



**FORM TO REQUEST SUBSTANTIAL CHANGES TO AN EXISTING UNDERGRADUATE MAJOR**

A request for substantial changes to an existing program requires approval from the school director/department head (managing administrator), college academic dean, Curricular Affairs, Undergraduate Council (UGC), and College Academic Administrators Council (CAAC). Additional approvals may be required, depending on the requested changes. Complete this form and submit to [Office of Curricular Affairs](#) no later than October 23, 2020 to be considered for inclusion in the 2021-2022 Academic Catalog.

**I. Requested by (College & School/Department):**

College of Applied Science and Technology  
Department of Applied Technology

**II. Proposer’s name, title, email and phone number:**

Li Xu, Program Manager, [lxu@arizona.edu](mailto:lxu@arizona.edu),  
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Paul Wagner, Department Head, [paulewagner@arizona.edu](mailto:paulewagner@arizona.edu), 513-255-0435

**III. Degree, major and number of students enrolled in the major. If you have emphases (sub-plans), list the number of students enrolled by emphasis:**

Career	Plan	Sub Plan	Academic Program	Academic Plan Type	Headcount	Fall 2020	Fall 2020	Fall 2020
						DIST	ONLN	SOUTH
<b>Grand Total</b>					<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>
Undergraduate	Applied Computing	Digital Design	College of Applied Sci & Tech	Major	7	2	4	1
		Information Management	College of Applied Sci & Tech	Major	11		11	
		Network Operations	College of Applied Sci & Tech	Major	32	1	22	9
		Software Development	College of Applied Sci & Tech	Major	24	4	17	3
<b>Applied Computing Total</b>					<b>74</b>	<b>7</b>	<b>54</b>	<b>13</b>

Applied Science	Informatics	College of Applied Sci & Tech	Major	34	8	19	7
	Network Administration	College of Applied Sci & Tech	Major	5	1		4
	Network Operations	College of Applied Sci & Tech	Major	43	5	21	17
<b>Applied Science Total</b>				<b>82</b>	<b>14</b>	<b>40</b>	<b>28</b>
CAST Thematic	Informatics Emphasis	College of Applied Sci & Tech	Minor	2		2	
		College of Science	Minor	3			3
		College of Soc & Behav Sci	Minor	6		6	
<b>CAST Thematic Total</b>				<b>11</b>		<b>8</b>	<b>3</b>
Undergraduate Total				<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>

**IV. Describe proposed changes to the major. Provide a rationale and explanation for making changes to the major and include any relevant supporting data. Are the changes proposed a result of Annual Program Review (APR) and/or a result from the assessment of programmatic outcomes? If you are requesting a name change, please indicate if the subject code (course prefix) will also change. Include requested new prefix code and description.**

Since we submitted the Applied Computing degree proposal in 2018, faculty in Applied Computing have routinely reviewed, examined, and improved the curriculum. The degree was approved in 2019 and entered its first offering in Fall 2020. However, as technology evolves quickly, the Applied Computing curriculum must evolve. To that end, we must provide students hands-on education in cutting-edge computing technologies. The intent behind this update to the core is to provide a better alignment of the core requirements to the content of the seven emphases where students can learn real-world applications to develop and manage complex networked systems of hardware and software.

In this proposal, we include the core update by removing a course from the core list and add one more specialization course in each of the four-existing emphases. More specifically, we remove APCV 401 from the core because it can serve as a specialization course rather than a core course applied to all emphases. In addition to the adjusted courses for each existing emphasis, we propose to include three additional emphases including Applied Artificial Intelligence, Cloud Computing, and DevOps Engineering.

**Software Development:** In the software development emphasis, we propose to update CSCV 381 Mobile Device Programming as a required course in software development emphasis. According to the occupational outlook handbook of the US Bureau of Labor Statistics, the employment of software developers is projected to grow 22 percent from 2019 to 2029, much faster than the average for all occupations. Demand will be driven by the growing popularity of mobile devices and eCommerce. This adjustment will ensure students practice software development on various platforms including mobile devices. Students in the software development emphasis learn a variety of software fundamentals, including object-oriented and system programming, UNIX, mobile app development, web programming, and secure computing.

**Information Management:** In the information management emphasis, we intend to support students to develop skills in data processing and analytics. Employment of data processing and analysis is projected to grow 10 percent from 2019 to 2029, which is also much faster than the average for all occupations. We propose to update the elective courses of the emphasis so that the courses provide more options for students to develop skills in cloud computing and administering computer systems in organizations. Students will learn the foundations of database systems, web design and programming, data visualization and analysis, as well as methods for visualizing, managing, and analyzing information

**Digital Design:** In the Digital Design emphasis, students are educated on and trained in topics that focus on ways in which the digital world, not just impacts, but actually drive the ways we interact with the world and one another. Career opportunities in Digital Design-related fields is expected to grow anywhere between 4% and 24% over the next ten years, depending on the particular area students choose to enter. We have included APCV 401 as a requirement and removed NETV courses so students in Digital Design may focus on the designing and analyzing of fields ranging from information design through statistics to game development. Digital Design students learn to build and shape the world around them in ways that connect with others and tell meaningful stories about the reality they themselves are helping to form. The breadth and depth of the Digital Design curriculum means students have both the soft and hard skills to enjoy careers not just from data analysis and visualization to graphic design and multimedia production, but to shape the careers of the future that are yet unnamed. Digital Design rests at the nexus of science and art and welcomes students that enjoy walking that line.

**Network Operations:** The network operations emphasis integrates the curriculum development efforts of network operations across Applied Computing, Computer Science, and Cybersecurity. The career outlook for this field is expected to grow by 6% over the next 10 years. It uses the core of Applied Computing to develop a solid foundation in statistics, programming, networking, and cybersecurity. The specialization courses in the new emphasis focus on network operations, from network architectures and development to applying network engineering principles to approach practical application problems in secure computing. Students will study applying network operations from a hands-on, interdisciplinary approach with peers and faculty members in Applied Computing, Computer Science, and Cyber Security.

### **PROPOSED NEW EMPHASES**

**DevOps Engineering:** The new DevOps emphasis integrates the curriculum development efforts of DevOps across Applied Computing, Computer Science, and Cybersecurity. It uses the core of Applied Computing to support students to develop a solid foundation in statistics, programming, networking, and cybersecurity. The specialization courses in the new emphasis focus on DevOps development and applying DevOps to approach practical application problems in secure computing. Students will study applying DevOps in a hands-on from an interdisciplinary approach with peers and faculty members in Applied Computing, Computer Science, and Cyber Security.

**Cloud Computing:** The new Cloud Computing provides a degree path to complement our Cloud Computing certificate. The demand for cloud computing skills is on the rise as more and more companies are adopting cloud services. According to Forbes, the worldwide spend on cloud computing services will grow at a 19.4% compound annual growth rate (CAGR) from nearly \$70B in 2015 to more than \$141B in 2019. Students in this emphasis will architect and implement cloud infrastructures with Amazon Web Services and Microsoft Azure that would be able to support organizations of any size in the public and private sectors.

**Applied Artificial Intelligence:** The new Applied AI emphasis integrates the curriculum development efforts on AI across Applied Computing, Computer Science, and Cybersecurity. The emphasis courses in the new emphasis focus on AI algorithm development and applying AI to approach practical application problems. The job market is booming for artificial intelligence engineers, data analysts, data scientists, and programmers, as well as many other AI-related jobs.

Forbes noted that artificial intelligence jobs rose more than 29 percent from 2018 to 2019. Analytics Insight estimates that the AI industry is expected to grow from \$18.8 billion in 2019 to \$80.3 billion in 2023. In CAST, in addition to supporting students in Applied Computing, we also expect the new emphasis will engage students in Cyber Operations (700+ students) and Intelligence & Information Operations (200+ students). Applied AI emphasis will provide students a firm understanding of AI technology, its applications, and its use cases. Students will be able to master concepts and tools including machine learning, statistical analysis, and data analytics in applied computing.

- V. **Comparison Chart**—complete the chart below using your existing [academic advisement report](#). You may not need to complete all portions. Highlight row(s) indicating the proposed significant changes. You can find course information to help complete the chart below by using the [UA course catalog](#) or [UAnalytics](#) (Catalog and Schedule Dashboard> “Printable Course Descriptions by Department” On Demand Report; right side of screen). Proposed changes resulting in similar curriculum with other plans (within department, college, or university) may require completion of an additional comparison chart.

	Existing Major Requirements	Requirements For Modified Major
Major, emphasis (if applicable) and degree *	AS	AS
CIP Code –lookup <a href="#">here</a> or contact <a href="#">the Office of Curricular Affairs</a> for assistance, if needed	11.0104	11.0104
Total units required to complete the degree*	120 units	120 units
Upper -division units required to complete the degree	39	39
Total CC transfer units that may apply to this degree*	<b>45 units for students with AAS degree from an Arizona Community College or CCAF -or- 60 units</b>	<b>45 units for students with AAS degree from an Arizona Community College or CCAF -or- 60 units</b>
Foundation courses		
<a href="#">Math</a>	APCV 302: Statistics in the Information Age	APCV 302: Statistics in the Information Age
<a href="#">Second Language</a>	2 <sup>nd</sup> Semester Proficiency	2 <sup>nd</sup> Semester Proficiency
<a href="#">General Education</a>		
Tier I GE Requirements (150, 160, 170)		

Tier II GE Requirements (Arts, HUMS, INDV, NATS)	TIER II GENERAL EDUCATION (21 Units) Natural Sciences (3 Units) Arts and Humanities (6 Units) Individuals and Societies (12 Units) Diversity Requirement	TIER II GENERAL EDUCATION (21 Units) Natural Sciences (3 Units) Arts and Humanities (6 Units) Individuals and Societies (12 Units) Diversity Requirement
Pre-major? (Yes/No)	No	No
List any special requirements to declare or gain admission to this major (completion of specific coursework, minimum GPA, interview, application, etc.)	The Applied Computing program requires a supplemental program application in addition to admission to The University of	The Applied Computing program requires a supplemental program application in addition to admission to The University of

	Arizona. The entrance requirements include: <ul style="list-style-type: none"> <li>· Minimum 2.5 GPA in your college coursework</li> <li>· Resume</li> <li>· Goal statement</li> <li>· AAS degree in computer related field (recommended)</li> </ul>	Arizona. The entrance requirements include: <ul style="list-style-type: none"> <li>· Minimum 2.5 GPA in your college coursework</li> <li>· Resume</li> <li>· Goal statement</li> <li>· AAS degree in computer related field (recommended)</li> </ul>
Minimum # of units required in the major (units counting towards major units and major GPA)	42	42
Minimum # of upper-division units required in the major (upper division units counting towards major GPA)	39	39
<a href="#">Minimum # of residency units to be completed in the major</a>	30	30
Required supporting coursework (courses that do not count towards major units and major GPA, but are required for the major). Courses listed must include prefix, number, units, and title. Include any limits/restrictions in place/needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	N/A	N/A

