



April 10, 2020

The Honorable James D. Fielder, Jr., Ph.D.
Secretary of Higher Education
Maryland Higher Education Commission
6 N. Liberty St.
Baltimore MD 21201

Dear Secretary Fielder,

The University of Baltimore is proposing a substantial modification to the Bachelor of Science in Applied Information Technology (AIT); the program has CIP code 11.0401 and a State program code of 0702-02. The modification will move the program from having 69 credits to 57 to 63, depending on whether a student elects to pursue an area of concentration. In addition, two existing 18-credit tracks of the program—Information Security and Assurance *and* Application Development and Programming—will be converted to 24-credit areas of concentration that will be renamed to, respectively, Cybersecurity and Application Development. The new names are more recognizable in the marketplace. The program believes as areas of concentration the students will have more depth in an area and also a credential that is better recognized. There will also be an 18-credit track of AIT electives that a student can design with an advisor.

Attached for your consideration are the three related applications:

- 1) The overall modification of the program that includes all changes;
- 2) A proposal for a Cybersecurity area of concentration; and
- 3) A proposal for an Application Development area of concentration.

Three separate payments are being electronically transferred to the Commission, each for \$250.

If you have any questions, please contact the Office of the Provost at 410.837.5243. Thank you for your review.

Sincerely,

Darlene Brannigan Smith, Ph.D.
Executive Vice President and Provost

Encl.

cc: Dr. Antoinette Coleman, USM

Office of the Executive
Vice President and Provost

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BALTIMORE

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Cover Sheet for In-State Institutions New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	University of Baltimore
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Each action below requires a separate proposal and cover sheet.

- | | |
|---|---|
| <input type="radio"/> New Academic Program | <input checked="" type="radio"/> Substantial Change to a Degree Program |
| <input type="radio"/> New Area of Concentration | <input type="radio"/> Substantial Change to an Area of Concentration |
| <input type="radio"/> New Degree Level Approval | <input type="radio"/> Substantial Change to a Certificate Program |
| <input type="radio"/> New Stand-Alone Certificate | <input type="radio"/> Cooperative Degree Program |
| <input type="radio"/> Off Campus Program | <input type="radio"/> Offer Program at Regional Higher Education Center |

Payment Submitted: <input type="radio"/> Yes <input type="radio"/> No	Payment Type: <input checked="" type="radio"/> R*STARS <input type="radio"/> Check	Payment Amount: \$250	Date Submitted:
Department Proposing Program	School of Science, Information Arts and Technology		
Degree Level and Degree Type	Bachelor of Science		
Title of Proposed Program	Applied Information Technology		
Total Number of Credits	57		
Suggested Codes	HEGIS: 702.02	CIP: 11.0401	
Program Modality	<input checked="" type="radio"/> On-campus <input type="radio"/> Distance Education (<i>fully online</i>)		
Program Resources	<input checked="" type="radio"/> Using Existing Resources <input type="radio"/> Requiring New Resources		
Projected Implementation Date	<input checked="" type="radio"/> Fall <input type="radio"/> Spring <input type="radio"/> Summer Year: 2020		
Provide Link to Most Recent Academic Catalog	URL: http://www.ubalt.edu/academics/uploads/catalogs/19-20_undergrad_catalog/19-20UGCatalog.pdf		
Preferred Contact for this Proposal	Name: Dr. Candace Caraco (for Dr. Giovanni Vincenti)		
	Title: Asst. Provost		
	Phone: (410) 837-5243		
	Email: ccaraco@ubalt.edu		
President/Chief Executive	Type Name: Dr. Darlene Brannigan Smith, Exec VP and Provost		
	Signature:		Date: 3/16/20
	Date of Approval/Endorsement by Governing Board:		

Revised 3/2019

UNIVERSITY SYSTEM OF MARYLAND INSTITUTION PROPOSAL FOR

<hr/>	New Instructional Program
X	Substantial Expansion/Major Modification
<hr/>	Cooperative Degree Program
X	Within Existing Resources, or
<hr/>	Requiring New Resources
<hr/>	

University of Baltimore

Institution Submitting Proposal

**Applied Information Technology with two areas of concentration:
Cybersecurity and Application Development**

Title of Proposed Program

BS

Award to be Offered

Fall 2020

Projected Implementation Date

0702-02

Proposed HEGIS Code

11.0401

Proposed CIP Code

**Div. of Science, Information Arts &
Technologies**

Department in which program will be located

Dr. Giovanni Vincenti

Department Contact

410-837-5243

Contact Phone Number

ccaraco@ubalt.edu

Contact E-Mail Address



Signature of President or Designee

April 29, 2020

Date

University of Baltimore substantive change, BS Applied Information Technology

A. Centrality to Institutional Mission and Planning Priorities:

The **Bachelor of Science (BS) in Applied Information Technology** has been offered at the University of Baltimore (UB) since 1999. UB's longtime tagline that it offers "Knowledge that Works" aligns with this applied science program that prepares students for high-demand jobs in information technology. UB's mission is to offer "career-focused education for aspiring and current professionals, providing the region with highly educated leaders who make distinctive contributions to the broader community."

The mission of the Applied Information Technology program is to provide students with the knowledge and skills to obtain a position in IT or related fields, to advance their careers, or to pursue graduate education. The curriculum prepares students in the latest technologies and methodologies by providing fundamentals, knowledge, and hands-on experience through individual and group work, problem-solving, and critical thinking exercises. Students graduate with skills in networking, security, application development, system administration and maintenance, and communication.

The changes described in this document will not affect the mission of the program or its goals. The proposed changes are geared towards streamlining the path to completion of each student, while retaining the main goal of preparing them for their next endeavor. Our program prepares students for the workforce by giving them theoretical and practical skills that they can apply immediately upon employment. Our program also prepares students for continuing their studies at the graduate level with a curriculum that is challenging and lays the foundations for the advanced application of theory, as well as the improvement of existing technologies.

The program currently has two specializations: *Information Assurance and Security* and *Application Development and Programming*, and the total major comprises 69 credits.

