Information Technology Advisory Meeting

Fall 2020 Agenda

September 29, 2020 @ 6:30 pm

MSCTC Moorhead B150 and Zoom

**Agenda for Fall 2020**

* MSCTC/M State welcome and updates
  + Physical Presence Health Check Reminder ([www.minnesota.edu](http://www.minnesota.edu))
  + Communications Check (Audio and Video)
  + Additions/approval of agenda
  + Approval of last meeting minutes
  + Introductions and membership list updates
    - *Note: M State recommends a sign in sheet. Please bring or send a business card so we may populate the sign in sheet, thank you.*
* Discussion of Industry Trends
  + What technologies are you dealing with now?
  + What technologies are in your future?
  + Describe the attributes of the ideal entry level employee.
  + What elements must be in an IT two year education?
* Program Updates
  + Computer Programming
  + Cybersecurity
  + Information Technology – Database Administration
  + Information Technology – AS
    - Articulation Update – Current version at the end of the document
    - This needs a recommendation from the group
* Course and Program Plan Review
  + The IT-AS update completes this need.
* Program Needs
  + Partnerships
  + Equipment
  + Recruitment
  + This is a call for Internships and entry-level job opportunities for M State students.
* College update
* Other
* Next Meeting Date

Actions Items

Advisory Member Functions (MSCTC Advisory Committee Guide)

* Identify specific subject areas of program inclusion
* Prioritizing the recommend subject areas
* Specifying appropriate program content level
* Reviewing program outcomes on an ongoing basis
* Assessment of program quality
* Specifying appropriate foundational skill standards for local needs
* Identifying general education and related technical skills needed by graduates
* Recommending equipment to support the program content

Information Technology – AS

Proposed Fall 2022 Changes

Version 10

9/14/2020

**Overview**

This is the voting/comment version of the M State Information Technology – AS program for the M State computer faculty and MSUM faculty. Your vote/comments are requested before September 26, 2020. Your comments and vote will be utilized for the advisory meeting to be scheduled after September 26, 2020. Should I not receive a response, I will count the no reply as acceptance.

The update is driven by three factors. One is the current agreement expires on 12/1/2022. I think I have provided enough time for college bureaucracies, but … The second factor is changes in the world of information technology since the last agreement. The final factor is the recent release of ACM IT Transfer Curriculum guidance.

The current version of the ACM Curricula recommendations for bachelor degree programs is found at <https://www.acm.org/binaries/content/assets/education/curricula-recommendations/it2017.pdf> .

The current version of the ACM Curricula recommendations for transfer associate degree programs is found at

<http://ccecc.acm.org/files/publications/IT-Transfer2020.pdf> .

[Curriculum Overview](#overview)

[Program Outcomes](#programoutcomes)

[ACM IT Transfer Degree Curriculum outcomes](#IT2020competencies)

**Curriculum Overview**

Current IT-AS Fall 2017 Recommended IT-AS Fall 2021

Changes listed in red

**Semester 1 Recommendation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course** | **Course Title** |  | **Course** | **Course Title** |
| CSCI 1110 | [Informatics](#csci1110) |  | CSCI 1110 | [Informatics](#csci1110) |
| CPTR 1122 | [Microcomputer Maintenance](#cptr1122) |  | CPTR 1122 | [Maintenance](#cptr1122) |
| CPTR 1170 | [Web Engineering 1](#cptr1170) |  | CPTR 1170 | [Web Engineering 1](#cptr1170) |
| COMM 1120 | [Intro to Public Speaking](#comm1120) |  | COMM 1120 | [Intro to Public Speaking](#comm1120) |
| MATH 1114 | [College Algebra](#math1114) |  | MATH 1114 | [College Algebra](#math1114) |

**Semester 2 Recommendation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course** | **Course Title** |  | **Course** | **Course Title** |
| CPTR 1108 | [Cisco 1](#cptr1108) |  | CPTR 1108 | [Cisco 1](#cptr1108) |
| CPTR 1106 | [Microcomputer Database](#cptr1106) |  | CPTR 1106 | [Microcomputer Database](#cptr1106) |
| CPTR 1178 | [Robotics](#cptr1178) |  | CPTR 1236 | [Security Essentials](#cptr1236) |
| ENGL 1101 | [College Writing](#engl1101) |  | ENGL 1101 | [College Writing](#engl1101) |
| [MnTC Elective](#mntcelective) |  |  | [MnTC Elective](#mntcelective) |  |

**Semester 3 Recommendation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course** | **Course Title** |  | **Course** | **Course Title** |
| CPTR 2224 | [Linux 1](#cptr2224) |  | CPTR 2224 | [Linux 1](#cptr2224) |
| CPTR 2272 | [Network Operating System](#cptr2272) |  | CSEC 2204 | [Managing Directory Services](#csec2204) |
| PSYC 1200 | [General Psychology](#psyc1200) |  | PSYC 1200 | [General Psychology](#psyc1200) |
| HUM 2236 | [Technology in the Humanities](#hum2236) |  | HUM 2236 | [Technology in the Humanities](#hum2236) |
| [MnTC Elective](#mntcelective) |  |  | [MnTC Elective](#mntcelective) |  |

**Semester 4 Recommendation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course** | **Course Title** |  | **Course** | **Course Title** |
| CPTR 1001 | [Intro to Programming & Scripting](#cptr1001) |  | CPTR 1001 | [Intro to Programming & Scripting](#cptr1001) |
| CPTR 2236 | [Network Security](#cptr2236) |  | CPTR 2245 | [Enterprise Network Technologies](#cptr2245) |
| [MnTC Elective](#mntcelective) |  |  | [MnTC Elective](#mntcelective) |  |
| [MnTC Elective](#mntcelective) |  |  | [MnTC Elective](#mntcelective) |  |
| [MnTC Elective](#mntcelective) |  |  | [MnTC Elective](#mntcelective) |  |

The document recommend changing the name of CPTR 1122 to simply maintenance. The term microcomputer has lost meaning in this day and age. The document recommends outcome changes to the maintenance class. Consideration is being given to adding more basic electronics to the class. The A+ certification seems to be wandering among topics found in other classes. The C.E.T certification is close, but maybe a bit too much in the world of basic electronics. The document plans to add requirement(s) to physically build/modify equipment. The program attracts students who need to physically touch/manipulate hardware in order to understand the future virtualized version. It also thought basic electronics will help with diagnosing IoT and edge computing devices.

