direct their research. Changing Dissertation Directors usually slows academic progress. Dissertation Directors also have the right to decline or to discontinue supervising students.

## Dissertation Committee

After a student and their Dissertation Director agree to work together, the dissertation committee can be formed. This committee administers the comprehensive exam, the dissertation proposal presentation evaluation, the dissertation pre-defense (if applicable) and final defense by submitting the appropriate approval forms to CECGS. Committee membership must be approved by the Dissertation Director and Concentration Director.

As explained above, the dissertation committee is chaired by the Dissertation Director, who must be a member of the Mason graduate faculty with an academic appointment of at least 50% within CEC. The committee may also include a Dissertation co-Director, who must also be a member of the Mason graduate faculty, but who may have an academic appointment outside CEC. The dissertation committee must

also include at least three other faculty who are members of the Mason graduate faculty. At least two CEC departments must be represented on the committee to meet expectations for interdisciplinary research.

Representatives from industry or government with key, related doctoral-level expertise may also be considered if they have been appointed to university graduate faculty status (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-12>).

## Dissertation and Final Defense

Once admitted to candidacy with the concurrence of the dissertation committee and CECGS, students proceed with their dissertation research.

During this time they must maintain continuous registration in IT 999 Doctoral Dissertation, (AP.6.10.6 (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-6>)). Students are encouraged to draw on the expertise and guidance of their dissertation committee during their research, including submission of a draft dissertation to the committee members. When the PhD student's research is complete to the satisfaction of the Dissertation Director, the student may submit the written dissertation to the dissertation committee.

The oral defense of the research is scheduled when the entire dissertation committee, inclusive of the Dissertation Director and Concentration Director believe the student has completed research that makes a definitive contribution to knowledge, sufficient to meet their expectations for awarding the PhD. The student must successfully defend their dissertation research in a final public oral defense, announced at least two weeks before the defense, AP.6.10.8 (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>). The committee or the student has the option to request a committee-only pre-defense to provide feedback to the student, however this cannot substitute for the public oral defense.

The entire dissertation committee and the Associate Dean must be present at the final oral defense, unless an exception is approved by the Associate Dean of Graduate Studies in advance of the defense. If the candidate successfully defends their dissertation research, the dissertation committee and Associate Dean recommend that the final form of the dissertation be completed, and the CEC faculty and the graduate faculty of Mason accept the candidate for the PhD degree. At that point, the student submits to the university library (<https://library.gmu.edu/udts/>) a final publishable dissertation that meets university guidelines.

If the student fails to successfully defend the dissertation research, the student may request a second public oral defense, following the same procedures as for the initial public oral defense. There is no time limit for this request other than general time limits for the doctoral degree (AP.6.10.1 (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-10-1>)). Students are strongly advised to consult with their Dissertation Director and dissertation committee before scheduling a second defense. If the student fails on the second attempt to defend the dissertation, the student will be terminated from the INFT program without being awarded the PhD.