<p>Major requirements. List all major requirements including core and electives. If applicable, list the emphasis^ requirements. Courses listed count towards major units and major GPA. Courses listed must include prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions in place/needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses being added and are not owned by your department. Recommend ordering requirements in the same order as your advisement report.</p>	<p><b>CORE</b>  ENG 306 – Advanced Composition (3units)  CYBV 329 – Cyber Ethics (3units)  APCV 302 – Statistics in the Information Age (3units)  CYBV 326 – Introductory Methods of Network Analysis (3units)  APCV 320 – Computational Thinking and Doing (3units)  CYBV 301 – Fundamentals of Cyber Security (3units)  APCV 310 – Introduction to Informatics (3units)  APCV 401 – Introduction to Human Computer Interaction (3units)  APCV 498 Senior Capstone (3units)</p> <p><b>SOFTWARE DEVELOPMENT</b>  CSCV 335 - Object-Oriented Programming and Design (3units)  CSCV 337 – Web Programming (3units)  CSCV 352 – Systems Programming and Unix(3units)  APCV 361 - Data Analysis and Visualization (3units)</p> <p><i><u>ELECTIVE (CHOOSE 1)</u></i>  CSCV 381 – Mobile Device Programming(3units)</p>	<p><b>CORE</b>  ENG 306 – Advanced Composition (3units)  CYBV 329 – Cyber Ethics (3units)  APCV 302 – Statistics in the Information Age (3units)  CYBV 326 – Introductory Methods of Network Analysis (3units)  APCV 320 – Computational Thinking and Doing (3units)  CYBV 301 – Fundamentals of Cyber Security (3units)  APCV 310 – Introduction to Informatics (3units)  APCV 498 Senior Capstone (3units)</p> <p><b>SOFTWARE DEVELOPMENT</b>  CSCV 335 - Object-Oriented Programming and Design (3units)  CSCV 337 – Web Programming (3units)  CSCV 352 – Systems Programming and Unix (3units)  APCV 361 -Data Analysis and Visualization (3units)  CSCV 381 - Mobile Device Programming (3units)</p> <p><i><u>ELECTIVE (CHOOSE 1)</u></i>  APCV 401 – Introduction to Human-Computer Interaction (3units)</p>
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	<p>CSCV 460 – Database Design (3units)  CYBV 473 – Violent Python (3units)</p> <p><b>INFORMATION MANAGEMENT</b>  CSCV 337 – Web Programming (3units)  CSCV 460 – Database Design (3units)  APCV 360 – Database Management Fundamentals (3units)  APCV 361 – Data Analysis and Visualization (3units)</p> <p><i><u>ELECTIVES (CHOOSE 1)</u></i>  APCV 403 – Principles of Web Design (3units)  NETV 370 – Intro to Network Design and Architecture (3units)  NETV 379 – Cloud Computing</p>	<p>CSCV 460 – Database Design (3units)  CYBV 473 – Violent Python (3units)  APCV 496 – Special Topics in Informatics (3units)</p> <p><b>INFORMATION MANAGEMENT</b>  CSCV 337 – Web Programming (3units)  CSCV 460 – Database Design (3units)  APCV 360 – Database Management Fundamentals (3units)  APCV 361 – Data Analysis and Visualization (3units)</p> <p><i><u>ELECTIVES (CHOOSE 2)</u></i>  APCV 403 – Principles of Web Design (3units)  NETV 379 – Cloud Computing</p>
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	<p>(3units)</p> <p><b><u>DIGITAL DESIGN</u></b>  APCV 403 – Principles of Web Design (3units)  APCV 405 – Introduction to Game Design (3units)  APCV 406 – Introduction to Game Development (3units)  APCV 361 – Data Analysis and Visualization (3units)</p> <p><i>ELECTIVE (CHOOSE 1)</i>  APCV 301 – Interpreting and Presenting Digitally (3units)  <del>NETV 370 – Intro to Network Design and Architecture (3units)</del>  <del>NETV 379 – Cloud Computing (3units)</del></p> <p><b><u>NETWORK OPERATIONS</u></b>  NETV 370 – Intro to Network Design and Architecture (3units)  NETV 371 – Network Security Principles (3units)  NETV 375 – Advanced Routing and WAN Technologies (3units)  <del>NETV 379 – Cloud Computing (3units)</del></p> <p><i><del>ELECTIVES (CHOOSE 1)</del></i>  <del>NETV 378 – System Administration (3units)</del> <del>NETV 374 – Routing: Theories and Applications (3units)</del> <del>NETV 382 – Network Defense, Incident Response &amp; Disaster Recovery (3units)</del></p>	<p>(3units)  <del>NETV 378 – System Administration (3units)</del>  <del>APCV 496 – Special Topics in Informatics (3units)</del></p> <p><b><u>DIGITAL DESIGN</u></b>  <del>APCV 401 – Introduction to Human-Computer Interaction (3units)</del>  APCV 403 – Principles of Web Design (3units)  APCV 405 – Introduction to Game Design (3units)  APCV 406 – Introduction to Game Development (3units)  APCV 361 – Data Analysis and Visualization (3units)</p> <p><i>ELECTIVE (CHOOSE 1)</i>  APCV 301 – Interpreting and Presenting Digitally (3units)  <del>APCV 362: Information Design (3 Units)</del>  <del>APCV 496 – Special Topics in Informatics (3units)</del></p> <p><b><u>NETWORK OPERATIONS</u></b>  NETV 370 – Intro to Network Design and Architecture (3units)  NETV 371 – Network Security Principles (3units)  <del>NETV 374 – Routing: Theories and Applications (3units)</del> <del>NETV 375 – Advanced Routing and WAN Technologies (3units)</del></p>
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NETV 477 – Advanced Computer Forensics (3units)  
NETV 479 – Advanced Cloud Computing (3units)  
CYBV 385 – Introduction to Cyber Operations (3units)  
CYBV 479 – Wireless Networking and Security (3units)  
CYBV 496 – Special Topics in Cyber Security (3units)

NETV 379 – Cloud Computing (3units)  
NETV 479 – Advanced Cloud Computing (3units)

**DEVOPS ENGINEERING (NEW)**

CYBV 302 – Linux Security Essentials (NEW)  
CYBV 303 – Windows Security Essentials (NEW)  
APCV 360 – Database Management Fundamentals  
INFV/NETV 378 – System Administration  
NETV 379 – Cloud Computing  
NETV 382 – Network Defense, Incident Response & Disaster Recovery

**CLOUD COMPUTING (NEW)**

NETV 301 – Virtualization: Applications and Best Practices (NEW)  
INFV/NETV 379 – Cloud Computing  
NETV 380 – Introduction to Microsoft Azure  
NETV 381 – Introduction to Amazon Web Services  
NETV 479 – Advanced Cloud Computing: Applications and Best Practices  
NETV 480 – Cloud Security: Incident Response, Penetration Testing, & Advanced Defense

**APPLIED ARTIFICIAL INTELLIGENCE (NEW)**

CSCV 345 – Analysis of Discrete Structures  
CSCV 471 – Artificial Intelligence  
APCV 361 – Data Analysis and Visualization  
CYBV 473 – Violent Python  
CYBV 474 – Advanced Analytics for Security Professionals

**Choose 1 (3 units)**

CYBV 475 – Cyber Deception Detection



		NETV 434 – Advanced Network and System Security APCV 496 – Special Topics in Informatics
Internship, practicum, applied course requirements. (Yes/No). If yes, provide description.	Yes. Students must complete APCV/NETV 498, Senior Capstone, with a minimum 45-hours student engagement experience.	Yes. Students must complete APCV/NETV 498, Senior Capstone, with a minimum 45-hours student engagement experience.
Senior thesis or senior project required (Yes/No). If yes, provide description.	Yes. Students engage in a senior project and write a senior project thesis paper as part of the APCV/NETV 498—Senior Capstone.	Yes. Students engage in a senior project and write a senior project thesis paper as part of the APCV/NETV 498—Senior Capstone.
Additional requirements (provide description)	Students must earn a minimum 2.0 major GPA.	Students must earn a minimum 2.0 major GPA.
Minor (optional or required)	Optional	Optional

\*May require Arizona Board of Regents (ABOR) approval

^Emphases are officially recognized sub-specializations within the discipline. [ABOR Policy 2-221 c. Academic Degree Programs Subspecializations](#) requires all undergraduate emphases within a major to share at least 40% curricular commonality across emphases (known as “major core”). Total units required for each emphasis must be equal.

**VI. Peer institution comparison-** describe how your modified major requirements are similar and different from major requirements of two peer institutions. Select peers from (in order of priority) [ABOR approved institutions](#), [AAU members](#), and/or other relevant institutions recognized in the field.

<b>Program name, sub-plan name (if applicable), degree, and institution</b>	<b>Proposed UA Program:</b> <b>Major:</b> Applied Computing <b>Subplans:</b> Software Development, Information Management, Digital Design, Network Operations, DevOps Engineering, Applied Artificial Intelligence, and Cloud Computing.  Bachelor of Applied Science degree College of Applied Science and Technology	<b>Peer 1</b> <b>Major:</b> Applied Computing Bachelor of Science  Arizona State University	<b>Peer 2:</b> <b>Major:</b> Applied Computer Science Bachelor of Science  Northern Arizona University
<b>Current # of enrolled students</b>		Unknown	89

<p><b>Major Description provide a description for the proposed program. Include the purpose, nature, and program highlights. Description must be consistent throughout the proposal documents and match departmental and college websites, handouts, and promotional materials.</b></p>	<p><b>Description of major:</b>  The Bachelor of Applied Science in Applied Computing introduces students to the core idea of applied computing with an interdisciplinary approach. Applied Computing is considered as the intersection of Information Technology, Computer Science, Information Science and Systems. It uses computation and technology as universal tools to solve problems, and design and build computer-based systems and digital artifacts. The strengths of the curriculum include a significant emphasis on real-world applications to design and manage complex networked systems of hardware and software.</p> <p>Applied Computing students develop a strong base of theoretical and practical interdisciplinary experiences. Digital ecosystems being one of the fastestgrowing sectors of the U.S. economy, a robust applied-computing skillset allows our graduates to find employment opportunities in web development, digital design, game development, data analytics, data engineering, AI programming, information architecture, systems administration, and network, cloud, and software engineering.</p>	<p>From <a href="https://newcollege.asu.edu/applied-computing-degree">https://newcollege.asu.edu/applied-computing-degree</a></p> <p>Students in the BS program in applied computing learn a computer science foundation and then explore the established knowledge and emerging developments in the high-demand areas of database systems, computer networks and cybersecurity. The program also provides the opportunity to investigate interdisciplinary connections, including the combination of computing with its real-world application in other disciplines through concurrent degrees and minors. Hands-on class projects, internships, industry partnerships and authentic and impactful research conducted with faculty provide numerous opportunities for students to apply their knowledge before they graduate. Students use their programming expertise, systems knowledge and critical thinking skills to effectively problem-solve and articulate their experience through presentations, scientific posters and professional papers.</p> <p>With the depth of knowledge and experience in databases, networks and cybersecurity, graduates have a strong foundation in systems with established interconnections among these fields, preparing them for graduate study and careers that include cybersecurity analysts, database architects and network engineers.</p>	<p>From <a href="https://nau.edu/school-ofinformatics-computing-andcyber-systems/bs-appliedcomputer-science/">https://nau.edu/school-ofinformatics-computing-andcyber-systems/bs-appliedcomputer-science/</a></p> <p>Picture yourself rolling out your own breakthrough software to be the next Google or YouTube, working on the next generation of computer gaming engines, or developing new applications at Microsoft, IBM, or Intel. Whether you start a career right away or pursue graduate study first, the Department of Computer Science will help build a platform for your high-tech dreams.</p> <p>If you're seeking a career in smaller scale, hands-on applied programming, our program might just get you there. Prepare to hit the career-ground running with our innovative Design4Practice Program. This sequence of team-based design courses focuses on implementation of real-world projects, simulating the highly integrated and globally distributed software development environments emerging in the modern corporate world. Work on project design teams with students from other disciplines to create software, building the technical and professional skills necessary for success in the expanding universe of high-tech. Thinking of studying abroad to take advantage of global career trends? We strongly encourage international study and facilitate internships in other countries. Wherever your imagination takes you, a computer science education at</p>
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			Northern Arizona University will open new doors.
<b>Target careers</b>	<ul style="list-style-type: none"> <li>• Software Developer</li> <li>• Game Designer/Developer</li> <li>• Web Designer/Developer</li> <li>• Data Engineer</li> <li>• Data Analyst</li> <li>• Digital Designer</li> <li>• Database Administrator</li> <li>• Network Engineer</li> <li>• Network Security Designer</li> <li>• IT System Analyst</li> <li>• Security Data Analyst</li> <li>• AI Specialist/Developer • Machine Learning Specialist/Engineer</li> <li>• Security Programmer</li> <li>• Cybersecurity Application Analyst</li> <li>• Systems Administrator</li> <li>• DevOps Engineer</li> <li>• Graphic/Multimedia Designer</li> <li>• User Experience Designer/Analyst</li> <li>• Data Science Generalist/Versatelist</li> <li>• Data Architects, Engineers, Ecologists</li> </ul>	<ul style="list-style-type: none"> <li>• Network and Computer Systems Administrators</li> <li>• Computer Network Support Specialists</li> <li>• Computer Programmers</li> <li>• Computer Systems Analysts</li> <li>• Database Administrators</li> <li>• Information Security Analysts</li> <li>• Computer and Information Systems Managers</li> <li>• Software Developers</li> <li>• Systems Software Developers, Applications</li> <li>• Web Developers</li> </ul>	<ul style="list-style-type: none"> <li>• Software consulting</li> <li>• Bio-informatics and data management</li> <li>• Graphics and game development</li> <li>• Defense software analysis</li> </ul>
<b>Total units required to complete degree</b>	120 units	120	120
<b>Upper-division units required to complete degree</b>	45 units	45	30