The proposed revision does the following:

- reduces the overall credits in the major to 57, which will benefit transfer students and generally facilitate students' timely completion and add flexibility;
- converts the two 18-credit specializations into the two 24-credit areas of concentration in order to provide students with a more distinctive set of credits dedicated to a specialty that can be recognized;
- renames the Information Assurance and Security specialization as the Cybersecurity area of concentration, which is better recognized in the marketplace (and aligns with the upper-division certificate in Cybersecurity already available in the program);
- renames the Application Development and Programming specialization as the Application Development area of concentration, which better represents the focus of the concentration; and

- provides a new flexible 18-credit specialization that students can shape with their advisor to meet their individual professional needs and educational pathway.

The revised AIT program supports UB's strategic plan, which calls for a focus on high-demand, professionally oriented programs that align with the University's Signature Areas of Excellence, one of which is Cybersecurity, Gaming, and Technology (Strategic Plan Goal 1, Strategy 1.1). Most of the students in the AIT program are transfer students, and the revision helps transfer students shorten their time to degree (Goal 2, Strategy 2.1). The program is scheduled to allow students to pursue the degree on a full- or part-time basis, which is also aligned with the strategic plan's strategies for ensuring programs can be flexible to meet the needs of UB students, most of whom work at least part-time.

The AIT program models high-impact teaching practices by engaging students in meaningful internships and curricular and co-curricular discipline-based activities that prepare students for successful careers. One example is that the program has been very successful in bringing students to high-profile national competitions at NASA in Houston, TX. Our students were selected for two years in a row for the NASA SUITS (Spacesuit User Interface Technologies for Students) Design Challenge. SUITS is one of the 6 Artemis Student Challenges, which have the primary goal of extending the applied research on new technologies to incorporate into space exploration and future generations of astronautical missions. With SUITS, NASA is looking for ideas to incorporate into their next generation space suit, including augmented reality and assistive technologies. With their practical experience and test-driven approaches to IT infrastructures, our students have shown significant aptitude to the task, and have impressed the NASA engineers and staff members who oversee the program.

The AIT program has been sustainable for 20 years, and this substantive change proposal does not require new resources. The University has the means to sustain the program over the next five years, and beyond.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan:

The 2017-2021 State Plan for Postsecondary Education: Student Success with Less Debt¹ outlines three primary goals for the postsecondary community in Maryland:

- **Access:** Ensure equitable access to affordable and quality postsecondary education for all Maryland residents.
- **Success:** Promote and implement practices and policies that will ensure student success.
- **Innovation:** Foster innovation in all aspects of Maryland higher education to improve access and student success.

The BS in Applied Information Technology aligns with Maryland's plan in the following ways:

¹ <https://mhec.state.md.us/About/Documents/2017.2021%20Maryland%20State%20Plan%20for%20Higher%20Education.pdf>

Access. The University of Baltimore has been recognized as an institution that provides quality programs at an affordable price². The University is a public institution and constituent member of the University System of Maryland, and most transfer students are from Maryland community colleges. The University has a student population that is diverse in many ways—age, race, ethnicity, socioeconomic status, parents and non-parents etc. In addition, a new Parsons Scholarship program provides last-dollar assistance to full-time, Pell-eligible students who transfer into the University with an associate degree.

With the program changes that we are requesting with this document, we aim at making the quality even greater by creating clear paths for two different types of students: those who wish to choose a concentration, and those whose interests are more general. The concentrations increment the number of courses geared completely towards the domain of interest (cybersecurity or application development), so that our students will be able to explore in greater depth technologies and approaches that are currently utilized in the workforce.

Those students who are instead interested in a more general path will not have to choose one track or another (currently the mandatory tracks are “Information Security and Assurance” and “Application Development and Programming”). These two tracks may be discouraging for students who are interested in networking or system administration, for example. Students will have more flexibility to create an academic path that will prepare them for their chosen careers.

Success. Another area in which the University of Baltimore has succeeded is the social mobility³ recorded by its graduates. The greater access to education that students have at the University of Baltimore, together with the non-traditional student population (average age for undergraduate students is 28 years⁴) create students who typically have very clear ideas about their goals. For several, this is their second or third career, and they have a clear idea where they want to go next. They do not wish to spend more time preparing for their careers by taking classes that are not building their skills and expertise in the areas that they wish to pursue. The review of course requirements for the general IT degree as well as the introduction of the two concentrations will enable students to reach their goal more quickly and be more effective upon graduation.

Our institution offers Upper-Division Certificates in Computer Programming and Cybersecurity. These certificates are designed for students who do not necessarily have a background in technology but wish to pursue careers or advanced degrees in this field. The new concentrations align with the Upper-Division Certificates, so students who are interested in continuing their studies past the certificate and wish to obtain an undergraduate degree can do so and apply their completed coursework towards the degree. This option will be particularly useful for students who completed 60+ credits at

² <https://www.ubalt.edu/news/news-releases.cfm?id=3153>

³ <http://www.ubalt.edu/about-ub/why-ub.cfm>

⁴ <https://www.ubalt.edu/about-ub/>

the undergraduate level, typically in community colleges, but have never completed a full undergraduate degree at a 4-year institution.

Innovation. Over the years we have tried different approaches to our pedagogical strategies. One of them was to include a greater number of project-based learning opportunities, as we reported in Section A. This shift has highlighted that having students complete many courses without a specific focus will lead to a shallower knowledge of skills and techniques that really matter for their workforce readiness. By creating concentrations, we wish to approach the students' experience at the University of Baltimore by minimizing the amount of non-concentration students who are enrolled in concentration courses, reducing the number of students who are in a particular course just because they have to take it. This will allow us to address the topics in greater depth, expecting a greater preparation and drive of all students who enroll in a concentration course.

The generic IT degree also implements a fundamental change compared to the current degree. Our students can take internships, undergraduate research experiences, independent studies, as well as special topics courses for credits that will get them closer to their degree. This change will significantly aid two student populations. First, those students who may not have a clear idea of their path after graduation can now earn credit and make progress towards their degree by working in the field through an internship or a special project. Then, those students who are interested in attending graduate school for the purposes of research can start these types of experience while still at the undergraduate level, also making progress towards their degree. Any of these paths will be closely and rigorously followed by their instructors, advisors, and the program director.

1. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State:

As of September 4, 2019, the Bureau of Labor and Statistics reported the projections for the 20 fastest growing occupations in the nation⁵ for the period 2018-2028. At number 6 we can find "Information Security Analyst" with an expected increase of 32% and at number 15 we can find "Software Developers, Applications" with an expected increase of 26%. This last category is also listed as number 6 (with 241,500 projected new jobs) in the list of 20 fields that are likely to report the most new jobs⁶ for the same time period. These lists have been distilled from the BLS Occupational Outlook Handbook.⁷ As these two occupations are perfectly in line with the two new proposed concentrations, we believe that these two specializations will create a workforce that will easily find occupation upon graduation.

The following list is a summary of other occupations related to Information Technology, which will be accessible to all students in the AIT program, either from the general track

⁵ <https://www.bls.gov/ooh/fastest-growing.htm>

⁶ <https://www.bls.gov/ooh/most-new-jobs.htm>

⁷ <https://www.bls.gov/ooh/>

or from one of the two concentrations. The list was created using information from the Occupational Outlook Handbook for the field of Computer and Information Technology⁸ for the period 2018-2028.

Occupation	Job Outlook	Compared to Average
Computer and Information Research Scientists	+16%	Much faster than average
Computer Network Architects	+5%	As fast as average
Computer Programmers	-7%	Decline
Computer Support Specialists	+10%	Faster than average
Computer Systems Analysts	+9%	Faster than average
Database Administrators	+9%	Faster than average
Information Security Analysts	+32%	Much faster than average
Network and Computer Systems Administrators	+5%	As fast as average
Software Developers	+21%	Much faster than average
Web Developers	+13%	Much faster than average

It is important to note that there is a difference between a computer programmer and a software developer. The first figure focuses more on creating and testing the code, while the second focuses on larger systems and their integration. Our concentration aims at developing well-rounded application developers, and not computer programmers. It is also important to note that our program will also focus on web development, which is another category that reports an expected growth much faster than average.

Shifting our focus to the State of Maryland, and in particular looking at the State's Long-Term Occupational Projections⁹ for the period 2016-2026, we can observe the expectations reported in the table below.

Occupation	Job Outlook
Computer Network Architects	+7.88%
Computer Network Support Specialists	+6.25%
Computer Programmers	+7.89%
Computer Systems Analysts	+7.56%
Database Administrators	+7.51%
Information Security Analysts	+7.61%
Network and Computer Systems Administrators	+7.76%
Software Developers, Applications	+7.42%
Software Developers, Systems Software	+7.48%
Web Developers	+7.67%
Total	+7.75%

- Overall, the employment outlook for graduates in the AIT program, either with a general degree or with one of the concentrations, is expected to be strong and grow at a pace that equals or exceeds the State and National averages.

⁸ <https://www.bls.gov/ooh/computer-and-information-technology/home.htm>

⁹ <https://www.dllr.state.md.us/lmi/iandoproj/maryland.shtml>

3. Reasonableness of Program Duplication:

The bachelor's degree program that most closely resembles UB's is the Information Technology degree at Towson University, which was added in 2010. Since the UB degree in Applied Information Technology has been in existence prior to the inception of Towson University's, we do not believe that this modification introduces any duplication of programs. Also, Towson University's IT program does not have concentrations, so the two new concentrations that we propose at the University of Baltimore will not be duplicative. Frostburg State University introduced an Information Technology degree in 2008, but it has no concentrations, and its tracks include accounting, business information systems, graphics, and mass communication, as well as computer security. The program appears to be more general and not duplicative.

Other degrees that appear as if they are closely related are those in Computer Science and Information Systems. However, it is important to note that there are significant distinctions among these three fields. The Association of Computing Machinery, ACM, the largest international organization for computing professionals, reported on these differences in the "2005 Computing Curricula" document¹⁰, on pages 18, 19, and 20. This document clearly outlines how Computer Science is more theoretical, whereas the primary focus of Information Systems is the organizational aspect, and Information Technology is more applied in nature. The different natures of the subjects lead to a fundamental lack duplication in the way courses are approached, even though the titles of topics may sound similar, such as Computer Networking.

4. Relevance to High-demand Programs at Historically Black Institutions (HBIs)

The AIT program is already offered by UB, and the modifications do not change the focus of the degree. The program is not an engineering program, such as Morgan offers, nor is it a computer science program, such as Coppin and Morgan offer; it is an applied program, which is consistent with UB's mission to provide career-focused programs for aspiring and current professionals. **Relevance to the identity of Historically Black Institutions (HBIs)**

5. This program revision will have no impact on the uniqueness or institutional identities or missions of HBIs.
6. **Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes (as outlined in COMAR 13B.02.03.10):**

Inception of the programs. The updated program and the two new concentrations are the result of periodical evaluation of learning outcomes, student success, market demands, and international curricular recommendations¹¹.

¹⁰ <https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2005-march06final.pdf>

¹¹ ACM Curricula Recommendations, <https://www.acm.org/education/curricula-recommendations>

Faculty. Currently the AIT program utilizes exclusively two full-time faculty members (Mohammed Ketel and Giovanni Vincenti). The program also utilizes five full-time faculty members who are primary faculty in other programs. A list of the personnel is reported in Section B.7. The AIT program also employs a group of qualified adjuncts who teach courses appropriate to their expertise. We are currently conducting a search for one full-time instructor with expertise in cybersecurity to take over the management of the courses related to that domain.

Program Learning Outcomes. Upon graduating from the B.S. in Applied Information Technology program, students will be able to:

- demonstrate a working knowledge of computer networks
- illustrate information technology security solutions
- solve problems using current programming languages
- administer operating systems
- implement relational databases that support web-based applications
- demonstrate effective written and oral communications skills.

Assessment. The program uses a two-year assessment cycle to document students' learning and achievement of program outcomes, and this assessment work is document in the University's assessment management system, Task Stream. All programs undergo periodic review that includes a self-study and external peer review. This periodic program review takes place on a seven-year cycle, as required by the University System of Maryland and the State of Maryland.