The document recommends removing the Robotics class. The document could not make the credit count work. It is sad.

The document replaces CPTR 2236 Network Security with a new class, CPTR 1236 Network Essentials. The new class name should help with potential confusion with class naming at MSUM. The document uses the Center for Internet Security guidelines as a guide for the outcomes. The new class is a first year class, allowing the second year classes to reinforce some concepts from the first year.

The document replaces CPTR 2272 with CSEC 2204 Managing Directory Services. The focus of CSEC 2204 becomes automation, group policy, permissions and implementing selected CIS controls.

The document adds CPTR 2245 Enterprise Network Technologies. This class deals with virtual machines, containers, cloud technology, performance management and if time is available the security paradigm “Zero Trust Networks”.

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Program Outcomes

**Comments**

This proposal does not recommend changing any program outcomes. It seems the current set of program outcomes drawn from earlier ACM Curricula recommendations is still relevant. A recent advisory committee meeting did not recommend any changes.

**Program Outcomes**

* Apply current technical practices in the core information technologies.
* Identify the requirements to provide effective solutions for organizations or individuals.
* Identify effective IT-based solutions.
* Evaluate current and emerging technologies.
* Identify the impact of technology on individuals, organizations and society including ethical, legal and policy issues.
* Demonstrate an understanding of best practices and standards.
* Demonstrate independent problem-solving skills.
* Collaborate in teams to accomplish a common goal.
* Communicate effectively and efficiently with clients, users and peers.
* Recognize the need for continued learning throughout one's career.

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**COMM 1120 - Intro to Public Speaking**

**Transfer Comments**

Currently this class is listed as a required MnTC class in the curriculum. In the past, the advisory committee very strongly insisted on public speaking. The advisory committee and MSUM faculty will be given the opportunity to decide on requiring this class or allowing students to select from Introduction to Public Speaking, Small Group Communication or Interpersonal Communications.

**Description**

Meets MnTC Goal Area 1. This course clarifies the process of oral communication, clarifies the basic principles of public speaking and allows the student to increase the application of these principles while both speaking and listening.

**Prerequisites/Corequisites**

Prerequisite: assessment into ENGL 1101

**Outcomes**

* Demonstrate the writing and speaking process through invention, organization, drafting, revision, editing, and presentation.
* Select appropriate communication choices for specific audiences.
* Complete speaking evaluations with an emphasis on listening and responding ethically.
* Demonstrate the ability to make sound rhetorical choices.
* Write and deliver speeches that demonstrate a clear, critical perspective on speech topic.
* Demonstrate the appropriate use of verbal and nonverbal delivery.
* Complete group work with emphasis on cooperative learning and critical thinking.
* Incorporate diverse and ethical supporting material in the speech-making process.
* Evaluate the effectiveness of logical and coherent arguments for the purpose of persuasion.

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CPTR 1001 - Intro to Programming & Scripting

**Transfer Comments**

This document does not recommend changing this class. This is a cored class between many programs and outcome changes need to be coordinated. It also considered the first class in a two class programming sequence at MSUM. MUSUM faculty have detected problems with this class. Currently M State is recommending IT-AS students take selected sections of CPTR 1001.

The document includes the current outcomes. Some suggested outcomes from the curriculum guidance is provided within this section. Finally, information about MSUM expectations of the course is listed.

**Description**

This course is an introduction to computer programming. Emphasis will be on programming concepts, program design methodology, program debugging, problem solving and writing clear code.

**Prerequisites/Corequisites**

None

**Outcomes**

* Describe the features and syntax of a programming language.
* Understand how software can be written to solve business problems.
* Use debugging and testing to create error-free code.
* Demonstrate industry standard code development techniques.
* Develop logic structures.
* Develop loop structures.
* Develop control structures.
* Understand datatypes.
* Understand functions.
* Create, update, and process data files.
* Understand techniques required for security in computer programming.

**ACM Curriculum guideline Global Professional Practice [ITE-GPP]**

* [GPP-S01] Produce a project plan for an IT project, including a cost/benefit analysis, risk considerations, and related issues. *(Project management)*
* [GPP-S02] Discuss current practices used to optimize the systems development life cycle, such as DevOps and agile approaches. *(Current industry practices)*

**ACM Curriculum guideline Software Fundamentals [ITE-SWF]**

* [SWF-E01] Produce a program that implements an appropriate style, intended input behavior, correct program components, and includes descriptions of program functionality. *(App development practices)*
* [SWF-E02] Develop algorithms to solve a computational problem. *(Algorithm development)*
* [SWF-S01] Explain how programs implement algorithms in terms of instruction processing, program execution, and running processes. *(Algorithm development)*
* [SWF-S02] Implement appropriate data structures, while using multiple levels of abstraction, to create a new program that requires teamwork and is socially relevant. *(Program development)*

**ACM Curriculum guideline Software Development and Management [ITS-SDM]**

* [SDM-S01] Use tools and services to develop computing systems that consider platform constraints, support version control, track requirements and bugs, and automate building. *(Development)*

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**MSUM Faculty Expectations**

**Topic Coverage: CSIS 153 –from Professor Rhonda Ficek, MSU Moorhead**

**Textbook for both CSIS 152 and CSIS 153**:  
 How to Think Like a Computer Scientist Learning with Python: Interactive Edition 2.0