<b>Foundation courses</b>			
English composition	ENGL 101 (3) First-Year Composition or equivalent ENGL 102 (3) First-Year Composition or equivalent	ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR	English Composition (minimum of 4 units)

		ENG 107 or ENG 108: First-Year Composition	
<a href="#">Second language</a>	2 <sup>nd</sup> Semester Proficiency	Completion of both ACO 101 and ACO 102 with a C or better fulfills the New College Language and Cultures requirement.  ACO 101: Introduction to Computer Science (CS)  ACO 102: Object-Oriented Programming (CS)	None
<a href="#">Math</a>	APCV 302: Statistics in the Information Age	MAT 210: Brief Calculus (MA)	MAT 226: Discrete Mathematics

<p><a href="#">General education requirements</a></p>	<p><b>TIER II GENERAL EDUCATION</b> (21 Upper Division Units)          Can be replaced with customized coursework if AGECE complete.  <b>Natural Sciences (3 Units)</b>          Can be taken at CC in 75/45 option  <b>Arts and Humanities (6 Units)</b>          Can be taken at CC in 75/45 option  <b>Individuals and Societies (12 Units)</b>          9 units can be taken at CC in 75/45 option  <b>Diversity Requirement</b></p>	<p><b>Five Core Areas (General Studies)</b></p> <p>L: Literacy and Critical Inquiry (three credit hours)</p> <p>MA and CS: Mathematical Studies (combined six credit hours)</p> <p>HU: Humanities, Arts and Design and</p> <p>SB: Social-Behavioral Sciences (combined 12 credit hours)</p> <p>SQ and SG: Natural Sciences (combined eight credit hours)</p> <p>Three Awareness Areas (General Studies)</p> <ol style="list-style-type: none"> <li>1. Cultural Diversity in the United States (C)</li> <li>2. Global Awareness (G)</li> <li>3. Historical Awareness (H)</li> </ol> <p>All students enrolled in a baccalaureate degree program must complete successfully a minimum of 29 credit hours of</p>	<p><b>Liberal Studies:</b>          All students seeking their first baccalaureate degree from Northern Arizona University must take thirty-five (35) units of Liberal Studies. Students will take courses to satisfy both the Foundation and Distribution requirements.</p> <p><b>Foundation Requirements</b></p> <ul style="list-style-type: none"> <li>• English Composition (minimum of 4 units)</li> <li>• Mathematics (minimum of 3 units)</li> </ul> <p><b>Distribution Block Requirements</b></p> <ul style="list-style-type: none"> <li>• Aesthetic and Humanistic Inquiry - AHI (minimum of 6 units)</li> <li>• Cultural Understanding - CU (minimum of 6 units)</li> <li>• Science (minimum of 7 units)</li> <li>• 3-4 units</li> </ul>
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		<p>approved General Studies courses.</p> <p>In addition to the 29 credit hours of lower-division general education coursework, university graduation requirements also require students to take six additional upper-division credit hours. Three hours with a Literacy (L) designation are required to be chosen from approved upper-division courses, preferably in the major. Three hours with either a humanities, arts and design (HU) or social-</p>	<p>of Science and Applied Science - SAS course (s) AND</p> <ul style="list-style-type: none"> <li>• 3-4 units of Science and Applied</li> </ul>
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		<p>behavioral sciences (SB) designation should also be chosen from approved upper-division courses, preferably in the major.</p>	<p>Science with embedded Lab Science course - LAB</p> <ul style="list-style-type: none"> <li>• Social and Political Worlds - SPW (minimum of 6 units)</li> </ul> <p>3 additional units from any distribution block or foundation category to meet the 35 unit Liberal Studies requirement</p> <p><b><u>DIVERSITY REQUIREMENTS</u></b></p> <p>All students seeking their first baccalaureate degree from Northern Arizona University, who graduate under the provisions of the 2005-2006 NAU Undergraduate Catalog and subsequent catalogs, must take:</p> <ul style="list-style-type: none"> <li>• 3 units of coursework that meet the criteria for the U.S. Ethnic Diversity requirement.</li> </ul>

			<ul style="list-style-type: none"> <li>• 3 units of coursework that meet the criteria for the Global Diversity requirement.</li> </ul> <p><b><i><u>Junior Writing and Senior Capstone</u></i></b></p> <p>There are two university requirements designed to meet the aims and goals of the Liberal Studies program that are embedded within the academic major. They are a junior-level writing course and a senior capstone experience. These courses are designed to build upon learning and skills developed through Liberal Studies and the major.</p> <p><b><i><u>Junior-Level Writing Course</u></i></b></p> <p>These courses are designated with a W at the end of the course number. Junior-level writing courses engage students in the writing process in the context of a discipline or profession.</p> <p><b><i><u>Senior Capstone</u></i></b></p> <p>These courses are designated with a C at the end of the course number. Capstone courses are culminating experiences in the major that involve students in application, synthesis, practice, or inquiry.</p>
<b>Pre-major? (Yes/No. If yes, provide requirements.) Provide email(s)/letter(s)</b>	No	No	No

) of support from home department head(s) for courses not owned by your department.			
<b>List any special requirements to declare or gain admission to this major (completion of specific coursework, minimum GPA, interview, application, etc.)</b>	The Applied Computing program requires a supplemental program application in addition to admission to The University of Arizona. The entrance requirements include: <ul style="list-style-type: none"> <li>· Minimum 2.5 GPA in your college coursework</li> <li>· Resume</li> <li>· Goal statement</li> <li>· AAS degree in computer related field (recommended)</li> </ul>	All students are required to meet general university admission requirements.	None
<b>Major requirements</b>			
<b>Minimum # of units required in major (units counting towards major units and major GPA)</b>	42	56	84
<b>Minimum # of upper-division units required in the major (upper division units counting towards major GPA)</b>	42	45	34
<b>Minimum # of residency units to be completed in the major</b>	30	12	12



<p><b>Required supporting coursework (courses that do not count towards major units and major GPA, but are required for the major). Courses listed must include subject</b></p>	<p>N/A</p>	<p>None</p>	<p>None</p>
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<p><b>code, units, and title. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.</b></p>			
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<p><b>Major requirements (list all required major coursework including major core, major electives, subplan core, and sub-plan electives; courses count towards major units and major GPA) Courses listed must include course prefix, number, units, and title. Mark new coursework (New). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.</b></p>	<p><b><u>Applied Computing CORE (24 Units):</u></b>  CYBV 301--Fundamentals of Cyber Security (3 units)  APCV 302--Statistics in Information Age (3 units)  ENGV 306--Advanced Composition (3 units)  APCV 310--Introduction to Informatics (3 units)  APCV 320--Computational Thinking and Doing (3 units)  CYBV 326--Introductory Methods of Network Analysis (3 units)  CYBV 329--Cyber Ethics (3 units)  APCV 498 or NETV 498--Senior Capstone (3 units)</p> <p><b><u>Software Development</u></b>  CSCV 335--Object-Oriented Programming and Design (3 units)  CSCV 352--System Programming and Unix (3 units)  APCV 361--Data Analysis and Visualization (3 units)  CSCV 337--Web Programming (3 units)  CSCV 381--Mobile Device Programming (3 units)</p> <p><b><u>Choose 1 (3 units)</u></b>  APCV 401--Intro to Human-Computer Interaction (3 units)  CYBV 473--Violent Python (3 units)  CSCV 460--Database Design (3 units)  APCV 496—Special Topics in Informatics</p> <p><b><u>Information Management</u></b>  APCV 360--Database Management Fundamentals (3 units)</p>	<p><b><u>Critical Courses</u></b>  ACO 102: Object-Oriented Programming (CS)  MAT 210: Brief Calculus (MA)  ACO 201: Data Structures and Algorithms (CS)  MAT 243: Discrete Mathematical Structures  ACO 240: Introduction to Programming Languages  STP 226: Elements of Statistics (CS)  ACO 320: Database Systems  ACO 330: Computer Networks  ACO 350: Systems Programming (CS)  ACO 484: Internship OR ACO 499: Individualized Instruction</p> <p><b><u>Upper Division Applied Computing Elective</u></b>  ACO 321: Database Development &amp; Applications  ACO 331: Network Forensics Analysis  ACO 351: Governance Risk and Compliance  ACO 361: Secure Coding Concepts  ACO 394: Special Topics  ACO 420: Big Data Systems  ACO 421: Data Mining and Warehousing  ACO 423: Data Science  ACO 430: Wireless Networks</p>	<p><b><u>Pre-professional Requirements: (19 units)</u></b>  MAT 136: Calculus I MAT 226: Discrete Mathematics (CENE 225: Engineering Analysis , STA 270 Applied Statistics Or STA 275: Statistical Analysis)  Technical electives at the 200level or above, from science and engineering disciplines: AST, BIO, CENE (excluding <a href="#">CENE 225</a>), CHM, CS, EE, GLG, GSP, INF, MAT, ME, PHY and STA (excluding <a href="#">STA 270</a> or <a href="#">STA 275</a>) (9 units).</p> <p><b><u>Major Courses (65 units)</u></b>  CS 105: Computer Tools I  CS 112: Introduction to the World Wide Web and Internet  CS 122: Programming for Engineering and Science  CS 122L: Programming for Engineering and Science Lab  CS 126: Computer Science I  CS 126L: Computer Science I Lab  CS 136: Computer Science II  CS 136L: Computer Science II lab  CS 200: Introduction to Computer Organization  CS 205: Computing Tools II  CS 212: Web Programming I  CS 249: Data Structures</p>
	<p>CSCV 337--Web Programming (3 units)  APCV 361--Data Analysis and</p>	<p>ACO 431: Network Security  ACO 432: Distributed Systems  ACO 461: Security Operations  ACO 494: Special Topics</p>	<p>CS 305: Computing tools III  CS 345: Database Systems  CS 386: Software Engineering</p>

Visualization (3 units)  
CSCV 460--Database Design (3 units)

**Choose 2 (6 units)**

APCV 403--Principles of Web Design (3 units)  
NETV 378--System Administration (3 units)  
NETV 379--Cloud Computing (3 units)  
APCV 496—Special Topics in Informatics

**Digital Design**

APCV 401--Intro to Human-Computer Interaction (3 units)  
APCV 403--Principles of Web Design (3 units)  
APCV 405--Introduction to Game Design (3 units)  
APCV 361--Data Analysis and Visualization (3 units)  
APCV 406--Introduction to Game Development (3 units)