Program faculty also periodically participate in assessment activities sponsored by the Center for Excellence in Teaching, Learning, and Technology that focus on such things as quantitative learning in courses or improving student outcomes in gateway courses.

List of courses. The following courses are either requirements or electives for the general IT track or the new concentrations.

AITC 151: Computer Programming I (3) A fundamental programming course focused on developing computational skills in problem-solving, algorithm development and program design, and principles of good programming. Topics include program flowcharting, pseudo-coding, input / output techniques, control structures, data types, modularization, procedures and file handling. A high-level programming language will be introduced and used throughout the course to supplement the theoretical foundations. Prerequisite: none

AITC 210: Computer Hardware/Software Support (3) Introduces students to the architecture and hardware components of modern computing systems such as PCs, servers and portable/mobile devices. Topics include hardware components and

peripherals, installation, configuration and upgrading, diagnosing and troubleshooting, safety and preventive maintenance, portable systems, installation and optimization of system software, and basic networking. Course materials also prepare students for the vendor-neutral CompTIA A+ industry certification exam. Prerequisite: none

AITC 212: Introduction to Linux (3) Provides the conceptual knowledge and hands-on skills necessary to work with the current distributions of the Linux operating system. Topics include open source software, Linux installation and system software, common commands, tools and utilities, file systems management, basic administration, process management, network and service configurations, application installation and writing of simple shell scripts. Course materials prepare students for the vendor-neutral CompTIA Linux+ industry certification exam. Prerequisite: none

AITC 251: Computer Programming II (3) Introduces the syntax of an object-oriented language and teaches object-oriented programming concepts and design. To teach these concepts, the course presents an object-oriented programming language such as Java, C#, or C++, while developing problem-solving and algorithm design skills. Prerequisite: AITC 151 or equivalent

AITC 253: Client-Side Web Programming (3) Introduces students to the basics of client-side web programming by looking at the Document Object Model's structure and adding dynamic properties. Topics include HTML, CSS and JavaScript, with an introduction to frameworks such as jQuery and React. Prerequisite: AITC 151

AITC 310: Fundamentals of Computer Networks (3) An introduction to computer networks, including network operating system concepts. Topics include network components, layered network architectures, topologies, network protocols, Ethernet, wireless transmission, local area networks, wide area networks, switching and routing, network configuration and troubleshooting. Course also prepares students for CompTIA's Network+ certification exam. Prerequisite: AITC 210 or equivalent

AITC 312: Administering and Supporting a Network Operating System (3) Prepares students to install, configure, administer and troubleshoot the current version of Microsoft Windows Server network operating system. Topics include setting up user and group accounts; securing network resources; auditing resources and events; monitoring network resources; backing up and restoring data; managing system policies, file systems and fault tolerance; interoperating between network operating systems; implementing network clients and directory replication; managing/ implementing disaster recovery; and troubleshooting. Prerequisite: AITC 310

AITC 317: Virtualization and Cloud Computing (3) This course exposes students to current topics and technologies in virtualization and cloud computing. Students become familiar with the various aspects of cloud computing systems and analyze new approaches. Topics include the concepts and principles of virtualization; the mechanisms and techniques of building virtualized systems; cloud architectures and service models; the economics and benefits of cloud computing; public cloud infrastructures such as

Amazon Web Services, Google Cloud Platform and Microsoft Azure; free cloud services and open source software; and security in cloud computing. Prerequisite: AITC 310

AITC 332: Fundamentals of Computer Security (3) Introduces students to core principles and practices in computer and network security. Covers the fundamentals of computer/network security including general security concepts; threats and vulnerabilities; application, data and host security; access control and identity management; basics of cryptography; and compliance and operational/organizational security. Current topics in computer security such as cloud computing security and application programming development security also are discussed. Course materials prepare students for the vendor-neutral CompTIA Security+ industry certification exam. Prerequisite: AITC 210 or equivalent

AITC 351: Object-Oriented Programming (3) Introduces abstract data types, as well as generic classes and methods, complexity and algorithms. It also focuses on the design and implementation of object-oriented data structures. The course is based on an object-oriented programming language such as Java, C#, or C++. Proficiency in an object-oriented programming language is required. Prerequisite: AITC 251 or equivalent

AITC 352: Advanced Scripting and Task Automation (3) Focuses on the automation of tasks typically associated with system administration and security by using a scripting language. Applies concepts of computer programming to repetitive tasks, such as log analysis, timed execution of actions, local and remote file operations. The course utilizes a scripting language that is widely used and applicable, such as Python or bash. Prerequisite: AITC 251

AITC 356: Database Systems (3) Introductory course to database design and implementation. Topics include modeling using Entity-Relationship (E-R) diagrams, query formulation with Structured Query Language (SQL), database planning and design, normalization, creating and maintaining a database administration. Basic concepts of the relational data model and SQL are discussed in detail. Students plan, design and test a relational database and associated application components. They also obtain hands-on experience using a current version of Microsoft SQL Server Database Management System or another system. Prerequisite: AITC 251

AITC 416: Wireless Networking: Applications and Security (3) This course provides an introduction to the fundamental principles, protocols, architectures, and current applications of wireless technologies. Examines the methods and techniques to secure these wireless technologies against threats and attacks. This course also explores emerging wireless technologies and Internet of Things (IoT) systems and their related security issues. Prerequisite: AITC 310

AITC 431: Applied Cryptography (3) This course introduces the principles and practices of cryptography. The course consists of three parts: mathematical background, cryptographic concepts and algorithms, and technologies to secure data and networks. Emphasizes the application and uses of these algorithms. The course also exposes

students to the basic steganography techniques and their applications. Topics include symmetric and public key encryption, key establishment and management, hash functions, digital signatures, public key infrastructures, and efficient implementation. Prerequisites: AITC 310, AITC 332, and MATH 321

AITC 432: Information Assurance (3) Provides an introduction to the various technical and administrative aspects of information security and assurance. Discusses the foundation for understanding the key issues associated with protecting information assets, determining the levels of protection and response to security incidents, and designing a consistent, reasonable information security system with appropriate intrusion detection and reporting features. Ethical, legal and professional issues in information security are also discussed. Students develop familiarity with research and information resources to forecast emerging problems and strategies in this area. Prerequisite: AITC 310 and AITC 332

