North Dakota Statewide Articulation Agreement
Dakota Digital Academy

Purpose: This agreement has been drafted by and is endorsed by the members of the Dakota Digital Academy. The following credits/courses are deemed transferrable among the institutions listed. The listed institutions have agreed to transfer the course(s) to meet the requirements of the program listed with the corresponding courses. It is intended to facilitate student transfer and Dakota Digital Academy program articulation among the following institutions:

NDUS Colleges and Universities

Bismarck State College
Dakota College at Bottineau
Dickinson State University
Lake Region State College
Mayville State University
Minot State University
North Dakota State College of Science
North Dakota State University
University of North Dakota
Valley City State University
Williston State College

Guidelines:

1. Described here are competency requirements for undergraduate certificate programs in Cybersecurity and in Software Development. The Cybersecurity program has two options.
2. The intent is that the participating institutions will design, develop and gain approval through their respective campus process for the specific certificate program(s) in which they have an interest. Describing each program in terms of competencies achieves two major objectives:
    a. ensuring that students who complete a program will have gained training and skills that are relevant and responsive in terms of the needs of employers, whether in private business and industry or government, and
    b. provides the participating institutions flexibility in how they structure their courses and curricular requirements to map to their respective competencies associated with each certificate.
3. In keeping with the founding principles of the Dakota Digital Academy (DDA) in facilitating and coordinating programs across the state, it is anticipated that this agreement will be reviewed on a recurring basis.

Undergraduate Certificate in Cybersecurity (Information Systems Management Option), 16-18 credits

Competencies	Example related courses (*)
Information Security Fundamentals. Business and management issues in security, including risk management, planning, fundamentals of intrusion detection and prevention, human error, legal and ethical issues, access control and firewalls, software attacks, cryptography, credentialing and certifications	**CIS 147 (**),** Principles of Information Security, BSC, WSC, DSU, DCB, LRSC, VCSU, MSU, NDSU, UND**; CIS 141,** Introduction to Cybersecurity, LRSC, WSC, NDSCS; **CIS 142 (**)**, Cybersecurity Operations, NDSCS, LRSC; **CSCI 290** (**), Cybersecurity and Information Assurance, UND.
Programming and Problem Solving. Fundamentals of coding in a higher-level language such as Java, C++, C#, JavaScript, Python; foundational problem solving techniques.	**SE 110 (**),** Discovering Computing, VCSU; **CSCI 124,** Beginning C++/Visual C++, BSC, VCSU, WSC; **CSCI 127;** Introduction to Programming in Java, VCSU,WSC; **CSCI 130,** Introduction to Scientific Programming, UND; **CSCI 159,** Computer Science Problem Solving, NDSU; **CSCI 160/161,** Computer Science I and II, NDSU, UND, BSC, LRSC, NDSCS, VCSU, DSU, MSU, WSC, MiSU; CIS 171, Fundamentals of Python Coding, WSC; **CSCI 174**, Intermediate