**Choose 1 (3 units)**

APCV 301--Interpreting and Presenting Digitally (3 units)  
APCV 362: Information Design (3 Units)  
APCV 496—Special Topics in Informatics

**Network Operations**

NETV 370--Intro to Network Design and Architecture (3 units)  
NETV 371--Network Security Principles (3 units)  
NETV 374--Routing: Theories and Applications (3 units)  
NETV 375--Advanced Routing and WAN Technologies (3 units)  
NETV 379--Cloud Computing (3 units)  
NETV 479—Advanced Cloud Computing (3 units)

**DevOps Engineering**

CYBV 302 - Linux Security Essentials

CS 476: Requirement Engineering  
CS 480: Operating Systems  
EE 222: Intermediate Programming  
INF 100: Discovering Informatics  
EGR 333W: Technology and Society  
CS 486C: Capstone Experience

	<p>CYBV 303 – Windows Security Essentials  APCV 360 – Database Management Fundamentals  NETV 378 – System Administration  NETV 379 – Cloud Computing  NETV 382 – Network Defense, Incident Response &amp; Disaster Recovery</p> <p><b><u>Cloud Computing</u></b>  NETV 301 – Virtualization: Applications and Best Practices  NETV 379 – Cloud Computing  NETV 380 – Introduction to Microsoft Azure  NETV 381 – Introduction to Amazon Web Services  NETV 479 – Advanced Cloud Computing: Applications and Best Practices  NETV 480 – Cloud Security: Incident Response, Penetration Testing, &amp; Advanced Defense</p> <p><b><u>Applied Artificial Intelligence</u></b>  CSCV 345 – Analysis of Discrete Structures  CSCV 471 – Artificial Intelligence  APCV 361 – Data Analysis and Visualization  CYBV 473 – Violent Python  CYBV 474 – Advanced Analytics for Security Operations</p> <p><b>Choose 1 (3 units)</b>  CYBV 475 – Cyber Deception Detection  NETV 434 – Advanced Network and System Security  APCV 496 – Special Topics in Applied Computing</p>		
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<b>Internship, practicum, applied course requirements (Yes/No. If yes, provide description)</b>	Yes. Students must complete APCV/NETV 498, Senior Capstone, with a minimum 45-hour student engagement experience.	ACO 484: Internship OR ACO 499: Individualized Instruction	CS 486C: Capstone Experience
<b>Senior thesis or senior project required (Yes/No. If yes, provide description)</b>	Yes. Students engage in a senior project and write a senior project thesis paper as part of the APCV/NETV 498—Senior Capstone.	Yes	Yes
<b>Additional requirements (provide description)</b>	Students must earn a minimum 2.0 major GPA.	Major GPA: 2.00 minimum Cumulative GPA: 2.00 minimum	At least 30 units of coursework taken through Northern Arizona University, of which at least 18 must be upper-division courses (300-level or above). This requirement is not met by credit-by-exam, retro-credits, transfer coursework, etc.  A cumulative grade point average of at least 2.0 on all work attempted at Northern Arizona University.
<b>Minor (specify if optional or required)</b>	Optional	Optional	Optional

**VII. Faculty impact**– indicate if new faculty hires will be required to deliver the proposed modified/new curriculum.

**None**

**VIII. Budgetary impact**– indicate new resources needed and source of funding to implement the proposed changes. If reallocating resources, indicate where resources will be taken from and the impact this will have on students/faculty/program/unit.

The proposed Applied Computing program is truly an interdisciplinary information technology program weaving in aspects of development, data, design, and security.

There will not be budgetary requirements or resource reallocation with this proposal. Most courses are currently in the catalog and are offered to support student degree completion.

Although we are adding emphases, it is grouping existing courses in an efficient manner to focus students. Each emphasis directs students to specific market sectors and having the additional specialization course will make students more marketable.

Program growth has been factored in for future budgetary years.

**IX. Required signatures**

**Paul Wagner**

Department Head

Managing unit administrator (print name and title): \_\_\_\_\_



Nov 4, 2020

Managing administrator's signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Linda Lee Denno**

Associate Dean

Managing unit administrator (print name and title): \_\_\_\_\_

Nov 4, 2020



Managing administrator's signature: \_\_\_\_\_

Date: \_\_\_\_\_

Dean (print name): \_\_\_\_\_

Dean's signature: \_\_\_\_\_

Date: \_\_\_\_\_

Dean (print name): \_\_\_\_\_

**Gary A Packard Jr**

Dean's signature: \_\_\_\_\_

**Gary A Packard Jr**

Nov 5, 2020

Date: \_\_\_\_\_

Note: In some situations, signatures of more than one unit head and/or college dean may be required.

For use by Curricular Affairs:

Committee	Approval date
Academic Programs Subcommittee	
Undergraduate Council	

College Academic Administrators Council	
Arizona Board of Regents (if applicable)	

**If ABOR approval required :**

- Notify proposers of approval
- If applicable, create approval memo
- Upload proposal documents to relevant UAccess tables
- Send memo to college/dept and acad\_org listserv.
- Notify ADVIP team and proposers
- If applicable, create new plan code (secondary too)
- If applicable, update emphases
- If applicable, add last admit term to prior plan code(s)
- Upload proposal docs to relevant UAccess table values
- Notify ADVIP team and proposers





# FINAL\_AC\_Request for Curricular Changes Form- Majors

Final Audit Report

2020-11-05

Created:	2020-11-04
By:	Esther M Henley (ehenley@email.arizona.edu)
Status:	Signed
Transaction ID:	CBJCHBCAABAA59rS1DWoVSEGHqvAcM-HTUQkblF5G1mt

## "FINAL\_AC\_Request for Curricular Changes Form- Majors" History

-  Document created by Esther M Henley (ehenley@email.arizona.edu)  
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✔ Agreement completed.

2020-11-05 - 1:12:16 PM GMT

**UNDERGRADUATE EMPHASIS (SUB-PLAN) REQUEST FORM  
MAJORS WITH EXISTING EMPHASES (SUB-PLANS)**

Requests for the creation of a new emphasis requires approval from the school director/department head (managing administrator), college academic dean, Curricular Affairs, Undergraduate Council (UGC), and College Academic Administrators Council (CAAC). Complete this form (for each proposed emphasis) and submit to the [Office of Curricular Affairs](#), no later than January 31, 2021 to be considered for inclusion in the 2021-2022 Academic Catalog.

**I. Requested by (College & School/Department):**

College of Applied Science and Technology  
Department of Applied Technology

**II. Proposer's name, title, email and phone number:**

Li Xu, Program Manager, [lxu@arizona.edu](mailto:lxu@arizona.edu),  
Henry Werchan, Program Manager, [werchanh@arizona.edu](mailto:werchanh@arizona.edu)  
Paul Wagner, Department Head, [paulewagner@arizona.edu](mailto:paulewagner@arizona.edu), 513-255-0435

**III. Degree, major and number of students currently enrolled in the major (include dual majors):**

Career	Plan	Sub Plan	Academic Program	Academic Plan Type	Headcount	Fall 2020	Fall 2020	Fall 2020
						DIST	ONLN	SOUTH
<b>Grand Total</b>					<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>
Undergraduate	Applied Computing	Digital Design	College of Applied Sci & Tech	Major	7	2	4	1
		Information Management	College of Applied Sci & Tech	Major	11		11	
		Network Operations	College of Applied Sci & Tech	Major	32	1	22	9
		Software Development	College of Applied Sci & Tech	Major	24	4	17	3
	<b>Applied Computing Total</b>					<b>74</b>	<b>7</b>	<b>54</b>
	Applied Science	Informatics	College of Applied Sci & Tech	Major	34	8	19	7

	Network Administration	College of Applied Sci & Tech	Major	5	1		4
	Network Operations	College of Applied Sci & Tech	Major	43	5	21	17
<b>Applied Science Total</b>				<b>82</b>	<b>14</b>	<b>40</b>	<b>28</b>
CAST Thematic	Informatics Emphasis	College of Applied Sci & Tech	Minor	2		2	
		College of Science	Minor	3			3
		College of Soc & Behav Sci	Minor	6		6	
<b>CAST Thematic Total</b>				<b>11</b>		<b>8</b>	<b>3</b>
Undergraduate Total				<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>

**IV. Total number of students that have completed the major in the past 3 years: 44**

**V. Complete the table below capturing information about your existing major emphases. Add columns as needed.**

Name of existing emphasis plan(s)	Software Development	Information Management	Digital Design	Network Operations
First term emphasis was offered	Aug 2020	Aug 2020	Aug 2020	Aug 2020
Minimum units required to complete major core and emphasis (total)	45	45	45	45
Minimum upper division (300 level or above) units required to complete major core and emphasis (total)	39	39	39	39
Additional requirements to complete emphasis (supporting coursework*, lecture series, GPA, non-credit workshop)	None	None	None	None
Number of students enrolled in emphasis	24	11	7	75
Total number of students that have completed emphasis in past 3 years	**NA	**NA	**NA	**NA

\*- courses that do not count towards major units and major GPA, but are required for the major

\*\* - The Applied Computing Program was first offered in Fall 2020. There have not been any graduates from this program. There have been 44 graduates from the feeder programs of Network Operations, Network Administration, and Informatics

**VI. Name of the proposed emphasis:  
Applied Artificial Intelligence**

**VII. Campus and location offering-**indicate the campus(es) and location(s) where this emphasis will be offered.

<input type="checkbox"/> Main	<input checked="" type="checkbox"/> UA <input type="checkbox"/> Online	<input type="checkbox"/> Phoenix <input type="checkbox"/> Biomedical	<input checked="" type="checkbox"/> Distance (type in location(s) below): Sierra Vista, Yuma, Chandler, Pima
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**VIII. Provide a rationale for the proposed new emphasis. Survey your current majors to provide evidence of student interest in/demand for the proposed emphasis – attach the survey questions and results at the end of this proposal. Write a short summary of the findings of the survey. Ensure your survey seeks evidence of how the new emphasis will impact existing emphases. You may also include external data (Bureau of Labor Statistics, reports/letters of support from relevant bodies, etc.). Curricular Affairs can provide a job posting/ demand report**

by skills obtained/outcomes of the proposed emphasis. Please contact [Office of Curricular Affairs](#) to request the report for your proposal.

The new Applied AI emphasis integrates the curriculum development efforts on AI across Applied Computing, Computer Science, and Cybersecurity. The emphasis courses in the new emphasis focus on AI algorithm development and applying AI to approach practical application problems. The job market is booming for artificial intelligence engineers, data analysts, data scientists, and programmers, as well as many other AI-related jobs. Forbes noted that artificial intelligence jobs rose more than 29 percent from 2018 to 2019. Analytics Insight estimates that the AI industry is expected to grow from \$18.8 billion in 2019 to \$80.3 billion in 2023. In CAST, in addition to supporting students in Applied Computing, we also expect the new emphasis will engage students in Cyber Operations (700+ students) and Intelligence & Information Operations (200+ students). Applied AI emphasis will provide students a firm understanding of AI technology, its applications, and its use cases. Students will be able to master concepts and tools including machine learning, statistical analysis, and data analytics in applied computing.

Artificial intelligence has been identified as one of the four specific technological advances in addition to ubiquitous high-speed mobile internet, widespread adoption of big data analytics, and cloud technology. The four technological advances have set to dominate the 2018–2022 period as drivers positively affecting business growth. Artificial intelligence has already revolutionized across a broad spectrum of industries including national defense, finance, healthcare, science, media, and business. The job market is booming for artificial intelligence engineers, data analysts, data scientists, and programmers, as well as many other AI-related jobs. High-paying career opportunities in artificial intelligence and related disciplines continue to grow at a rapid pace of about 30% year over year.