AITC 433: Network Security (3) Deals with the conceptual and technological aspects of network security. The course begins with a review of various forms of network attacks, including scanning, exploits and denial-of-service attacks. It discusses the role of major networking devices, including routers, firewall technology and servers, in establishing a secure network. It provides a comprehensive overview of building and maintaining firewalls in a business environment. It discusses how to make an intelligent choice of firewall technology and firewall planning/design and presents basic firewall troubleshooting. It also covers security policy development, authentication, encryption, VPNs and IDSs. Prerequisite: AITC 310 and AITC 332

AITC 434: Web and Database Security (3) Introduces the security challenges and threats in database/Web-based systems. Students learn how to describe and apply security principles and technologies and how to implement them across various database/Web systems. In addition, advanced topics related to database/ Web systems such as e-commerce security, security problems in data warehousing and data mining are introduced. Prerequisite: AITC 155, AITC 332, and AITC 356

AITC 435: Digital Forensics for Information Technology (3) Introduces students to computer forensics and investigation and examines the digital footprints left behind by the use or misuse of computer systems and networks. Exposes students to current techniques, tools and best practice in securing, collecting, processing, examining and presenting digital evidence. Prerequisite: AITC 310 and AITC 332

AITC 451: Object-Oriented Analysis and Design (3) Presents concepts and techniques in the development of robust design models and of applications of the Unified Modeling Language to fundamental object-oriented analysis and design concepts, including architecture, objects, classes, components, relationships, and supporting diagrams. Prerequisite: AITC 351

AITC 453: Advanced Web Development (3) Presents a detailed study of the methods and technologies for building highly interactive websites and other Web-based

applications. Principles for building websites that exhibit usability, security and maintainability are presented. Students learn scripting, coding and utilizing website development tools to enhance the performance and functionality of a website. Technologies such as HTML5, XML and Ajax are introduced. Requires students to build multiple Web pages and implement a major website/ Web application in phases. Prerequisites: AITC 251 and AITC 253 or their equivalents

AITC 456: Advanced Database Systems (3) Covers advanced topics in database systems, intended to help students understand storage and indexes, query processing and optimization, transaction management, concurrency control, database administration and security, data warehousing concepts, OLAP and data mining, and distributed database and replication. Prerequisite: AITC 356

AITC 457: Mobile Applications Programming (3) Introduces students to mobile application programming and provides an understanding of the underlying wireless architecture and infrastructure in native environments. Discusses various aspects of mobile applications and design patterns, and students gain hands-on development experience with at least one mobile platform. Prerequisite: AITC 351 or equivalent

AITC 458: Software Security (3) Reinforces concepts of secure programming introduced in earlier courses. Students focus on injecting security-based techniques and algorithms into new or already existing applications through concepts of application design and code refactoring. Topics include SQL injections, Web application vulnerabilities, data type overflows and race conditions. Prerequisite: AITC 351 and AITC 356

AITC 459: Open Source Software Development (3) Allows students to learn about and practice the development of open source applications, including the contribution to well-known systems as well as starting brand new projects. Introduces students to tools and practices typically utilized in the development and dissemination of open source software. Topics include licensing, versioning systems, testing, and source code documentation. Prerequisite: AITC 351 and AITC 356

AITC 461: IT Project Management (3) Introduces the concepts and practices associated with IT project management and helps students understand how successful IT projects are effectively managed so that projects are completed on time, within budget and meeting customer's needs. Teaches students the key processes, from project initiation to project closure. Students gain working experience with the latest versions of the most popular project management software and tools available to project managers. Prerequisite: WRIT 300

AITC 480: Internship in Applied Information Technology (3-4) Provides students with hands-on work experience in Applied Information Technology. Students may arrange placement with an external organization, subject to written approval by the instructor and an official of the organization. Prerequisites: five courses (15 credits) within the AIT major at any level and approval of the instructor.

AITC 481: Undergraduate Research Experience (1-4) Preparation of a work of original research or a substantial IT project displaying practical knowledge of relevant research. Each student develops a substantial thesis project that incorporates innovative approaches to technology-based problems. Eligible for continuing studies (CS) grade. Prerequisites: five courses (15 credits) within the AIT major at any level and approval of the instructor

AITC 490: Capstone in Information Technology (3) Provides students with hands-on work experience in applied information technology. Students may arrange placement with an external organization, subject to written approval by the instructor and an official of the organization. Alternatively, students may participate in an in-house project managed by the instructor. In the latter case, students attend regular class meetings as part of their project work. Prerequisites: AITC 461 and at least 3 courses in the student's chosen track

AITC 497: Special Topics in Information Technology (3) Intensive exploration of topics in information technology of mutual interest to faculty and students. Content varies according to the current interests of faculty and students. The topic for study appears under that name in the class schedule. Course may be repeated for credit when topic changes.

AITC 499: Independent Study (1-3) The pursuit of independent study under the supervision of a full-time faculty member. The number of credits to be earned is determined by the supervising faculty member before the study begins. Students may earn up to 3 credits for this independent study. Prerequisite: varies; see class schedule or instructor

GAME 324: Designing for Humans (3) Introduces key concepts of human/computer interaction, including how humans interact with technology to find and process information. It also introduces the concepts of systematic software testing to students of applied information technology and students of interactive simulation and computer gaming. Students learn principles of interface and software construction and apply them to practical problems of software or game evaluation in the process of learning principles that underlie good interaction and play design. Readings cover theory of human/computer interaction, interaction design and usability testing. Prerequisite: none

MATH 303: Applied Probability and Statistics (3) Applied probability and statistics focusing on statistical methods and applications such as hypothesis testing. Introduces probability, random variables, normal distributions, sampling distributions and hypothesis testing. Statistical methods include one- and two- sample procedures for means and proportions, chi-square tests, analysis of variance and linear regression. Prerequisite: Math 111 or equivalent

MATH 321: Mathematical Structure for Information Technology (3) A study of number systems, sets, Boolean algebra and propositional calculus, relations and

databases, and directed and undirected graphics with applications to algorithms and networks. Prerequisite: MATH 111 or equivalent

Program Requirements. The following are the requirements for the updated general IT program, as well as the two new concentrations. The general IT track requires the completion of 57 credits, while either concentration requires the completion of 63 credits.