* <http://interactivepython.org/runestone/static/thinkcspy/index.html>
* Table of Contents: <http://interactivepython.org/runestone/static/thinkcspy/toc.html#t-o-c>

|  |
| --- |
| **Linux (using our department’s linux machine called Smaug)**   * Basic linux commands: ls, mkdir, rmdir, cd, mv, pwd, more, less * Compression of files: nautilus utility to zip * Development and saving programs is done in the linux environment |
| **Control Structures** (review from CSIS 152) -Sequence  -Selection: if, elif, nested if  -Iteration: for, while, nested for, nested while |
| **Operators** (review from CSIS 152)  Arithmetic, Relational, Logical, Assignment  Order of Operations, Associativity of operators, short-circuit |
| **Functions:**   * min, max, sum, len, type, chr, ord, id * functions:   + defining     - with/without parameters, with/without return     - formal vs actual parameters     - default arguments     - scope of identifiers   + calling existing functions, call stack * emphasis of modularization of code, creating functions as much as possible |
| **I/O:**   * input, print, format method * command line arguments and sys.argv * redirection of input and output * text files: open, close, read, readline, readlines, write  itertools and os.sys modules  2 forms of import statement-- example: from itertools import \* or import itertools |
| **Strings(review and more in-depth use)**   * slices * split * functions: len, min, max * methods: startswith, endswith, isdigit, isalpha, isalnum, islower, isspace, isupper  lower, upper, title, capitalize, count, find, rfind, replace, strip, lstrip, rstrip |
| **Collection Types:**   * **Lists**    + Review of list functions and methods from CSIS 152   + Nested lists (lists with sublists)   + List Comprehension * **Tuples**   + Rationale for use of tuples since they are immutable   + Methods and functions available for tuples * **Dictionaries**   + Functions: min, max, len   + Methods   + Simple dictionaries: {key:value, key:value}   + Other dictionaries: {key:someList, key:someList}   + Passing dictionaries to/from functions |
| **Unit Testing**   * Rationale for using * Using unitTest module to define a test suite * Developing a unit test for a function that students wrote |
| **Dates and Times in Python**   * datetime module 🡪 classes covered: date, datetime, time, timedelta  Attributes and methods of each of those 4 classes * calendar module 🡪 use of monthrange, isleap * date arithmetic and comparison |
| **Object-Orientation in Python**   * Terminology:   + Data encapsulation, Inheritance, Polymorphism   + Class: collection of related attributes & methods vs Object: instance of a class   + Module: collection of related classes, functions, constants   + is-a vs has-a * Creating a class:   + Attributes: class-level vs instance-level   + Methods: class-level vs instance-level  constructor  getters/setters  str * Inheritance (is-a relationship)   + Creating a class which inherits attributes and methods from a parent class   + Calling parent methods from within the child class * Class with object as one of the attributes (has-a relationship) * Polymorphism   + Creating a Fraction class: \_\_add\_\_, \_\_sub\_\_, \_\_floordiv\_\_, \_\_mul\_\_, \_\_gt\_\_, etc. |
| **Creation of Python documentation using pydoc command**   * preconditions, postconditions * \_\_author\_\_, \_\_date\_\_ * pydoc command to create documentation web page * Using Python documentation – familiarity with the organization of the material on a page, and familiarity with notation |
| **Searches**   * Linear search * Binary search |
| **Sorting**   * Bubble sort, election, insertion sort * Brief description of limitations of these and the use of more powerful and efficient sorts like quicksort, heapsort, etc |
| **GIT and Version control**   * Types of version control systems * Basic GIT commands: git init, git status, git log, git diff, git add, etc. * Using GitHub repositories |
| **Bash Shell Programming**   * Basics – input, output, function, iteration, selection |
| **Optional Topics – covered when time permits**   * Recursion * Tkinter module – graphical user interfaces |

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CPTR 1106 - Microcomputer Database

**Transfer Comments**

This document does not recommend changing this class. This is a cored class between many programs and outcome changes need to be coordinated.

The document includes the current outcomes. Some suggested outcomes from the curriculum guidance is provided within this section.

**Description**

This course covers database concepts, design and construction using the latest database software. Topics include database normalization and table relationships, database objects, file creation, file manipulation, queries, macros, form development and report generation. Database programming concepts will also be introduced.

**Prerequisites/Corequisites**

None

**Outcomes**

* Create database reports.
* Create table relationships.
* Define referential integrity.
* Create database queries.
* Manipulate database data.
* Perform data import operations.
* Create data entry forms.
* Demonstrate database programming concepts.
* Create database tables.
* Create and manage a switchboard.
* Create database macros.

**ACM Curriculum guideline Integrated Systems Technology [ITE-IST]**

* [IST-S02] Describe how a commonly used intersystem communication protocol works, including its advantages and disadvantages. *(Intersystem communication protocols)*

**ACM Curriculum guideline Information Management [ITE-IMA]**

* [IMA-E01] Create simple and intermediate queries to construct and modify objects that store, manipulate, and analyze data. *(Testing and performance)*
* [IMA-S01] Design and implement a physical model based on appropriate organization rules for a given scenario including the impact of normalization and indexes. *(Requirements and development)*
* [IMA-S02] Perform major database administration tasks such as create and manage database users, roles and privileges, backup, and restore database objects to ensure organizational efficiency, continuity, and information security. *(Testing and performance)*

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CPTR 1108 - Cisco 1

**Transfer Comments**

This document does not recommend changing this class. This is a cored class between many programs and outcome changes need to be coordinated. Cisco education tends to provide the updates for this class.

The document includes the current outcomes. Some suggested outcomes from the curriculum guidance is provided within this section.

**Description**

This is an introduction to networks course that covers the architecture, structure, functions and components of the Internet and other computer networks. Students achieve a basic understanding of how networks operate while building simple local area networks (LANs). Students perform basic configurations for routers and switches and implement Internet Protocol.

**Prerequisites/Corequisites**

None

**Outcomes**

* Explain how physical and data link layer protocols support the operation of Ethernet in a switched network.
* Explain how the upper layers of the Open Standards Interconnect (OSI) model support network applications.
* Configure switches and end devices to provide access to local and remote network resources.
* Configure routers to enable end-to-end connectivity between remote devices.
* Explain Internet Protocol addressing and subnetting.
* Create Internet Protocol version 4 and Internet Protocol version 6 addressing schemes and verify network connectivity between devices.
* Configure a small network with security best practices.
* Troubleshoot connectivity in a small network.