In CAST, faculty in Applied Computing and Cyber Security has been developing courses that focus on applying AI to solve problems in practical applications. The new Applied AI emphasis integrates the curriculum development efforts on AI across Applied Computing, Computer Science, and Cybersecurity. It uses the core of Applied Computing to support students to develop a solid foundation in statistics, programming, networking, and cybersecurity. The emphasis courses in the new emphasis focus on AI algorithm development and applying AI to approach practical application problems in secure computing.

Related Positions:

AI Specialist/Developer

Machine Learning Specialist/Engineer

Data Engineer

Data Analyst

Security Programmer

Cybersecurity Application Analyst

IX. At minimum, provide two unique learning outcomes for the proposed emphasis. Which courses in the emphasis will Introduce, Practice, and/or Assess the learning outcomes? Use the table below to provide the information. Add rows as needed.

X.

Learning Outcome	Introduced	Practiced	Assessed
Identify and approach problems computationally based on AI technology	APCV 361 CYBV 473 CSCV 345	CSCV 471 CYBV 474	APCV 498
Use AI to solve problems design computer-based systems	APCV 361 CYBV 473 CSCV 345	CSCV 471 CYBV 474	APCV 498
Prepare for continued professional development	APCV 361	CSCV 471	APCV 498

X. Requirements to meet 40% commonality across emphases. [ABOR Policy 2-221-c. Academic Degree Programs Subspecializations](#) requires all undergraduate emphases within a major to share at least 40% curricular commonality across emphases (known as “major core”-courses counting towards major units and major GPA). List the required major core curriculum required of all emphases. Refer to your existing [advisement report\(s\)](#), if needed. Include the prefix, course number, course title and number of units. Add rows as needed.

<b><u>Requirement Title/Description</u></b>	<b><u>Courses (include prefix, number, title, units)</u></b>	<b><u>Minimum units needed to satisfy requirement</u></b>
General Education	TIER II GENERAL EDUCATION (21 Units) Natural Sciences (3 Units) Arts and Humanities (3 Units) Individuals and Societies (12 Units) Diversity Requirement (3 Units)	21
Major Core	ENGV 306 – Advanced Composition (3 Units) CYBV 329 – Cyber Ethics (3 Units) APCV 302 – Statistics in the Information Age (3 Units) CYBV 326 – Introductory Methods of Network Analysis (3 Units) APCV 320 - Computational Thinking and Doing (3 Units) CYBV 301 – Fundamentals of Cyber Security (3 Units) APCV 310 - Introduction to Informatics (3 Units)	21
	<b>Total major core upper division units required</b>	42
	<b>Total major core units required</b>	42

Requirements specific to the proposed emphasis. List the required emphasis core, electives, and any special conditions students must meet to complete the emphasis using the table below. Include the prefix, course number, course title, and units for each course. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Highlight and label (NEW) any new courses that must be developed for the emphasis. Add rows as needed.

Note: a proposed emphasis having similar curriculum with other plans (within department, college, or university) may require completion of a [comparison chart](#). Total units required for each emphasis must be equal.

<b><u>Requirement Title/Description</u></b>	<b><u>Courses (include prefix, number, title, units)</u></b>	<b><u>Minimum units needed to satisfy requirement</u></b>
Emphasis Core	CSCV 345 – Analysis of Discrete Structures (3 Units) CSCV 471 – Artificial Intelligence (3 Units) APCV 361 – Data Analysis and Visualization (3 Units) CYBV 473 – Violent Python (3 Units) CYBV 474 – Advanced Analytics for Security Operations (3 Units)	15
Emphasis Electives	NETV 434 – Advanced Network and System Security (3 Units) CYBV 475 – Cyber Deception Detection (3 Units) APCV 496 – Special Topics in Informatics (3 Units)	3
	<b>Total emphasis upper division units required</b>	18
	<b>Total major emphasis units required*</b>	60

\* All emphases offered for this major must have the same minimum number of units required



XIII. **Emphasis course/faculty information for existing courses. Complete the table below for all emphasis coursework. You can find information to complete the table using the [UA course catalog](#) or [UAnalytics](#) (Catalog and Schedule Dashboard > “Printable Course Descriptions by Department” On Demand Report; right side of screen). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Add rows as needed.**

Course prefix and number	Title	<a href="#">Course Description</a>	Typically Offered (F, Sp, Su, W) and Frequency (every year, odd years, etc.)	Home Department	Faculty members available to teach the courses
CSCV 345	Analysis of Discrete Structures	Introduction to and analysis of algorithms and characteristics of discrete structures. Course topics include algorithm analysis techniques, recurrence relations, structural induction, hierarchical structures, graphs, hashing, and sorting.	SP	Computer Science	Amanda Smith
APCV 361	Data Analysis and Visualization	This course will lay a foundation for students to understand how to process, analyze, and visualize data. Topics include data collection and integration, exploratory data analysis, statistical inference and modeling, machine learning, and data visualization. The emphasis of the course topics will be placed on integration and synthesis of concepts and their application to solving problems. Students will explore these topics using software tools.	F	Applied Computing	Li Xu
CYBV 473	Violent Python	CYBV 473 will provide students with advanced practical applications of Python programming to support offensive and defensive cybersecurity operations. A crosscut of Python concepts, tools, and techniques will be presented. Students will use interactive programming activities to master and create advanced Python tools to support common cybersecurity tasks.	F, Sp	Cyber Operations	Chester Hosmer
CSCV 471	Artificial Intelligence	The class is an introduction to Artificial Intelligence from a computer science perspective. Emphasis of the course is knowledge representation and reasoning techniques in the design and implementation of intelligent systems. Topics include problem formulation, problem solving and search, knowledge-based systems and inference, and machine learning. Students are expected to identify and analyze real problems in the world around us that might benefit from	F odd years	Computer Science	Diana Saldana

		Artificial Intelligence and to design and implement possible solutions.			
CYBV 474	Advanced Analytics for Security Operations	CYBV474 provides students an in-depth examination of how the Python scripting language can be used to support advanced analysis in offensive and defensive security operations. Students will use hands-on scripting exercises to evaluate the strengths and weaknesses of automated tools to solve complex security-related problems; practice creating and using Python-based algorithmic solutions; and gain a technical understanding on how to apply the existing Python libraries to support common security-related tasks.	F, Sp	Cyber Operations	Chester Hosmer
NETV 434	Advanced Network and System Security	Advanced Network and System Security allows students to apply their knowledge to advanced topics in network and system security. Machine learning and network sensor techniques, as applied to security, allows students to develop, implement and test secure coding practices and secure systems.	F, SP	Applied Computing	Henry Werchan Paul Wagner
APCV 496	Special Topics in Informatics	Content and scope of work will vary depending on topic. The fields of informatics, design, data visualization, and technoscience move at an incredibly fast pace. This course looks at timely, relevant topics that impact tomorrow's scholars, creatives, and designers.	F, Sp	Applied Computing	Ryan Straight

**XIV. Emphasis course/faculty information for NEW courses. Complete the table below. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Add rows as needed. Add rows as needed.**

Course	Title	Course Description	Status*	Anticipated first term offered	Typically Offered (F, Sp, Su, W) and Frequency (every year, odd years, etc.)	Home Dept.	Faculty members available to teach the courses
CYBV 475	Cyber Deception Detection	CYBV475 will provide students with an in-depth investigation into the use of cyber deception techniques in both offensive and defensive operations. The course will focus on the development of new methodologies to create,	S	Fall 2021	F, Sp	Cyber Operations	Chester Hosmer

		detect, analyze, and respond to online cyberdeception campaigns. Students will use interactive programming exercises to detect and counter fake news; fake images; deep fake video and audio; advanced data hiding methods; covert communications; and covert tagging and tracking methods					
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\*In development (D); submitted for approval (S); approved (A)

XIII. Using the table below, list each faculty member who will contribute to the teaching of courses in this emphasis and the teaching FTE they will contribute. Add rows as needed.

Course(s)	Name	Department	Rank	Degree	Faculty/% effort
CSCV 345	Amanda Smith	Applied Technology	Adjunct	MS	20%
CSCV 471	Diana Saldana	Applied Technology	APP	MS	20%
APCV 361	Li Xu	Applied Technology	Professor (Tenured)	PhD	20%
CYBV 473	Chester Hosmer	Applied Technology	APP	BS	20%
CYBV 475	Chester Hosmer	Applied Technology	APP	BS	20%
CYBV 474	Chester Hosmer	Applied Technology	APP	BS	20%
NETV 434	Henry Werchan	Applied Technology	APP	MS	20%
	Paul Wagner		APP	MS	20%
APCV 496	Ryan Straight	Applied Technology	APP	PhD	20%

**Special conditions for admission to/declaration of this emphasis** – explain in detail the criteria to declare this emphasis, including GPA requirements, completion of courses prior to declaration, application process, interviews, etc. These conditions must be approved by faculty governance to be enforced.

The Applied Computing program requires a supplemental program application in addition to admission to The University of Arizona. The entrance requirements include:

- Minimum 2.5 GPA in your college coursework
- Resume
- Goal statement
- AAS degree in computer related field (recommended)

XIV. **Emphasis productivity** – provide a detailed plan in the case the emphasis does not attract the number of anticipated students and/or the new courses have low enrollments. Will emphasis courses continue to be offered as described in Section XIII and XIV or will students be offered alternative courses from outside the emphasis as substitutions? Is the department/school/college committed to offering the courses regardless of the emphasis productivity?

The emphasis courses include CSCV courses that support majors in Computer Science, APCV courses that support majors in existing emphases in Applied Computing, and CYBV courses that support students in Cyber Security. The currently enrolled students are sufficient to regularly rotate the courses to support the new emphasis.

XVII. **Do you want the emphasis name to appear on the transcript?**  Yes  No

XVIII. **Do you want the emphasis name to appear on the diploma?**  Yes  No

XVII. **Anticipated semester and year to launch the proposed emphasis:** Fall 2021

XVIII. **Number of new faculty hires required to deliver the emphasis:** None

XIX. **Budgetary impact**– indicate new resources needed and source of funding to implement the proposed emphasis. If reallocating resources, indicate where resources will be taken from and the impact this will have on the students/faculty/program/unit.

The proposed Applied Computing program is truly an interdisciplinary information technology program weaving in aspects of development, data, design, and security.

There will not be budgetary requirements or resource reallocation with this proposal. Most courses are currently in the catalog and are offered to support student degree completion.

Although we are adding emphases, it is grouping existing courses in an efficient manner to focus students. Each emphasis directs students to specific market sectors and having the additional specialization course will make students more marketable.


Program growth has been factored in for future budgetary years.

Decision process for approval will include:

- 1) efficiency of course offerings.
- 2) course offerings are appropriate and match the expertise of the faculty.
- 3) evidence of sufficient student demand.
- 3) no major conflict with existing programs.

**XXII. Required signatures**

Managing Unit Administrator (print name and title): Paul Wagner Department Head

Managing Administrator's Signature:  Date: Nov 6, 2020

Managing Unit Administrator (print name and title): Linda Lee Denno Associate Dean

Managing Administrator's Signature:  Date: Nov 6, 2020

Dean (print name and title): \_\_\_\_\_

Dean's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Dean(printednameandtitle): GaryAPackard Jr Dean

Dean'sSignature: GaryAPackardJr Date: Nov 9, 2020

**All programs that will be offered through distance learning and/or fully online must include the following signature. The signature of approval does not indicate a commitment to invest in this program. Any potential investment agreement is a separate process.**

Craig Wilson, Vice Provost, Online and Distance Education

Signature: Craig Wilson Date: Nov 9, 2020

Note: In some situations, signatures of more than one unit head and/or college dean may be required.