Applied Information Technology Core (30 credits) – Currently, 39 credits

**The COSC abbreviation is about to be changed for most program courses to AITC, so the catalog shows COSC 151 rather than AITC 151 etc.*

- AITC 151 Computer Programming I
- AITC 210 Computer Hardware/Software Support
- AITC 212 Introduction to Linux
- AITC 251 Computer Programming II
- AITC 253 Client-Side Web Programming
- AITC 310 Fundamentals of Computer Networks
- GAME 324 Designing for Humans
- AITC 332 Fundamentals of Computer Security
- AITC 356 Database Systems
- AITC 461 IT Project Management

- Core no longer includes AITC 155, AITC 356, or AITC 401. Material has been incorporated into other courses.

Capstone (3 credits): AITC 490 Capstone in Information Technology

Math Requirements (6 credits)

- MATH 303 Applied Probability and Statistics
- MATH 321 Mathematical Structure for Information Technology

Choose a Concentration (24 credits) or the General track (18 credits)

- ***Concentration in Application Development (24 credits)***
 - AITC 317 Virtualization and Cloud Computing (new for this area)
 - AITC 351 Object-Oriented Programming (new for this area)
 - AITC 451 Object-Oriented Analysis and Design
 - AITC 453 Advanced Web Development
 - AITC 456 Advanced Database Systems
 - AITC 457 Mobile Applications Programming
 - AITC 458 Software Security
 - AITC 459 Open Source Software Development

- This area no longer requires students take either AITC 434 & either 432, 433, or 435.

- **Concentration in Cybersecurity (24 credits)**
 - AITC 312 Administering and Supporting a Network Operating System (new for this area)
 - AITC 352 Advanced Scripting and Task Automation (new for this area)
 - AITC 416 Wireless Networking: Applications and Security (new for area)
 - AITC 431 Applied Cryptography
 - AITC 432 Information Assurance
 - AITC 433 Network Security
 - AITC 434 Web and Database Security
 - AITC 435 Digital Forensics for Information Technology
- This area no longer requires AITC 430 Legal Issues in High-Technology Crime, nor does it require either AITC 453, 456, or 457.
- **General track (18 credits) [new]**
 - Choose one: AITC 351 or AITC 352
 - Choose one: AITC 312 or AITC 317
 - 12 AITC credits at the 400-level

General Education Requirements and Graduation Requirements. The University of Baltimore requires 38 credits of General Education (GE), and five Graduation Requirements (GR). Courses can be taken within the program's requirements to satisfy both the AIT requirements as well as GE and GR requirements¹². Below is a list of courses that students can take in order to fulfill each requirement. Students from other Maryland public institutions may easily transfer in general education requirements, and they may transfer in credits that could meet some of the graduation requirements (not the capstone).

Type	Requirement	Course
GE	Arts & Humanities (9 credits, including 3 that are upper-division humanities ethics)	PHIL 301 (preferred) or IDIS 302 plus any two other qualifying courses
GE	Social & Behavioral Sciences (6 credits)	Any qualifying courses
GE	Physical & Biological Sciences (7 credits)	Any qualifying courses
GE	Mathematics (3 credits)	MATH 111 ^c
GE	English Composition (6 credits)	WRIT 101 and WRIT 300 ^c
GE	General Education Electives (7+ credits)	Any qualifying courses
GR	Information Literacy	INFO 110
GR	Technological Fluency	AITC 151 ^A or AITC 351 ^B
GR	Oral Communication	AITC 490 ^A
GR	Global Awareness & Diverse Perspectives	AITC 332 ^A
GR	Capstone Experience	AITC 490 ^A

¹² Courses marked with an A are also requirements of the AIT program. Courses marked with a B are requirements of one of the concentrations. Courses marked with a C are pre-requisites to required courses. We are planning on adding more courses to the list of Graduation Requirements, especially for the category of Technological Fluency, including the course AITC 352.

Accreditation. The program is not currently looking for any specialized accreditation; the institution has regional accreditation.

External Contractors. Not applicable.

Program Requirements and Advising Documents. A series of documents are available to current and perspective students through advisors, the program director, or the admissions office. Those resources include:

- Detailed outline of the course requirements, presented in the catalog and on the program's website, as well as other miscellaneous advising and marketing material available to all,
- A sample two- and four-year completion plan (Guides to Graduation) that advisors discuss with current and perspective students, and
- Course requirements and pre-requisite maps¹³ that are available publicly and advertised to all students by the program director and the academic advisors.

7. Adequacy of Articulation

The AIT program has worked in the past with several Maryland community colleges to ensure that students can transfer as much of their work as possible, shortening their time at UB when appropriate. Upon changing the requirements of the program, we will promptly work with 2-year institutions to instate new agreements that cover the updated program requirements. We will begin with the following community colleges:

- Community College of Baltimore County
- Montgomery College
- Anne Arundel Community College
- Harford Community College
- Howard Community College
- Baltimore City Community College

8. Adequacy of Faculty Resources (as outlined in COMAR 13B.02.03.11).

Faculty teaching in the program will come primarily from the Division of Science, Information Arts and Technologies (SIAT) in the Yale Gordon College of Arts and Sciences. The program will also include faculty from the Department of Information Systems and Decision Science (ISDS) as well as the Department of Management in the Merrick School of Business. Some courses are taught by adjunct professors.