**Cisco Outcomes (CCNA: Introduction to Networks)**

* Build simple LANs, perform basic configurations for routers and switches, and implement IPv4 and IPv6 addressing schemes.
* Configure routers, switches, and end devices to provide access to local and remote network resources and to enable end-to-end connectivity between remote devices.
* Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer.
* Configure and troubleshoot connectivity a small network using security best practices

**Class matching IT Transfer Outcomes**

**ACM Curriculum guideline Networking [ITE-NET]**

* [NET-E01] Compare the characteristics of various communication protocols and how they support application requirements within a telecommunication system. *(Requirements and Technologies)*
* [NET-E02] Describe different network standards, components, and requirements of network protocols within a distributed computing setting. *(Network Protocol Technologies)*
* [NET-E03] Explain different main issues related to network management. *(Network Management)*
* [NET-S01] Contrast various networking topologies in terms of robustness, expandability, and throughput used within a cloud enterprise. *(Technologies)*

**ACM Curriculum guideline Applied Networks [ITS-ANE]**

* [ANE-S01] Investigate security and performance issues related to wireless networks. *(Security and performance)*

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CPTR 1122 - Maintenance

**Transfer Comments**

This course needs renaming to simply “maintenance”. The term microcomputer has lost meaning.

It is considered important to focus of basic electronics and hands on building projects.

The current course is loosely based on A+. The current A+ standards focus primarily on software, neglecting hardware. The proposals is using ACM Curriculum guidelines and C.E.T standards.

**Description**

The course provides a basic electronics and basic electronics safety overview. This background enables to students to better understand current computing technology and future devices such as IoT. Students will spend time assembling and troubleshooting electrical components.

**Prerequisites/Corequisites**

|  |  |
| --- | --- |
| **Current Outcomes** | **Proposed Outcomes** |
| Analyze the operation of a microcomputer. | Describe how the historical development of hardware and operating system computing platforms produced the computing systems we have today. |
| Recognize microcomputer system architecture. | Choose the most effective operating system based on a computer’s intended use. |
| Examine the various types of computer hardware. | Diagram the main parts of a computer, including interconnections. |
| Demonstrate hardware troubleshooting skills. | Perform at least one operating system installation on a computer. |
| Plan the building of a working computer. | Use appropriate and emerging technologies to improve the performance of computer systems. |
| Analyze the operation of system software. | Use wireless sensors within an ad-hoc network architecture to capture data within a multimedia system. |
| Plan a working operating system installation. | Demonstrate proper electrical safety |
| Manage a working operating system. | Use appropriate electrical test equipment |
| Demonstrate operating system troubleshooting skills. | Demonstrate an understanding of DC and AC electronics |
| Examine the various types of networks. | Perform at least one computing device hardware build. |
| Examine the various types of printers. |  |
| Examine the various types of portable microcomputers. |  |

ETA Associate C.E.T

<https://www.eta-i.org/comps/CETa_comps.pdf>

Safety Precautions

Electrical Theory

Electronic Components

Electronic Circuits: Series and Parallel

Soldering - Desoldering Tools

Block Diagrams - Schematics - Wiring Diagrams

Cabling

Test Equipment and Measurements

Mathematics and Formulas

Power Supplies

Amplifiers

Interfacing of Electronics Products

Identify each basic digital gate

Computer Electronics

Computer Applications

Audio and Video Systems

Optical Electronics

Radio Communications Technology

Telecommunications Basics

Technician Work Procedures

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CPTR 1170 - Web Engineering 1

**Transfer Comments**

This document does not recommend changing this class. This is a cored class between many programs and outcome changes need to be coordinated.

The document includes the current outcomes. Some suggested outcomes from the curriculum guidance is provided within this section.

**Description**

This course is an introduction to programming and maintaining professional Web pages for the business environment. Topics will include page design, authoring tools, accessibility issues and Web page and website development. Focus will be given to client-side programming languages such as HTML and JavaScript, Web server software, Web server maintenance and Internet protocols.

**Outcomes**

* Describe components of an URL.
* Describe the process of obtaining an Internet domain address.
* Describe the need for, and legal requirements of, Web site policies.
* Describe layouts, structure, design principles, and considerations for well-designed Web sites.
* Evaluate Web sites using principles of good format, structure, design, and programming practices.
* Install and configure Web page programming tools.
* Use current Web programming languages to create and maintain a Web page.
* Incorporate an e-mail link on a Web page.
* Incorporate internal and external hypertext links on a Web page.
* Incorporate tables on a Web page.
* Incorporate forms on a Web page.
* Create client-side scripting code to handle error checking in Web forms.
* Describe the security concerns of Web server administrators.
* Configure Web server software.
* Compare Web server operating systems and software.

**ACM Curriculum guideline Software Fundamentals [ITE-SWF]**

* [SWF-S03] Implement a mobile or web app with appropriate user experience design, functionality, and security analysis while using standard libraries, unit testing tools, and version control in a team environment. *(App development practices)*

**ACM Curriculum guideline User Experience Design [ITE-UXD]**

* [UXD-E01] Develop a simple application that maximizes usability by using relevant tools and techniques, such as prototyping. *(Design tools and techniques)*
* [UXD-S01] Develop an interactive application that optimizes usability while applying a user-centered design cycle with related tools and techniques. *(Design tools and techniques)*

**ACM Curriculum guideline Web and Mobile Systems [ITE-WMS]**

* [WMS-E01] Describe the major components of a web system and how they function together, including the web server, database, analytics, and front end. *(Web system infrastructure)*
* [WMS-S01] Analyze how a responsive web application utilizes a web framework and presentation technologies in support of a diverse online community. *(Web application development)*
* [WMS-S02] Develop a mobile app that is usable, efficient, and secure on more than one device. *(Mobile app development)*
* [WMS-S03] Analyze a web or mobile system and correct security vulnerabilities. *(Web and mobile security)*
* [WMS-S04] Implement storage, transfer, and retrieval of digital media with appropriate file, database, or streaming formats. *(Digital media storage and transfer)*

**ACM Curriculum guideline Mobile Applications [ITS-MAP]**

* [MAP-S01] Discuss various implementation strategies for web applications, including an application programming interface (API) and a platform-independent interpreted code. *(Technologies)*
* [MAP-S02] Produce a functional server-side application using several techniques for server-side programming. *(Design and Development)*

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CPTR 1178 - Robotics

**Transfer Comments**

This class is scheduled for removal from the curriculum. This makes requiring physical component hands on in maintenance more important.