**For use by Curricular Affairs:**

Committee	Approval date
Academic Programs Subcommittee	
Undergraduate Council	
College Academic Administrators Council	

- Create approval memo
- Send memo to college/dept and acad\_org listserv
- Create emphasis code in UAccess, including secondary major emphasis code
- Upload approval memo and proposal documents to UAccess
- Notify acad\_org of the plan code creation
- Notify ADVIP team, include proposers









# FINAL\_Applied AI\_Undergraduate Emphasis Request Form\_EXISTING\_EMPHASES\_for 2021 (004)

Final Audit Report


2020-11-09

Created:	2020-11-
By:	Esther M Henley (ehenley@email.arizona.edu)
Status:	Signed

## "FINAL\_Applied AI\_Undergraduate Emphasis RequestForm\_EXISTING\_EMPHASES\_for 2021 (004)" History

-  Document created by Esther M Henley (ehenley@email.arizona.edu)  
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-  Email viewed by Paul Wagner (paulewagner@arizona.edu)  
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2020-11-06 - 11:51:05 PM GMT
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2020-11-07 - 0:35:41 AM GMT- IP address: 70.190.158.196
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 Document e-signed by Craig Wilson (craigwilson@arizona.edu)

Signature Date: 2020-11-09 - 6:43:34 PM GMT - Time Source: server- IP address: 150.135.165.47

 Agreement completed.

2020-11-09 - 6:43:34 PM GMT



THE UNIVERSITY  
OF ARIZONA

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**UNDERGRADUATE EMPHASIS (SUB-PLAN) REQUEST FORM  
MAJORS WITH EXISTING EMPHASES (SUB-PLANS)**

Requests for the creation of a new emphasis requires approval from the school director/department head (managing administrator), college academic dean, Curricular Affairs, Undergraduate Council (UGC), and College Academic Administrators Council (CAAC). Complete this form (for each proposed emphasis) and submit to the [Office of Curricular Affairs](#), no later than January 31, 2021 to be considered for inclusion in the 2021-2022 Academic Catalog.

**I. Requested by (College & School/Department):**

College of Applied Science and Technology  
Department of Applied Technology

**II. Proposer's name, title, email and phone number:**

Li Xu, Program Manager, [lxu@arizona.edu](mailto:lxu@arizona.edu),  
Henry Werchan, Program Manager, [werchanh@arizona.edu](mailto:werchanh@arizona.edu)  
Paul Wagner, Department Head, [paulewagner@arizona.edu](mailto:paulewagner@arizona.edu), 513-255-0435

**III. Degree, major and number of students currently enrolled in the major (include dual majors):**

Career	Plan	Sub Plan	Academic Program	Academic Plan Type	Headcount	Fall 2020	Fall 2020	Fall 2020
						DIST	ONLN	SOUTH
<b>Grand Total</b>					<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>
Undergraduate	Applied Computing	Digital Design	College of Applied Sci & Tech	Major	7	2	4	1
		Information Management	College of Applied Sci & Tech	Major	11		11	
		Network Operations	College of Applied Sci & Tech	Major	32	1	22	9
		Software Development	College of Applied Sci & Tech	Major	24	4	17	3
	<b>Applied Computing Total</b>					<b>74</b>	<b>7</b>	<b>54</b>
	Applied Science	Informatics	College of Applied Sci & Tech	Major	34	8	19	7

	Network Administration	College of Applied Sci & Tech	Major	5	1		4
	Network Operations	College of Applied Sci & Tech	Major	43	5	21	17
<b>Applied Science Total</b>				<b>82</b>	<b>14</b>	<b>40</b>	<b>28</b>
CAST Thematic	Informatics Emphasis	College of Applied Sci & Tech	Minor	2		2	
		College of Science	Minor	3			3
		College of Soc & Behav Sci	Minor	6		6	
<b>CAST Thematic Total</b>				<b>11</b>		<b>8</b>	<b>3</b>
Undergraduate Total				<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>

**IV. Total number of students that have completed the major in the past 3 years: 44**

**V. Complete the table below capturing information about your existing major emphases. Add columns as needed.**

Name of existing emphasis plan(s)	Software Development	Information Management	Digital Design	Network Operations
First term emphasis was offered	Aug 2020	Aug 2020	Aug 2020	Aug 2020
Minimum units required to complete major core and emphasis (total)	45	45	45	45
Minimum upper division (300 level or above) units required to complete major core and emphasis (total)	39	39	39	39
Additional requirements to complete emphasis (supporting coursework*, lecture series, GPA, non-credit workshop)	None	None	None	None
Number of students enrolled in emphasis	24	11	7	75
Total number of students that have completed emphasis in past 3 years	**NA	**NA	**NA	**NA

\*- courses that do not count towards major units and major GPA, but are required for the major

\*\* - The Applied Computing Program was first offered in Fall 2020. There have not been any graduates from this program. There have been 44 graduates from the feeder programs of Network Operations, Network Administration, and Informatics

**VI. Name of the proposed emphasis:  
Cloud Computing**

**VII. Campus and location offering-**indicate the campus(es) and location(s) where this emphasis will be offered.

<input type="checkbox"/> Main	<input checked="" type="checkbox"/> UA <input type="checkbox"/> Online	<input type="checkbox"/> Phoenix <input type="checkbox"/> Biomedical	<input checked="" type="checkbox"/> Distance (type in location(s) below): Sierra Vista, Yuma, Chandler, Pima
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**VIII. Provide a rationale for the proposed new emphasis. Survey your current majors to provide evidence of student interest in/demand for the proposed emphasis – attach the survey questions and results at the end of this proposal. Write a short summary of the findings of the survey. Ensure your survey seeks evidence of how the new emphasis will impact existing emphases. You may also include external data (Bureau of Labor Statistics, reports/letters of support from relevant bodies, etc.). Curricular Affairs can provide a job posting/ demand report**

by skills obtained/outcomes of the proposed emphasis. Please contact [Office of Curricular Affairs](#) to request the report for your proposal.

At the College of Applied Science and Technology, faculty in Applied Computing have been developing courses that focus on applying Cloud Computing to solve problems in practical applications. The demand for cloud computing skills is on the rise as more and more companies are adopting cloud services. According to Forbes, the worldwide spend on cloud computing services will grow at a 19.4% compound annual growth rate (CAGR) from nearly \$70B in 2015 to more than \$141B in 2019. And with that growth, comes the demand for the cloud professionals who will manage the technology ([The Top Cloud Skills in Demand for 2019](#)).

Related Positions:

- Software architect
- Cloud engineer
- Data engineer

IX. At minimum, provide two unique learning outcomes for the proposed emphasis. Which courses in the emphasis will Introduce, Practice, and/or Assess the learning outcomes? Use the table below to provide the information. Add rows as needed.

Learning Outcome	Introduced	Practiced	Assessed
Identify and approach problems computationally based on Cloud Computing technology	NETV 379 NETV 301	NETV 380 NETV 381 NETV 479	APCV 498 NETV 480
Use Cloud Computing to solve problems and design computer-based systems	NETV 379 NETV 301	NETV 380 NETV 381 NETV 479	APCV 498 NETV 480
Prepare for continued professional development	NETV 379 NETV 301	NETV 380 NETV 381 NETV 479	APCV 498 NETV 480

X. Requirements to meet 40% commonality across emphases. [ABOR Policy 2-221-c. Academic Degree Programs Subspecializations](#) requires all undergraduate emphases within a major to share at least 40% curricular commonality across emphases (known as “major core”-courses counting towards major units and major GPA). List the required major core curriculum required of all emphases. Refer to your existing [advisement report\(s\)](#), if needed. Include the prefix, course number, course title and number of units. Add rows as needed.

<u>Requirement Title/Description</u>	<u>Courses (include prefix, number, title, units)</u>	<u>Minimum units needed to satisfy requirement</u>
General Education	TIER II GENERAL EDUCATION (21 Units) Natural Sciences (3 Units) Arts and Humanities (3 Units) Individualsand Societies(12 Units) Diversity Requirement (3 Units)	21
Major Core	ENGV 306 – Advanced Composition (3 Units) CYBV 329 – Cyber Ethics (3 Units) APCV 302 – Statistics in the Information Age (3 Units) CYBV 326 – Introductory Methods of Network Analysis (3 Units) APCV 320 - Computational Thinking and Doing (3 Units) CYBV 301 – Fundamentals of Cyber Security (3 Units) APCV 310 - Introduction to Informatics (3 Units)	21
	<b>Total major core upper division units required</b>	42

	<b>Total major core units required</b>	42
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Requirements specific to the proposed emphasis. List the required emphasis core, electives, and any special conditions students must meet to complete the emphasis using the table below. Include the prefix, course number, course title, and units for each course. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Highlight and label (NEW) any new courses that must be developed for the emphasis. Add rows as needed.

Note: a proposed emphasis having similar curriculum with other plans (within department, college, or university) may require completion of a [comparison chart](#). Total units required for each emphasis must be equal.

<u>Requirement Title/Description</u>	<u>Courses (include prefix, number, title, units)</u>	<u>Minimum units _ needed to satisfy requirement</u>
Emphasis Core	NETV 301 – Virtualization: Applications and Best Practices (3 Unit) (NEW) NETV 379 – Cloud Computing (3 Units) NETV 380 – Introduction to Microsoft Azure (3 Units) (NEW) NETV 381 – Introduction to Amazon Web Services (3 Units) (NEW) NETV 479 – Advanced Cloud Computing: Applications and Best Practices (3 Units) NETV 480 – Cloud Security: Incident Response, Penetration Testing, and Advanced Defense (3 Units) (NEW)	18
	<b>Total emphasis upper division units required</b>	18
	<b>Total major emphasis units required*</b>	60

\* All emphases offered for this major must have the same minimum number of units required

XII. **Emphasis course/faculty information for existing courses. Complete the table below for all emphasis coursework. You can find information to complete the table using the [UA course catalog](#) or [UAnalytics](#) (Catalog and Schedule Dashboard > “Printable Course Descriptions by Department” On Demand Report; right side of screen). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Add rows as needed.**

Course prefix and number	Title	<u>Course Description</u>	Typically Offered (F, Sp, Su, W) and Frequency (every year, odd years, etc.)	Home Department	Faculty members available to teach the courses
NETV 379	Cloud Computing	Course covers the theory and application of cloud computing, including Cloud Computing network design and connectivity, server management, best-practices, security, and provider service level agreements. Case studies of industry examples are used as applications to reinforce the discussed theories.	F, Sp, Su	Applied Computing	Henry Werchan Paul Wagner Patrick Heming
NETV 479	Advanced Cloud Computing: Applications and Best Practices	NETV 479 reviews theory and application of cloud computing. It builds upon this and delves into advanced cloud computing concepts including virtualization, containerization, microservices, cloud storage and programming, software defined architectures (compute, storage and networking), and advanced cloud security. The course also establishes the economic foundations of cloud computing and how to evaluate different cloud service provider offerings. There is a significant application of hands-on exercises to give the student a practical understanding of these advanced topics.	F, Sp, Su	Applied Computing	Henry Werchan Paul Wagner Patrick Heming

XIII. **Emphasis course/faculty information for NEW courses. Complete the table below. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Add rows as needed. Add rows as needed.**