	C++, WSC, NDSCS; **CIS 185**, Introduction to Programming, BSC, DSU, NDSCS, MSU, VSCU, NDSU, UND; **CSCI 227/228, C**omputing Fundamentals I and II, NDSU; **CIS 257**, JavaScript with jQuery, BSC, DSC, MSU, NDSCS, VCSU, NDSU, UND.
Networks, Network Security, Information Technology Practices. Protocols, traffic analysis, scanning to detect network vulnerabilities, wireless technologies, packet level tracing and analytics, hands-on lab activities.	**CIS 164(**)/165**: Fundamentals of Networking I and II, BSC, DCB, DCU, WSC, VCSU, NDSCS, LRSC, MSU, MiSU, NDSCS, NDSU; **CIS 255**, Computer and Network Security, BSC, LRSC, NDSU; CIS 268, Intermediate Networking, BSC; **CIS 280**, Fundamentals of Network Security I, NDSCS; **CIS 282**, Managing Network Security, NDSCS, BSC.
Social and Ethical Implications. Privacy, search and seizure, censorship, the First and Fourth Amendments, role of mobile devices and the internet of things, social interaction, assistive technology, social media, computational biology. intellectual property, biometrics, computer-based crime, risks and reliability, artificial intelligence, game addiction.	**CIS 280**, Cyber Ethics, BSC, VCSU, NDSU; **CSCI 289 (**)**, Social Implications in Computing Technology, DBC, UND, WSC; **CSCI 331**, Social Implications of Computers, MSU; **New 300-level course** (**), Social Engineering, NDSU; **CSCI 331** (**), Social Implications of Computers, MiSU; **CSCI 486**, Social Implications of Computing, DSU, MSU, NDSCS; **CSCI 489**, Social Implications of Computers, NDSU, **New 400-level course** (**), Ethics of Cyber Sciences, BSC.
Specialized Topics in Cybersecurity. Fundamental concepts of defensive and offensive cybersecurity, forensics, distributed system security. Hands-on lab activities.	**CIS 116,** Internet of Things: Security, WSC; **CIS 241/242,** IT Forensics I and II, BSC, LRSC (CIS 241, not CIS 242), NDSCS, VCSU, WSC, NDSU; **CIS 142 (**),** Ethical Hacking & Network Defense, WSC, NDSU, LRSC; **CIS 282**, Ethical Hacking, BSC; **CIS 470**, Penetration Testing, BSC.
Industry-related Experience	**CIS 197** Cooperative Education/Internship/Capstone, BSC, NDSCS, WSC; **CIS 269**, Cybersecurity and Computer Networks Capstone, BSC, NDSU; **New course** (**), A Nice Intro to Entrepreneurship, NDSU; **CSCI 297** Experiential Learning, UND**; CSCI 445** Software Projects Capstone, NDSU; **CSCI 460**, Capstone Management, MiSU; **CSCI 492/493,** Senior Capstone I and II, UND, **CSCI 491**, Computer Science Seminar, NDSCC.

Undergraduate Certificate in Cybersecurity (Advanced Option), 16-18 credits

Competencies	**Example related courses (*)**
Programming and Problem Solving. Coding in a higher-level language such as Java, C++, C#, JavaScript, Python; problem solving techniques.	**CSCI 124.** C++, BSC, VCSU, **CSCI 127.** Introduction to Programming in Java, LRSC, VCSU, **CSCI 130,** Introduction to Scientific Programming, UND; **CSCI 159,** Computer Science Problem Solving, NDSU; **CSCI 160/161,** Computer Science I and II, NDSU, UND, BSC,

	NDSCS, VCSU, DSU, MSU, LRSC, WSC, MiSU; **CSCI 213**, Modern Software Development, NDSU; **CSCI 227/228, C**omputing Fundamentals I and II, NDSU.
Principles of Cybersecurity – Fundamentals of types of attacks (e.g., denial of service), malware (e.g., viruses, spyware, ransomware); social engineering; privacy protection; basic incident recovery; basic forensics; switching and routing, security audits.	**CIS 282**, Computer System Security, NDSCI; **CSCI 290** (**), Cybersecurity and Information Assurance, UND; **CSCI 345**, Principles of Cybersecurity, NDSU.
Networks and Network Security. Protocols, traffic analysis, wireless systems and security, scanning to detect network vulnerabilities, proxy servers, monitoring methods, troubleshooting, domain name system principles, segmentation, types of networks (WANs, LANs, VPNs, etc.), hands-on activities.	**CIS 164(**)/165**: Fundamentals of Networking I and II, BSC, DCB, DSU, WSC, NDSCS, LRSC, MSU, VCSU, MiSU, NDSCS; **CIS 255**, Computer and Network Security, LRSC, NDSU, VCSU, BSC; CIS 268, Intermediate Networking, BSC, VCSU; **CIS 280**, Fundamentals of Network Security I, NDSCS; **CIS 282**, Managing Network Security, NDSCS, VCSU; CSCI 327 Data Communication, UND.
Defensive Cybersecurity. Threat modeling, vulnerability assessment, management of operating systems, automation of security tasks, multi-platform security procedures, firewall configuration, access control, intrusion detection, incident response procedures. Scripting, email and web security protocols, social engineering, hands-on activities.	**CIT 368,** Cybersecurity Prevention & Countermeasures, BSC; **CSCI 277**, Introduction to UNIX, NDSU; **CSCI 403,** Defensive Network Security**,** NDSU.
Offensive Cybersecurity – penetration testing and ethical hacking, user behaviors, exploitation methods, identity management, access control, privilege escalation, plants and multi-system pivoting and persistence.	**CIT 470,** Penetration Testing, BSC**; CSCI 487 (**),** Penetration Testing, UND**; CSCI 404**, Security+ and Ethical Hacking, NDSU.
Industry-related Experience	**CIS 197** Cooperative Education/Internship/Capstone, BSC, NDSCS; **CIS 269**, Cybersecurity and Computer Networks Capstone, BSC, NDSU; **New course** (**), A Nice Intro to Entrepreneurship, NDSU; **CSCI 297** Experiential Learning, UND**; CSCI 445** Software Projects Capstone, NDSU; **CSCI 492/493,** Senior Capstone I and II, UND; **CSCI 495**, Field Experience, NDSU.