**Description**

This course teaches basic robot building, programming and troubleshooting. The robot building includes working with multiple motors and sensors on a robot. The robot program includes working with a graphical and command line programing environment. Along with reading current literature about robotics, this class provides the student the fundamentals of robotics.

**Prerequisites/Corequisites**

None

**Outcomes**

* Examine current robot design.
* Manage a robot building schedule.
* Build robots to meet requirements.
* Manage robot motion systems.
* Manage robot sensor systems.
* Create robot control programs.
* Administer robot communication systems.
* Demonstrate troubleshooting skills.
* Design test procedures for robot systems.
* Manage robot power consumption.
* Describe current automation trends.
* Document robot operation.

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CPTR 1236 - Security Essentials

**Transfer Comments**

This is a new class for first year students.

Suggest the class number be CPTR 1236, could be CSEC if necessary.

Base security class focusing on policies, encryption, log file management and CIS controls.

The ACM Curriculum guidance is found withing the proposed competencies.

**Description (proposed)**

Security is an important component of Information Technology. This class follows several of the recommendation of the Center for Internet Security controls. Students will practice implementing an example of several controls. Students will implement encryption for data in storage and in transit.

**Prerequisites/Corequisites**

**Competencies (proposed)**

* Implement CIS inventory and control of hardware assets
* Implement CIS inventory and control of software assets.
* Implement CIS controlled use of administrative privileges
* Implement CIS maintenance, monitoring and analysis of audit logs
* Implement CIS email and web browser protections
* Implement CIS malware defenses
* Implement CIS limitation and control of network ports, protocols and services
* Implement CIS data recovery capabilities
* Implement appropriate “at rest” data encryption.
* Implement appropriate “in transit” data encryption.
* Evaluate the specific skills necessary for maintaining continued employment in an IT career.

**ACM Curriculum guideline Global Professional Practice [ITE-GPP]**

* [GPP-E02] Evaluate the specific skills necessary for maintaining continued employment in an IT career. *(Employability)*
* [GPP-E03] Carry out IT policies within an organization that include privacy, legal, and ethical considerations. *(Legal and ethical)*

**ACM Curriculum guideline Cybersecurity Principles [ITE-CSP]**

* [CSP-E01] Evaluate the purpose and function of cybersecurity technology, identifying the tools and systems that reduce the risk of data breaches while enabling vital organization practices. *(Cybersecurity functions)*
* [CSP-E02] Apply appropriate tools and concepts to minimize the risk to an organization's cyberspace to address cybersecurity threats. *(Tools and threats)*
* [CSP-S01] Implement a risk management approach for responding to and recovering from a cyber-attack on systems which contain high-value information and assets such as an email system. *(Response and risks)*

**ACM Curriculum guideline Cybersecurity Emerging Challenges [ITS-CEC]**

* [CEC-E01] Implement common standards, procedures, and applications used to protect the confidentiality, integrity and availability of information and information systems. *(System integrity)*
* [CEC-E02] Analyze human facets that enable the exploitation of computing-based systems. *(Human dynamics)*

**ACM Curriculum guideline Social Responsibility [ITS-SRE]**

* [SRE-S01] Evaluate various security breaches and their effect on business operations. *(Risk management)*

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CPTR 2224 - Linux 1

**Transfer Comments**

This document does not recommend changing this class. This is a cored class between many programs and outcome changes need to be coordinated.

The document includes the current outcomes. Some suggested outcomes from the curriculum guidance is provided within this section. It also appears some MSUM faculty suggestions could be included.

**Description**

This course deals with Linux installation, configuration and system administration. This course lays the groundwork for continued study of Linux.

**Prerequisites/Corequisites**

**Outcomes**

* Create Linux accounts.
* Manage Linux accounts.
* Prepare appropriate documentation.
* Analyze graphical environments.
* Write simple shell scripts.
* Manage application software.
* Manage security.
* Evaluate fault-tolerance solutions.
* Use appropriate software and commands.
* Manage printing.

**ACM Curriculum guideline Global Professional Practice [ITE-GPP]**

* [GPP-E02] Evaluate the specific skills necessary for maintaining continued employment in an IT career. *(Employability)*

**ACM Curriculum guideline Cybersecurity Emerging Challenges [ITS-CEC]**

* [CEC-S01] Perform common malware analysis procedures on mobile and desktop computer systems. *(Malware and forensic analysis)*

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CPTR 2236 - Network Security

**Transfer Comments**

This class is scheduled for removal from the curriculum.

The “Security Essentials” class is sort of the replacement. Many students will take additional security classes at MSUM and other places. A foundational class should server the student needs.

**Description**

This course deals with the understanding of basic network security. Students learn how to manage systems to guard against various security threats.

**Prerequisites/Corequisites**

Corequisite: cptr2272

**Outcomes**

* Identify network security threats.
* Administer encryption and authentication for wireless networks.
* Examine protecting advanced communications.
* Identify web-related threats.
* Perform network hardening.
* Examine e-mail threats.
* Configure VPNs for secure sessions.
* Analyze remote access security and social engineering threats.
* Identify software exploits.
* Examine major types of attacks on information systems.
* Identify the factors in a secure network strategy.
* Practice securing web communications utilizing SSL/TLS.
* Examine cryptography.
* Apply IPSec policies.
* Explore basic computer forensics methods.
* Plan a patch management strategy for network servers.
* Analyze the role of firewalls, routers and switches in security.
* Examine intrusion detection systems.

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CPTR 2245 - Enterprise Network Technologies

**Transfer Comments**

This class is due an outcome update

Now deals with VM, containers and cloud technology

This will become a required class in the IT-AS curriculum

**Description (proposed)**

This course will introduce information technologies used in an enterprise network environment. This course follows computing development from single hardware/single operating system operation to virtualization to container technology to implementation on the cloud. Student work with technology from each phase of computing development. The class discusses current trends within enterprise networking.