¹³ The pre-requisite maps show the current requirements, and they will be updated once the changes to the current requirements and the new concentrations will be added: <http://home.ubalt.edu/gvincenti/ait/advising.php>

Full-Time Faculty Members:

- **Giovanni Vincenti, Program Director of Applied Information Technology & Associate Professor, Science, Information Arts & Technology**
 - D.Sc., Applied Information Technology, Towson University
 - Teaches AITC 151, AITC 251, AITC 253, AITC 351, AITC 352, AITC 356, AITC 434, AITC 451, AITC 453, AITC 456, AITC 457, AITC 458, AITC 459, AITC 490
 - Can teach AITC 210, AITC 212, AITC 310, AITC 312, AITC 317, AITC 332, AITC 416, AITC 431, AITC 432, AITC 433, AITC 435, AITC 461, AITC 497
 - Can supervise AITC 480, AITC 481, AITC 499
- **Mohammed Ketel, Associate Professor, Science, Information Arts & Technology**
 - Ph.D., Electrical Engineering, New York University - Tandon School of Engineering
 - Teaches AITC 210, AITC 212, AITC 310, AITC 312, AITC 317, AITC 332, AITC 416, AITC 431, AITC 432, AITC 433, AITC 435
 - Can teach AITC 151, AITC 251, AITC 253, AITC 351, AITC 352, AITC 356, AITC 434, AITC 451, AITC 453, AITC 456, AITC 457, AITC 458, AITC 459, AITC 461, AITC 490, AITC 497
 - Can supervise AITC 480, AITC 481, AITC 499
- **Greg Walsh, Associate Professor, Science, Information Arts & Technology**
 - Ph.D., Information Studies, University of Maryland College Park
 - Associate Professor, SIAT
 - Teaches GAME 324
- **Haitham Alkhateeb, Professor, Science, Information Arts & Technology**
 - Ph.D., Mathematics Education, Ohio University
 - Director, Mathematics Learning Center
 - Teaches MATH 303 and MATH 321
- **Mona Hajghassem, Assistant Professor, Science, Information Arts & Technology**
 - Ph.D., Applied Mathematics, UMBC
 - Teaches MATH 303 and MATH 321
- **Danielle Fowler, Associate Professor, Information Systems & Decision Science**
 - Ph.D., Information Systems, Swinburne University
 - Chair, Department of Information Systems and Decision Science
 - Teaches AITC 451, cross-listed as INSS 406

- **Paul William Richardson, Lecturer, Management**
 - D.M., University of Maryland University College
 - Teaches AITC 461, cross-listed as INSS 370

We are actively looking for a Lecturer with expertise in Cybersecurity that will join the faculty of the Applied Information Technology program. The new faculty member will be able to teach the following courses: AITC 352, AITC 431, AITC 432, AITC 433, AITC 434, AITC 435, AITC 458. The new faculty member will also be able to supervise the following courses: AITC 480, AITC 481, AITC 499.

All the courses can also be taught by qualified adjuncts, chosen as necessary by the Program Director.

Adjunct faculty:

- Rustam Abakaev
 - Current position and employer: Security Engineer, Amobee
 - Highest degree: Master of Professional Studies in Cybersecurity, University of Maryland, Baltimore County
 - Courses taught: AITC 332
 - Can teach: AITC 310, AITC 312, AITC 352, AITC 433
- Shawn Suter
 - Current position and employer: Linux System Administrator, Johns Hopkins University
 - Highest degree: Master of Science in Cybersecurity, UMUC
 - Courses taught: AITC 432, AITC 435
 - Can teach: AITC 212, AITC 312, AITC 352, AITC 433
- Morgan Denner
 - Current position and employer: Lead UX Designer, Mindgrub
 - Highest degree: Master of Science in Interactive Design and Information Architecture, University of Baltimore
 - Courses taught: AITC 434, AITC 453, AITC 457
 - Can teach: AITC 251, AITC 253, AITC 351, AITC 459
- Tanisha Faulkner
 - Current position and employer: Software Developer, ASRC Federal
 - Highest degree: Master of Science in Information Technology - Software Engineering, University of Maryland University College; and Master of Science in Forensic Science - High Technology Crime, University of Baltimore (Spring 2020 graduation)
 - Courses taught: AITC 251
 - Can teach: AITC 151, AITC 332, AITC 435
- Michael Ifeonu
 - Current position and employer: Critical Infrastructure Protection Sr. Analyst, Exelon Corporation

- Highest degree: Master of Business Administration in Information Technology, University of Maryland, College Park; and Master of Science in Information Assurance, University of Maryland, College Park
- Courses taught: AITC 332
- Can teach: AITC 432

The University of Baltimore offers faculty development opportunities through the Bank of America Center for Excellence in Learning, Teaching, and Technology (CELTT), which supports online education at the University of Baltimore. Faculty members are also engaged in pedagogical research that relates to high impact practices, and in particular online education¹⁴ and project-based learning¹⁵.

9. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12).

Students and faculty members in the Applied Information Technology program have access to 113 databases through the Robert L. Bogomolny Library. Among them, the most relevant for the discipline are the following:

- ACM Digital Library: the most widely utilized database for IT-related research
- Business Source Complete: important repository that connects IT-related matters to the world of business
- Catalog USMAI: a series of resources shared among all USM institutions
- Ebsco Discovery Service: an aggregator that includes topics related directly as well as indirectly to IT
- ERIC: an educational database that includes material on IT education
- Global Issues: a database that makes world-wide press resources available to our students, including matters related to IT
- Homeland Security Digital Library: a repository of material that includes cybersecurity
- Web of Science: one of the most widely utilized indexing services that provides access to scholarly work from all around the world

10. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment (as outlined in COMAR 13B.02.03.13)

Each full-time faculty member has exclusive access to an office. The facility also includes other rooms that can be utilized as research lab space dedicated only to the faculty members.

The program utilizes exclusively three laboratories. One is primarily dedicated to computer programming and database systems, the second is dedicated to networking and

¹⁴ Vincenti, G., Hilberg, J. S., & Braman, J. (2017). Student preferences and concerns about supplemental instructional material in CS0/CS1/CS2 courses. *International Journal on E-Learning*, 16(4), 417-441.

¹⁵ Vincenti, G. (2019). Engaging IT Students through the NASA SUITS Design Challenge: An Experience Report. In *Proceedings of the 20th Annual SIG Conference on Information Technology Education* (pp. 22-27).

system administration, and the third is dedicated to cybersecurity and is also self-contained in terms of computer connectivity, so that instructors and students will not damage any of the University's IT infrastructure, should some exercises in cybersecurity not go as planned.