Undergraduate Certificate in Software Development, 16-18 credits

Competencies	Example related courses (*)
Programming and Data Structures. Content associated with widely accepted recommendations for what are known as CS1 (programming) and CS2 (data structures) courses. Topics areas include object orientation, abstraction, conditionals, functions, iteration, arrays, loops, case classes, GUIs, sorting and searching, recursion, lists, trees, graphs. Algorithm design and performance evaluation. Documentation and code reviews. Specific choice of higher-level language is arbitrary.	**CSCI 160/161,** Computer Science I and II, 4 credits each, NDSU, UND, BSC, NDSCS, VCSU, DSU, MSU, LRSC, WSC, MiSU; **CSCI 174**, Intermediate Programming C++, DSU, MSU; **CSCI 227/228, C**omputing Fundamentals I and II, NDSU; **CSCI 242** Algorithms and Data Structures, UND.
Software Engineering Fundamentals. Basic principles and tasks of the software development life cycle, including planning, requirements, design, coding, testing, deployment, maintenance.	**CSCI 160/161,** Computer Science I and II, 4 credits each, NDSU, UND, BSC, NDSCS, VCSU, DSU, MSU, LRSC, WSC, MiSU; **CSCI 213,** Modern Software Development, NDSU; **CSCI 227/228, C**omputing Fundamentals I and II, NDSU; **MIS 315** (**), System Analysis and Design, NDSU.
Specialized and Advanced Topics in Software Development. Virtualization, cloud computing, development of mobile apps, distributed systems, comparative languages, web development, internet of things, declarative languages, database management, structured query language.	**CIS 180,** Creating Web Pages, WSC, NDSCS, VCSU, DCB; **CIS 204**, Database Design and Structured Query Language, BSC, DCS, MSU, VCSU, NDSCS, NDSU; **CSCI 265,** Introduction to Programming Languages, UND; **CSCI 266**, Tools and Techniques of Computing Practice UND; **CSCI 270**, Computer Organization, BSC, LRSC, VCSU, MiSU, NDSCS; **CSCI 270** Programming for Data Science, UND; **CSCI 275 (**),** Computer and Digital Hardware, MiSU**; CSCI 280,** Object Oriented Programming, UND; **CSCI 310,** Advanced Computer Programming in Java, NDSCS; **CSCI 312.** Survey of Programming Languages, NDSU**; CSCI 313**. Advanced Software Development, NDSU; **CSCI 330,** Systems Programming, UND; **CSCI 335**, Systems Programming, MiSU; **CSCI 360**, Database management, NDSCS; **CSCI 366**, Database Systems, NDSU; **CSCI 374**, computer Organization and Architecture, NDSU; **MIS 375** (**), Database Design for Business Applications, NDSU; **CSCI 488**, Human-Computer Interaction, NDSU.
Industry-related Experience	**CIS 197** Cooperative Education/Internship/Capstone, BSC, NDSCS; **New course** (**), A Nice Intro to Entrepreneurship, NDSU; **CSCI 279** Experiential Learning, UND; **CSCI 445** Software Projects Capstone, NDSU; **CSCI 492/493,** Senior Capstone I and II, UND.

(*) Suggested only, not intended to be a complete course candidate list.

(**) Courses designed and developed for remote delivery under Dakota Digital Academy funding.

Campus Abbreviations:

BSC – Bismarck State College
DCB – Dakota College of Bottineau
DSU – Dickinson State University
LRSC – Lake Region State College
MaSU – Mayville State University
MiSU – Minot State University
NDSCS – North Dakota State College of Science
NDSU – North Dakota State University
UND – University of North Dakota
VCSU – Valley City State University
WSC – Williston State College

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