**Prerequisites/Corequisites**

CPTR 2272 (Recommend this be changed to CPTR 1108)

|  |  |
| --- | --- |
| **Competencies** | **Competencies (proposed)** |
| Analyze the cause and cost of network downtime. | Evaluate the specific skills necessary for maintaining continued employment in an IT career. |
| Develop strategies for high availability. | Discuss various concepts and technologies related to cloud computing. |
| Analyze SAN technology. | Distinguish cloud service categories, including public, private, and hybrid clouds, and be aware of privacy regulation impact on cloud application requirements. |
| Analyze server virtualization. | Discuss various factors, including basic architecture, that affect the performance of cloud applications. |
| Analyze active and passive server clustering. | Contrast virtualized and non-virtualized platforms. |
| Evaluate concepts for cloud computing. | Implement virtualization for desktops and servers. |
| Design an enterprise network. | Implement use performance measurement tools. |
| Implement server virtualization. | Explain virtualization for applications and network platforms. |
| Develop electronic documents supporting an enterprise network design. | Develop electronic documents supporting an enterprise network design. |
| Evaluate options for green technologies |  |

**ACM Curriculum guideline Global Professional Practice [ITE-GPP]**

* [GPP-E02] Evaluate the specific skills necessary for maintaining continued employment in an IT career. *(Employability)*

**ACM Curriculum guideline Cloud Computing [ITS-CCO]**

* CPTR 2245 [CCO-E01] Discuss various concepts and technologies related to cloud computing. *(Technologies)*
* CPTR 2245 [CCO-S01] Distinguish cloud service categories, including public, private, and hybrid clouds, and be aware of privacy regulation impact on cloud application requirements. *(Legal and Design)*
* CPTR 2245 [CCO-S02] Discuss various factors, including basic architecture, that affect the performance of cloud applications. *(Technology)*

**ACM Curriculum guideline Virtual Systems and Services [ITS-VSS]**

* CPTR 2245 [VSS-E01] Contrast virtualized and non-virtualized platforms. *(Technologies)*
* CPTR 2245 [VSS-E02] Implement virtualization for desktops and servers. *(Install technologies)*
* CPTR 2245 [VSS-S01] Implement a storage environment and use performance measurement tools. *(Technologies and performance)*
* CPTR 2245 [VSS-S02] Explain virtualization for applications and network platforms. *(Install technologies)*

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CPTR 2272 - Network Operating System

**Transfer Comments**

This class is scheduled for removal from the curriculum.

The “Managing Directory Services” and “Enterprise Network Technologies: classes provide the necessary outcomes.

**Description**

This course teaches the functions of a network operating system so the student can effectively maintain and manage a network. The student learns how to establish and oversee the operations of a network, create logins, design and establish directory structures and implement security.

**Prerequisites/Corequisites**

Prerequisites: cptr1148, cptr1001 or cptr1122

**Outcomes**

* Manage network accounts and groups.
* Configure remote network access.
* Manage network services.
* Design network domain structures.
* Describe multi-domain network structures.
* Create fault-tolerant resource plans.
* Manage security settings and policies.
* Analyze network resource utilization.
* Document network configuration.

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CSCI 1110 - Informatics

**Transfer Comments**

This document does not recommend changing this class. This is a cored class between many programs and outcome changes need to be coordinated.

The document includes the current outcomes. Some suggested outcomes from the curriculum guidance is provided within this section.

**Description**

This course explores how data is gathered and analyzed and how it can be applied to information technology solutions to maximize the benefits of data analysis, including increases in the efficiency and productivity of information systems. Students will explore the social, ethical and personal implications of implementing information technologies and how information processes can impact business on a local and global level.

**Prerequisites/Corequisites**

**Outcomes**

* Analyze and evaluate various data transmission methods.
* Analyze various Information Technology solutions for applicability in various environments.
* Evaluate data security systems in relation to current legal and social implications.
* Differentiate between authenticity and authority of different information sources.
* Identify and select factual information to provide a potential solution to a problem.
* Interpret and present data conclusions in an appropriate and logical manner for the audience.
* Organize a small group to evaluate various solutions presented from the data.
* Evaluate and understand data security methods in relation to legal and ethical requirements in selected regions of the world.
* Articulate the impact of Information Technology on personal ethics.
* Evaluate the impact of Information Technology on a chosen field of study.

**ACM Curriculum guideline Global Professional Practice [ITE-GPP]**

* [GPP-E01] Use effective communication skills and cultural awareness in a team setting to help advance organizational goals in a global environment. *(Communication and teamwork)*
* [GPP-E02] Evaluate the specific skills necessary for maintaining continued employment in an IT career. *(Employability)*

**ACM Curriculum guideline Data Scalability and Analytics [ITS-DSA]**

* [DSA-S01] Use appropriate data analysis methods to solve real-world problems. *(Requirements and development)*

**ACM Curriculum guideline Social Responsibility [ITS-SRE]**

* [SRE-E01] Discuss the roles that teamwork, ethics, and legal considerations play in an IT organization. *(Teamwork, legal and ethical considerations)*
* [SRE-E02] Summarize how governmental and environmental regulations affect an organization's environment. *(Government and environment)*

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CSEC 2204 - Managing Directory Services

**Transfer Comments**

This class is due an outcome update

Now deals with managing Active Directory, permissions and rights

This will become a required class in the IT-AS curriculum

**Description (proposed)**

Directory services provide a central repository for the information available on the network. The student will learn that the first function of the directory is to provide information about objects in the directory including users and other resources. In addition, the student will learn that the information contained in the directory is crucial for the correct and secure operation of the network.