Course	Title	Course Description	Status*	Anticipated first term offered	Typically Offered (F, Sp, Su, W) and Frequency (every year, odd years, etc.)	Home Dept.	Faculty members available to teach the courses
NETV 301	Virtualization: Applications	NETV 301 introduces the theory and application of virtualization. Virtualization is an increasingly	S	Fall 2021	F, Sp, Su	Applied Computing	Henry Werchan Paul Wagner Patrick Heming



	and Best Practices	ubiquitous feature of current computing architectures. This course is an introduction to virtualization concepts and technologies. It delves into advanced virtualization concepts including containerization, microservices, software defined architectures, and virtualization security. Topics to be covered include: basics of virtualmachines, containers and microservices; CPU, memory, storage and network virtualization; paravirtualization, hardware virtualization, and OS-level virtualization (containers); hardware features supporting virtualization and nested virtualization. Actual virtualization software will be used to provide hands-on experience with virtualization.					
NETV 380	Introduction to Microsoft Azure	NETV 380 develops technical expertise in cloud computing architecture, design and implementation using Microsoft Azure. Microsoft Azure is an ever-expanding set of cloud services to help organization meet their business challenges. Azure provides the ability to build, manage, and deploy applications on a massive, global network using well established tools and frameworks. This course will address designing Azure compute infrastructures, including virtual machines, web applications, serverless and microservices. It will address designing effective network implementations in Azure as well as designing data implementationsusingdifferent	S	Fall 2021	F, Sp, Su	Applied Computing	Henry Werchan Paul Wagner Patrick Heming

		data services, relational database storage, and NoSQL storage. It will include practical hands-on experiencesolvingreal-worldcloud computing problems with Azure.					
NETV 381	Introduction to Amazon Web Services	NETV 381 develops technical expertise in cloud computing architecture, design and implementation using Amazon Web Services (AWS). Amazon Web Services (AWS) is a comprehensive and broadly adopted cloud platform, offering over 175 fully featured services from data centers globally. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—use AWS to lower costs, become more agile, and innovate faster. This course will address applying AWS business and technical tools and architecting and designing cloud solutions using AWS. This course will address how AWS can help meet compliance, governance, and regulatory requirements. It will include practical hands-on experience solvingreal-world cloud computing problems with AWS.	S	Fall 2021	F, Sp, Su	Applied Computing	Henry Werchan Paul Wagner Patrick Heming
NETV 480	Cloud Security: Incident Response, Penetration Testing, and Advanced Defense	NETV480 addresses the theory and best practice application of security in cloud computing. Cloud computing has become ubiquitous in the information technology and service provisioning sectors, allowing for on-demand, highly elastic, and seemingly infinitely scalable compute and storage capabilities, and supports the secure delivery of business-critical enterprise applications and			F, Sp, Su	Applied Computing	Henry Werchan Paul Wagner Patrick Heming

		<p>services. Given the growing importance of cloud delivered services and their very distributed nature, it is imperative that they be afforded proper security. This course will review cloud concepts, architecture, and design, then proceed to addressing cloud data security, cloud platform and infrastructure security, cloud application security, cloud security operations, cloud risk management and compliance management. This course leverages cloud computing security guidelines set forth by the International Organization for Standardization (ISO), European Union Agency for Network and Information Security (ENISA), National Institute of Standards and Technology (NIST), and the Cloud Security Alliance(CSA).</p>					
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\*In development (D); submitted for approval (S); approved (A)

XIII. Using the table below, list each faculty member who will contribute to the teaching of courses in this emphasis and the teaching FTE they will contribute. Add rows as needed.

Course(s)	Name	Department	Rank	Degree	Faculty/% effort
NETV 301	Henry Werchan Patrick Heming	Applied Technology	APP Adjunct	MS MS	20% 20%
NETV 379	Henry Werchan Patrick Heming	Applied Technology	APP Adjunct	MS MS	20% 20%
NETV 380	Henry Werchan Patrick Heming	Applied Technology	APP Adjunct	MS MS	20% 20%
NETV 381	Henry Werchan Patrick Heming	Applied Technology	APP Adjunct	MS MS	20% 20%
NETV 479	Henry Werchan	Applied Technology	APP Adjunct	MS	20%
NETV 480	Henry Werchan	Applied Technology	APP Adjunct	MS	20%

**Special conditions for admission to/declaration of this emphasis** – explain in detail the criteria to declare this emphasis, including GPA requirements, completion of courses prior to declaration, application process, interviews, etc. These conditions must be approved by faculty governance to be enforced.

The Applied Computing program requires a supplemental program application in addition to admission to The University of Arizona. The entrance requirements include:

- Minimum 2.5 GPA in your college coursework
- Resume
- Goal statement
- AAS degree in computer related field (recommended)

XIV. **Emphasis productivity** – provide a detailed plan in the case the emphasis does not attract the number of anticipated students and/or the new courses have low enrollments. Will emphasis courses continue to be offered as described in Section XIII and XIV or will students be offered alternative courses from outside the emphasis as substitutions? Is the department/school/college committed to offering the courses regardless of the emphasis productivity?

If courses do not remain full or at sufficient capacity, then students will be enrolled in Network Operations or DevOps courses. These courses are sufficiently aligned with the area of emphasis.

XVII. **Do you want the emphasis name to appear on the transcript?**  Yes  No

XVIII. **Do you want the emphasis name to appear on the diploma?**  Yes  No

XVII. **Anticipated semester and year to launch the proposed emphasis:** Fall 2021

XVIII. **Number of new faculty hires required to deliver the emphasis:** None

XIX. **Budgetary impact**– indicate new resources needed and source of funding to implement the proposed emphasis. If reallocating resources, indicate where resources will be taken from and the impact this will have on the students/faculty/program/unit.

The proposed Applied Computing program is truly an interdisciplinary information technology program weaving in aspects of development, data, design and security.

There will not be budgetary requirements or resource reallocation with this proposal. Most courses are currently in the catalog and are offered to support student degree completion.

Although we are adding emphases, it is grouping existing courses in an efficient manner to focus students. Each emphasis directs students to specific market sectors and having the additional specialization course will make students more marketable.

Program growth has been factored in for future budgetary years.

Decision process for approval will include:

- 1) efficiency of course offerings.
- 2) course offerings are appropriate and match the expertise of the faculty.
- 3) evidence of sufficient student demand.
- 3) no major conflict with existing programs.

**XXII. Required signatures**

Managing Unit Administrator (print name and title): Paul Wagner Department Head

Managing Administrator's Signature:  Date: Nov 4, 2020

Managing Unit Administrator (print name and title): LindaLeeDenno Associate Dean

Managing Administrator's Signature:  Date: ~~Nov 4, 2020~~

Dean (print name and title): \_\_\_\_\_

Dean's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Gary A Packard Jr (Dean)**

Dean (printed name and title): \_\_\_\_\_

Dean's Signature: GaryAPackardJr(Dean) Date: Nov 5, 2020

**All programs that will be offered through distance learning and/or fully online must include the following signature. The signature of approval does not indicate a commitment to invest in this program. Any potential investment agreement is a separate process.**

Craig Wilson, Vice Provost, Online and Distance Education

Signature: Craig Wilson Date: Nov 16, 2020

Note: In some situations, signatures of more than one unit head and/or college dean may be required.

**For use by Curricular Affairs:**

Committee	Approval date
Academic Programs Subcommittee	
Undergraduate Council	
College Academic Administrators Council	

- Create approval memo
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# FINAL\_Cloud Computing\_Undergraduate Emphasis Request Form\_EXISTING\_EMPHAS ES\_for 2021

Final Audit Report

2020-11-16


Created:	2020-11-
By:	Esther M Henley (ehenley@email.arizona.edu)
Status:	Signed

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-  Document created by Esther M Henley (ehenley@email.arizona.edu)  
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Signature Date: 2020-11-05 - 1:08:28 PM GMT - Time Source: server- IP address: 150.135.165.139

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2020-11-16 - 6:01:52 PM GMT- IP address: 150.135.165.22

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Signature Date: 2020-11-16 - 6:04:03 PM GMT - Time Source: server- IP address: 150.135.165.51

 Agreement completed.

2020-11-16 - 6:04:03 PM GMT



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**UNDERGRADUATE EMPHASIS (SUB-PLAN) REQUEST FORM  
MAJORS WITH EXISTING EMPHASES (SUB-PLANS)**

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Department of Applied Technology

**II. Proposer's name, title, email and phone number:**

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Henry Werchan, Program Manager, [werchanh@arizona.edu](mailto:werchanh@arizona.edu)  
Paul Wagner, Department Head, [paulewagner@arizona.edu](mailto:paulewagner@arizona.edu), 513-255-0435

**III. Degree, major and number of students currently enrolled in the major (include dual majors):**

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		College of Soc & Behav Sci	Minor	6		6	
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Undergraduate Total				<b>164</b>	<b>21</b>	<b>100</b>	<b>43</b>

**IV. Total number of students that have completed the major in the past 3 years: 44**

**V. Complete the table below capturing information about your existing major emphases. Add columns as needed.**

Name of existing emphasis plan(s)	Software Development	Information Management	Digital Design	Network Operations
First term emphasis was offered	Aug 2020	Aug 2020	Aug 2020	Aug 2020
Minimum units required to complete major core and emphasis (total)	45	45	45	45
Minimum upper division (300 level or above) units required to complete major core and emphasis (total)	39	39	39	39
Additional requirements to complete emphasis (supporting coursework*, lecture series, GPA, non-credit workshop)	None	None	None	None
Number of students enrolled in emphasis	24	11	7	75
Total number of students that have completed emphasis in past 3 years	**NA	**NA	**NA	**NA

\*- courses that do not count towards major units and major GPA but are required for the major

\*\*.-The Applied Computing Program was first offered in Fall 2020. There have not been any graduates from this program. There have been 44 graduates from the feeder programs of Network Operations, Network Administration, and Informatics

**VI. Name of the proposed emphasis:**

DevOps Engineering

**VII. Campus and location offering-**indicate the campus(es) and location(s) where this emphasis will be offered.

<input type="checkbox"/> Main	<input checked="" type="checkbox"/> UA Online	<input type="checkbox"/> Phoenix Biomedical	<input checked="" type="checkbox"/> Distance (type in location(s) below): Sierra Vista Chandler Yuma Pima
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**VIII. Provide a rationale for the proposed new emphasis. Survey your current majors to provide evidence of student interest in/demand for the proposed emphasis – attach the survey questions and results at the end of this proposal. Write a short summary of the findings of the survey. Ensure your survey seeks evidence of how the new emphasis will impact existing emphases. You may also include external data (Bureau of Labor Statistics,**

reports/letters of support from relevant bodies, etc.). Curricular Affairs can provide a job posting/ demand report by skills obtained/outcomes of the proposed emphasis. Please contact [Office of Curricular Affairs](#) to request the report for your proposal.

At the College of Applied Science and Technology, faculty in Applied Computing has been developing courses that focus on applying DevOps, or Development and Operations, to solve problems in practical applications. According to Amazon Web Services, "DevOps is the combination of cultural philosophies, practices, and tools that increases an organization's ability to deliver applications and services at high velocity: evolving and improving products at a faster pace than organizations using traditional software development and infrastructure management processes. This speed enables organizations to better serve their customers and compete more effectively in the market." ([What is DevOps?](#)).

DevOps is a method of software development that takes the entire software lifecycle into account, from planning to use and maintenance. It is a very popular framework in the cloud computing industry... ([The Top Cloud Computing Skills You Need To Pick Up This Year](#)).

The new DevOps Engineering emphasis integrates the curriculum development efforts of DevOps across Applied Computing, Computer Science, and Cybersecurity. It uses the core of Applied Computing to support students to develop a solid foundation in statistics, programming, networking, and cybersecurity. The specialization courses in the new emphasis focus on DevOps development and applying DevOps to approach practical application problems in secure computing. Students will study applying DevOps in a hands-on, interdisciplinary approach with peers and faculty members in Applied Computing, Computer Science, and Cyber Security.