The program also has access to two more laboratories. One is shared with other technology-related programs at the University of Baltimore. The second shared lab is an open lab that students can utilize at any time during open hours to work on their projects. The open lab also contains a library of reference books donated by the faculty, staff, and alumni. The library is available to any student that utilizes the lab and is a resource that is independent of the main Library on campus.

Each lab is equipped with 24 seats, with one computer per seat. Each computer has between 16GB and 32 GB of memory, with processors and other hardware that has been released within the last three years. This allows each student to have access to significant computing power, including running several virtual machines at once on each device. The lab dedicated to cybersecurity also has four server-grade machines, one per 6 students, where users can gain experience in managing larger, enterprise systems.

During the 2019-20 Academic Year, the Applied Information Technology program, in conjunction with the Information Systems and Technology Management program, has received a University System of Maryland Workforce Development Initiative Grant for the combined amount of \$260,000. The grant will allow the program to maintain and develop the labs available for education, special project, and research to students and faculty members.

Faculty members as well as students have complete access to the Bank of America Center for Excellence in Learning, Teaching, and Technology (CELTT), which supports online education at the University of Baltimore. Any online delivery is achieved through several technologies, including:

- Sakai, our Learning Management System
- SharePoint and OneDrive, for secure file sharing with the students
- Panopto, for the delivery of synchronous and asynchronous video lectures
- Zoom and Skype, for the delivery of synchronous video lectures as well as to meet with the students whole working remotely

11. Adequacy of Financial Resources with Documentation (as outlined in COMAR 13B.02.03.14)

Narrative: *It is assumed this program revision will be fundamentally a resource-neutral program modification. Although the changes aim at improving the program and also enhancing enrollment, only modest increases are anticipated, and the program can be sustained without growth.*

1. Complete [Table 1: Resources and Narrative Rationale](#):

b. Annual Tuition/Fee Rate	\$0		\$0	\$0	\$0
c. Total F/T Revenue (a*b)	\$0	\$0	\$0	\$0	\$0
d. Number of P/T students	0	0	0	0	0
e. Credit Hour Rate	\$0	\$0	\$0	\$0	\$0
f. Annual Credit Hours Rate (per student, average)	0	0	0	0	0
g. Total P/T Revenue (d*e*f)	\$0	\$0	\$0	\$0	\$0
3. Grants, Contracts & Other External Sources	0	0	0	0	0
4. Other Sources	\$0	\$0	0	0	0
TOTAL (Add 1-4)	\$0	\$0	\$0	\$0	\$0

2. Complete [Table 2: Program Expenditures and Narrative Rationale](#). Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each expenditure category.

Narrative:

It is assumed this program revision will be fundamentally a resource-neutral program modification. No new space or equipment is needed nor new hires. Equipment update schedules are not altered by change. Indeed, this change would not be a substantive one were it not for making the specializations into concentrations by requiring two more courses

in each, and there are already faculty resources for teaching these courses. Overall, the program will require fewer credits. Thus, the chart is filled with zeroes.

Resource Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1.Faculty (b+ c below)	0	0	0	0	0
a. # of FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
2.Admin Staff	0	0	0	0	0
3. Support Staff (b+c below)	0	0	0	0	0
a. # of FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c.Total benefits	0	0	0	0	0
4. Technical Support and Equipment	0	0	0	0	0
5. Library	0	0	0	0	0
6. New or Renovated Space	0	0	0	0	0
7.Other Expenses	0	0	0	0	0
TOTAL (Add 1-7)	0	0	0	0	0

12. Adequacy of Provisions for Evaluation of Program (as outlined in COMAR 13B.02.03.15).

The University has a shared governance process for curriculum approval. Both new courses and new programs are required to submit student learning outcomes (SLOs),

which are then evaluated by faculty curriculum committees, plus staff in the deans' and provost's office. Courses that are to meet General Education or Graduation Requirement criteria must demonstrate that they include the appropriate shared SLOs. The General Education Council of the University Faculty Senate then assesses courses that meet general education requirements on a regular schedule. Courses that meet graduation requirements are assessed either by the program or by the General Education Council.

Faculty are evaluated annually by their supervisor and dean. In addition, policies for tenure-track and tenured faculty call for in-depth peer review at regular intervals.

Courses undergo student evaluation using the college-wide software tool Explorance Evaluations. Students complete evaluations of their course and the instructor at the end of each semester, using an online form. Data from these evaluations are incorporated in the annual chair's evaluation and are used in faculty promotion and tenure decisions.

Program course learning outcomes will be evaluated every two years. Year 1 will be dedicated to the collection and analysis of the material, and Year 2 will be dedicated to implementing any changes related to the findings of Year 1. We cannot assess more frequently as not all courses are offered every semester. This process will also include the assessment of the Program Learning Outcomes, since all our courses are related directly to the PLOs.

The assessment of course-level and program-level learning outcomes is coordinated by the Provost's Office as part of the curriculum shared governance process, with the college process supervised by the Associated Dean. The Program Director will work with faculty members teaching the courses. The Program Director will also collect the material generated by each instructor. Evaluation of the material will be managed within the Division, with the participation of faculty members that are close enough to the domain.

We will perform the 7-Year Program Assessment as required by USM and MHEC.

13. Consistency with the State's Minority Student Achievement Goals (as outlined in COMAR 13B.02.03.05).

1. Discuss how the proposed program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.

The University of Baltimore is an unusually diverse institution, with an average undergraduate age over 25, a majority minority undergraduate population, and over 400 international students on campus. Approximately 47 percent of UB students are African Americans and 32 percent white. The University serves nontraditional students, which includes many working adults. UB's current strategic plan underlines the importance of diversity, equity, and inclusion, and one of the strategic goals is specifically to strengthen UB's commitment these core values.

The University of Baltimore also follows a diversity plan and reports annually to the University System of Maryland on progress toward its goals. This program is transfer-friendly, thereby making it easier for a diverse population to enter and complete the degree and to do so in an economical way. The program students are

also diverse, and the program contributes to producing more minority STEM graduates.

14. Relationship to Low Productivity Programs Identified by the Commission:

Not applicable

15. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

This program will not be a distance education program; however, the University is approved to offer distance education and complies with C-RAC guidelines when distance education is offered.