**Prerequisites (needs review)**

CPTR1148, CPTR1122 or CPTR1001

|  |  |
| --- | --- |
| **Outcomes** | **Outcomes (proposed)** |
| Describe the structure of Active Directory. | Evaluate the specific skills necessary for maintaining continued employment in an IT career. |
| Describe the philosophy of directory services. | Implement appropriate procedures and technologies to enforce administrative policies within a corporate environment |
| Explain the role of Domain Name Services in Active Directory. | Implement effective and appropriate system administration policies with sensitivity to the goals and constraints of an organization. |
| Design an Active Directory architecture. | Implement the CIS Data Protection |
| Install Domain Name Services using current best practices. | Implement CIS Controlled Access Based on the Need to Know |
| Implement Active Directory replication to current standards. | Implement CIS Account Monitoring and Control |
| Create an Active Directory auditing plan. | Troubleshoot directory services. |
| Employ current authentication and authentication methods. | Apply software management using group policy or similar. |
| Demonstrate proper management of objects. | Describe the structure of a directory service. |
| Monitor Active Directory performance. | Describe the philosophy of directory services. |
| Demonstrate proper planning for disaster recovery. |  |
| Apply software management using group policy. |  |
| Implement group policy on Active Directory objects. |  |
| Employ Active Directory operation masters. |  |
| Troubleshoot Active Directory. |  |

**ACM Curriculum guideline Global Professional Practice [ITE-GPP]**

* [GPP-E02] Evaluate the specific skills necessary for maintaining continued employment in an IT career. *(Employability)*

**ACM Curriculum guideline System Paradigms [ITE-SPA]**

* [SPA-E01] Implement appropriate procedures and technologies to enforce administrative policies within a corporate environment. *(Operational activities)*
* [SPA-S01] Implement effective and appropriate system administration policies with sensitivity to the goals and constraints of an organization. *(System governance)*

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ENGL 1101 - College Writing

**Transfer Comments**

Currently this class is listed as a required MnTC class in the curriculum. In the past, the advisory committee very strongly insisted on writing class.

This class is listed by name in the articulation agreement

**Description**

Meets MnTC Goal Area 1. This is an introductory writing course designed to prepare students for later college and career writing. The course focuses on developing fluency through a process approach, with particular emphasis on revision. Students will consider purpose and audience, read and discuss writing and further develop their own writing processes through successive revisions to produce polished drafts. Course work will include an introduction to argumentative writing, writing from academic sources and a short research project.

**Prerequisites/Corequisites**

Prerequisites: Completion of ELL1080, ENGL0096, or ENGL0097 with a grade of C or higher OR placement into college-level English.

**Outcomes**

* Demonstrate the writing process through invention, organization, drafting, revision, editing and presentation.
* Participate effectively in groups with emphasis on listening, critical and reflective thinking and responding.
* Locate and evaluate information from diverse academic sources.
* Synthesize information from diverse academic sources.
* Construct logical and coherent arguments.
* Use authority, point-of-view and individual voice and style in writing.
* Respond critically via discussion.
* Respond critically via writing.
* Employ syntax and usage appropriate to academic disciplines and the professional world.
* Select appropriate communication choices for specific audiences.
* Use a discipline-appropriate style guide to responsibly credit and document information.

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HUM 2236 - Technology in the Humanities

**Transfer Comments**

Currently this class is listed as a required MnTC class in the curriculum.

This class is listed by name in the articulation agreement. The inclusion of this class insures all student have MnTC credits within the correct number of goal areas.

**Description**

Meets MnTC Goal Areas 2, 6 and 8. Developments in the arts, architecture, science, philosophy and education and studies in human interaction are often provoked by changes in technology. Early changes in military technology made it possible for civilizations to take charge of various places on the world's stage. However, over time, changes in how the world was understood, motivated by general advances in global exploration, astronomy and other sciences as well as specific inventions such as movable type, proved even more instrumental in driving people to new and different understandings of what it means to be human. This course explores how technology impacts developments in a culture's world view and tries to anticipate how future changes in technology might alter the course of otherwise established ways of life.

**Prerequisites/Corequisites**

**Outcomes**

* Students will demonstrate an understanding of the relationship between advances in technologies and changes in the daily lives of societies that adopt them.
* Students will be able to recognize how various technologies have impacted on today's social order and anticipate advantages and difficulties associated with emerging technologies
* Students will be able to draw connections between advances in technology and inevitabilities such as changes in how education is demanded and delivered
* Students will be able to identify specific philosophical, political and social movements and how they helped foster technical innovation or prevent natural technical evolution
* Students will recognize how changes in technology such as paint, sound recordings and motion pictures have affected the range of expressions available to artists.
* Students will demonstrate the importance of understanding technology both an aid to ethical and productive self-expression and a hindrance to responsible social interaction.
* Students will draw connections between modes of expression and associated limitations resulting from inequities in education and economic and social class.
* Students will demonstrate an understanding of how major technical advances such as the printing press promoted global communication and cultural exchanges.
* Students will be able to identify which applications of modern technology improve ethnic diversity and which applications promote intolerance.
* Students will be able to identify which apparently small improvements in military technology were responsible for major political changes on a global scale.
* Students will be able to posit workable solutions for addressing inequities in matters of global social and economic development imposed by changes in technology.

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MATH 1114 - College Algebra

**Transfer Comments**

Currently this class is listed as a required MnTC class in the curriculum.

This class is listed by name in the articulation agreement. MSUM BS requires additional math building on this class.

**Description**

Meets MnTC Goal Areas 2 and 4. This course includes rational, polynomial, exponential, logarithmic, inverse and quadratic functions. The course also includes equations, inequalities, complex numbers and systems of linear equations. Additional topics may include matrices and determinants.

**Prerequisites/Corequisites**

Prerequisite: MATH1020

**Outcomes**

* Analyze characteristics of linear functions and their graphs.
* Analyze characteristics of the inverses of linear functions and their graphs.
* Analyze characteristics of quadratic functions and their graphs.
* Analyze characteristics of the inverses of quadratic functions (on an appropriate domain) and their graphs.
* Analyze characteristics of polynomial functions and their graphs.
* Analyze characteristics of rational functions and their graphs.
* Analyze characteristics of exponential functions, their inverses and their graphs.
* Analyze characteristics of logarithmic functions, their inverses and their graphs.
* Analyze characteristics of radical functions.
* Solve linear systems of equations by substitution, elimination, and graphing.
* Determine real and complex zeros of polynomials.
* Perform function operations including composition.
* Use mathematical modeling to solve application problems.