Related Positions:

- Software engineer
- Software architect
- Development operations engineer
- Full stack developer
- Data engineer

**IX. At minimum, provide two unique learning outcomes for the proposed emphasis. Which courses in the emphasis will Introduce, Practice, and/or Assess the learning outcomes? Use the table below to provide the information. Add rows as needed.**

Learning Outcome	Introduced	Practiced	Assessed
Identify and approach problems computationally based on DevOps technology	CYBV 302 CYBV 303 APCV 360	NETV 378 NETV 371/382 NETV 379	APCV 498
Use DevOps to solve problems and design computer-based systems	CYBV 302 CYBV 303 APCV 360	NETV 378 NETV 371/382 NETV 379	APCV 498
Prepare for continued professional development	CYBV 302 CYBV 303 APCV 360	NETV 378 NETV 371/382 NETV 379	APCV 498

**X. Requirements to meet 40% commonality across emphases. [ABOR Policy 2-221-c. Academic Degree Programs Subspecializations](#) requires all undergraduate emphases within a major to share at least 40% curricular commonality across emphases (known as “major core”-courses counting towards major units and major GPA).**

List the required major core curriculum required of all emphases. Refer to your existing [advisement report\(s\)](#), if needed. Include the prefix, course number, course title and number of units. Add rows as needed.

<u>Requirement Title/Description</u>	<u>Courses (include prefix, number, title, units)</u>	<u>Minimum units needed to satisfy requirement</u>
General Education	TIER II GENERAL EDUCATION (21 Units) Sciences (3 Units) Arts and Humanities (3 Units) Individualsand Societies(12 Units) Diversity Requirement (3 Units)	21
Major Core	ENGV 306 – Advanced Composition (3 Units) CYBV 329 – Cyber Ethics (3 Units) APCV 302 – Statistics in the Information Age (3 Units) CYBV 326 – Introductory Methods of Network Analysis (3 Units) APCV 320 - Computational Thinking and Doing (3 Units) CYBV 301 – Fundamentals of Cyber Security (3 Units) APCV 310 - Introduction to Informatics (3 Units)	21
	<b>Total major core upper division units required</b>	42
	<b>Total major core units required</b>	42

Requirements specific to the proposed emphasis. List the required emphasis core, electives, and any special conditions students must meet to complete the emphasis using the table below. Include the prefix, course number, course title, and units for each course. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Highlight and label (NEW) any new courses that must be developed for the emphasis. Add rows as needed  
Note: a proposed emphasis having similar curriculum with other plans (within department, college, or university) may require completion of a [comparison chart](#). Total units required for each emphasis must be equal.

<u>Requirement Title/Description</u>	<u>Courses (include prefix, number, title, units)</u>	<u>Minimum units _ needed to satisfy requirement</u>
Emphasis Core	CYBV 302 – Linux Security Essentials (3 Units) CYBV 303 – Windows Security Essentials (3 Units) APCV 360 – Database Management Fundamentals (3 Units) NETV 378 – System Administration (3 Units) NETV 382 – Network Defense, Incident Response & Disaster Recovery (3 Units)	15
Emphasis Electives	NETV 371 – Network Security Principles (3 Units) NETV 379 – Cloud Computing (3 Units)	3
	<b>Total emphasis upper division units required</b>	18
	<b>Total major emphasis units required*</b>	60

\* All emphases offered for this major must have the same minimum number of units required



**XII. Emphasis course/faculty information for existing courses. Complete the table below for all emphasis coursework. You can find information to complete the table using the [UA course catalog](#) or [UAnalytics \(Catalog and Schedule Dashboard> “Printable Course Descriptions by Department” On Demand Report; right side of screen\)](#). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Add rows as needed.**

<b>Course prefix and number</b>	<b>Title</b>	<b><a href="#">Course Description</a></b>	<b>Typically Offered (F, Sp, Su, W) and Frequency (every year, odd years, etc.)</b>	<b>Home Department</b>	<b>Faculty members available to teach the courses</b>
CYBV 302	Linux Security Essentials	CYBV 302 provides students with an in-depth analysis of Linux and Unix security issues. This includes configuration guidance using industry standards and benchmarks and implementation through practical, real world examples. The course will examine how to mitigate or eliminate general problems that apply to Nix like OSs, including vulnerabilities in passwords and password authentication systems, virtual memory system, and applications most commonly run.	F, Sp, Su	Cyber Operations	Thomas Jewkes Paul Wagner Jonathan Martinez Patrick Heming
CYBV 303	Windows Security Essentials	CYBV 303 provides students with the foundational knowledge of the Windows Operating System and securing Windows environments including; learning PowerShell scripting, host hardening and active directory scripting, smart tokens and Public Key Infrastructure (PKI), protecting admin credentials, and thwarting hackers inside the network. Students will use hands-on labs and exercises to secure Windows systems, networks, applications, and data.	F, Sp, Su	Cyber Operations	Thomas Jewkes Paul Wagner Jonathan Martinez Patrick Heming
APCV 360	Database Management Fundamentals	This course provides an introduction to database management concepts	F, Sp	Applied Computing	Li Xu Diana Saldana

		including definitions of data elements, basic data structures, data modeling, and systems architectures. Topics also cover some of the leading database management products and design tools currently in use.			
NETV 378	System Administration	This course covers the theory and application of system administration from a UNIX and Windows perspective, including installation, management, optimization, and security. Case studies of industry examples are used as applications to reinforce the discussed theories.	F, Sp	Applied Computing	Henry Werchan Paul Wagner Patrick Heming Gurmindersingh Khalsa
NETV 382	Network Defense, Incident Response & Disaster Recovery	NETV 382 provides network defenders with the skills to respond quickly to incidents and recover critical data in the event of a disaster. Students will earn the Active Cyber Defense Cycle (ACDC) and apply the concepts of cyber intelligence and network security monitoring towards the response and defense of networks.	F, Sp	Applied Computing	Henry Werchan Paul Wagner Patrick Heming Gurmindersingh Khalsa
NETV 371	Network Security Principles	In-depth coverage of current risks and threats to an organization's information including methods of addressing the safeguarding of these critical assets. Coverage includes theoretical and historical background necessary to understand the various risks and hands on techniques for working in the security field.	F, Sp	Applied Computing	Henry Werchan Paul Wagner Patrick Heming Gurmindersingh Khalsa

NETV 379	Cloud Computing	Course covers the theory and application of cloud computing, including Cloud Computing network design and connectivity, server management, best-practices, security, and provider service level agreements. Case studies of industry examples are used as applications to reinforce the discussed theories.	Su	Applied Computing	Henry Werchan Paul Wagner
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**XIII. Emphasis course/faculty information for NEW courses. Complete the table below. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department. Add rows as needed. Add rows as needed.**

Course	Title	Course Description	Status*	Anticipated first term offered	Typically Offered (F, Sp, Su, W) and Frequency (every year, odd years, etc.)	Home Dept.	Faculty members available to teach the courses

\*In development (D); submitted for approval (S); approved (A)

**III. Using the table below, list each faculty member who will contribute to the teaching of courses in this emphasis and the teaching FTE they will contribute. Add rows as needed.**

Course(s)	Name	Department	Rank	Degree	Faculty/% effort
CYBV 302	Thomas Jewkes Paul Wagner Jonathan Martinez Patrick Heming	Applied Technology	APP APP Adjunct Adjunct	MS MS MS MS	20% 20% 20% 20%
CYBV 303	Thomas Jewkes Paul Wagner Jonathan Martinez Patrick Heming	Applied Technology	APP APP Adjunct Adjunct	MS MS MS MS	20% 20% 20% 20%
APCV 360	Li Xu Diana Saldana	Applied Technology	Professor (Tenured) APP	PhD MS	20% 20%
NETV 378	Henry Werchan Paul Wagner Patrick Heming Gurmindersingh Khalsa	Applied Computing	APP APP Adjunct Adjunct	MS MS MS MS	20% 20% 20% 20%
NETV 382	Henry Werchan Paul Wagner Patrick Heming Gurmindersingh Khalsa	Applied Computing	APP APP Adjunct Adjunct	MS MS MS MS	20% 20% 20% 20%
NETV 371	Henry Werchan Paul Wagner	Applied Computing	APP APP	MS MS	20% 20%

	Patrick Heming Gurmindersingh Khalsa		Adjunct Adjunct	MS MS	20% 20%
NETV 379	Henry Werchan Paul Wagner	Applied Computing	APP APP	MS	20%

**Special conditions for admission to/declaration of this emphasis** – explain in detail the criteria to declare this emphasis, including GPA requirements, completion of courses prior to declaration, application process, interviews, etc. These conditions must be approved by faculty governance to be enforced.

The Applied Computing program requires a supplemental program application in addition to admission to The University of Arizona. The entrance requirements include:

- Minimum 2.5 GPA in your college coursework
- Resume
- Goal statement
- AAS degree in computer related field (recommended)

**IV. Emphasis productivity** – provide a detailed plan in the case the emphasis does not attract the number of anticipated students and/or the new courses have low enrollments. Will emphasis courses continue to be offered as described in Section XIII and XIV or will students be offered alternative courses from outside the emphasis as substitutions? Is the department/school/college committed to offering the courses regardless of the emphasis productivity?

If courses do not remain full or at sufficient capacity, then students will be enrolled in Network Operations or DevOps Engineering courses. These courses are sufficiently aligned with the area of emphasis.

**XVII. Do you want the emphasis name to appear on the transcript?**  Yes  No

**XVIII. Do you want the emphasis name to appear on the diploma?**  Yes  No

**VII. Anticipated semester and year to launch the proposed emphasis:** Fall 2021

**VIII. Number of new faculty hires required to deliver the emphasis:** None

**IX. Budgetary impact**– indicate new resources needed and source of funding to implement the proposed emphasis. If reallocating resources, indicate where resources will be taken from and the impact this will have on the students/faculty/program/unit.

The proposed Applied Computing program is truly an interdisciplinary information technology program weaving in aspects of development, data, design, and security.

There will not be budgetary requirements or resource reallocation with this proposal. All courses are currently in the catalog and are offered to support student degree completion.

Although we are adding emphases, it is grouping existing courses in an efficient manner to focus students. Each emphasis directs students to specific market sectors and having the additional specialization course will make students more marketable.

Program growth has been factored in for future budgetary years.


Decision process for approval will include:

- 1) efficiency of course offerings.
- 2) course offerings are appropriate and match the expertise of the faculty.
- 3) evidence of sufficient student demand.
- 3) no major conflict with existing programs.



**XXII. Required signatures**

Managing Unit Administrator (print name and title): Paul Wagner Department Head

Managing Administrator's Signature:  Date: Nov 4, 2020

Managing Unit Administrator (print name and title): Linda Lee Denno Associate Dean

Managing Administrator's Signature:  Date: Nov 4, 2020

Dean (print name and title): Gary A Packard Jr. Dean

Dean's Signature: Gary A Packard Jr. Date: Nov 5, 2020

Dean (printed name and title): \_\_\_\_\_

Dean's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**All programs that will be offered through distance learning and/or fully online must include the following signature. The signature of approval does not indicate a commitment to invest in this program. Any potential investment agreement is a separate process.**

Craig Wilson, Vice Provost, Online and Distance Education  
Signature: Craig Wilson Date: Nov 16, 2020

Note: In some situations, signatures of more than one unit head and/or college dean may be required.

For use by Curricular Affairs:

Committee	Approval date
Academic Programs Subcommittee	
Undergraduate Council	
College Academic Administrators Council	

- Create approval memo
- Send memo to college/dept and acad\_org listserv
- Create emphasis code in UAccess, including secondary major emphasis code
- Upload approval memo and proposal documents to UAccess
- Notify acad\_org of the plan code creation
- Notify ADVIP team, include proposers









# FINAL\_DevOps\_Undergraduate Emphasis Request Form\_EXISTING\_EMPHASES\_for 2021

Final Audit Report

2020-11-16

Created:	2020-11-
By:	Esther M Henley (ehenley@email.arizona.edu)
Status:	Signed

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