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MnTC Elective (5 classes)

**Transfer Comments**

50% of the AS degree is MnTC classes.

This is a place holder for five (5) of the ten (10) required MnTC classes.

Students get a recommendation of goal areas.

Not specifying classes simplifies transfers into the program.

Some students consider adding the AA degree to the AS degree.

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PSYC 1200 - General Psychology

**Transfer Comments**

Currently this class is listed as a required MnTC class in the curriculum.

This class is listed by name in the articulation agreement.

**Description**

Meets MnTC Goal Areas 5 and 9. This is a comprehensive introductory overview of psychology that studies human behavior and mental processes. Topics include (but are not limited to) research methods, the history of psychology, neuroscience and behavior, developmental psychology, sensation and perception, motivation and emotion, health psychology, learning and memory, personality, social psychology, psychopathology and treatments, and states of consciousness such as sleep and dreams.

**Prerequisites/Corequisites**

**Outcomes**

* Describe the history of psychology and how psychology is distinct from related disciplines such as sociology and philosophy.
* Adopt the framework of psychological science (correctly use terminology and concepts, engage in scientific problem-solving).
* Compare and contrast the major theoretical approaches to psychology.
* Explore the biological basis for behavior.
* Contrast how abnormal behavior might be explained and treated by different schools of psychology.
* Analyze the ethical nature of psychological experimentation on animals and people.
* Demonstrate knowledge of legal rights of individuals with mental health disorders.
* Describe scientific research methods used in psychology.
* Apply course concepts to one's own daily life.
* Utilize critical thinking skills (e.g., evaluate information quality, distinguish between causation and correlation, adopt multiple perspectives for a given problem).
* Demonstrate an understanding and appreciation for aspects of human diversity as it applies to psychology.
* Demonstrate an understanding of key topics in psychology.

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**Articulation Agreement Suggested Changes**

Major, Emphasis, Restricted, Unrestricted Electives or Other Courses

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CPTR 1001 Introduction to Programming & Scripting | 3 | CSIS 152 Intro to Computers & Programming 1-a | 3 | Equiv |
| CPTR 1106 Microcomputer Database | 3 | CSIS 103 Computer Concepts & Applications | 3 | Equiv |
| CPTR 1122 Maintenance | 3 | CSIS 222 Computer Maintenance | 3 | Equiv |
| CPTR 1170 Web Engineering 1 | 3 | CSIS 241 Intro to Web Design & Management | 3 | Equiv |
| CSCI 1110 Informatics | 3 | CSIS 145 Intro to Information Systems | 3 | Equiv |
| CPTR 1108 Cisco 1 | 3 | Elective | 3 |  |
| CPTR 2245 Enterprise Network Technologies | 3 | Elective | 3 |  |
| CSEC 2204 Managing Directory Services | 3 | Elective | 3 |  |
| CPTR 2224 Linux 1 | 3 | Restricted Elective | 3 |  |
| CPTR 1236 Security Essentials | 3 | Restricted Elective | 3 |  |

This is a modification from the current articulation agreement.

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**ACM IT 2020 Competencies**

Cybersecurity Principles [ITE-CSP]

* CPTR 1236 [CSP-E01] Evaluate the purpose and function of cybersecurity technology, identifying the tools and systems that reduce the risk of data breaches while enabling vital organization practices. *(Cybersecurity functions)*
* CPTR 1236 [CSP-E02] Apply appropriate tools and concepts to minimize the risk to an organization's cyberspace to address cybersecurity threats. *(Tools and threats)*
* CPTR 1236 [CSP-S01] Implement a risk management approach for responding to and recovering from a cyber-attack on systems which contain high-value information and assets such as an email system. *(Response and risks)*

Global Professional Practice [ITE-GPP]

* CSCI 1110, COMM 1120[GPP-E01] Use effective communication skills and cultural awareness in a team setting to help advance organizational goals in a global environment. *(Communication and teamwork)*
* [GPP-E02] Evaluate the specific skills necessary for maintaining continued employment in an IT career. *(Employability)*
* CPTR 1236 [GPP-E03] Carry out IT policies within an organization that include privacy, legal, and ethical considerations. *(Legal and ethical)*
* [GPP-S01] Produce a project plan for an IT project, including a cost/benefit analysis, risk considerations, and related issues. *(Project management)*
* CPTR 1001 [GPP-S02] Discuss current practices used to optimize the systems development life cycle, such as DevOps and agile approaches. *(Current industry practices)*

Information Management [ITE-IMA]

* CPTR 1106 [IMA-E01] Create simple and intermediate queries to construct and modify objects that store, manipulate, and analyze data. *(Testing and performance)*
* CPTR 1106 [IMA-S01] Design and implement a physical model based on appropriate organization rules for a given scenario including the impact of normalization and indexes. *(Requirements and development)*
* CPTR 1106 [IMA-S02] Perform major database administration tasks such as create and manage database users, roles and privileges, backup, and restore database objects to ensure organizational efficiency, continuity, and information security. *(Testing and performance)*

Integrated Systems Technology [ITE-IST]

* CPTR 1001 [IST-E01] Design, including debugging and testing, a script that includes sequence, selection, repetition, and parameter passing. *(Integrative programming and scripting)*
* CPTR 1001 [IST-E02] Implement secure coding techniques, such as input validation, wrapper code, securing method access, and buffer overflow prevention. *(Defensible integration)*
* CPTR 1001 [IST-S01] Describe how to code and store characters, images, and other forms of data in computers, and why data conversion is often a necessity when merging disparate computing systems. *(Data mapping and exchange)*
* CPTR 1106 [IST-S02] Describe how a commonly used intersystem communication protocol works, including its advantages and disadvantages. *(Intersystem communication protocols)*

Networking [ITE-NET]

* CPTR 1108 [NET-E01] Compare the characteristics of various communication protocols and how they support application requirements within a telecommunication system. *(Requirements and Technologies)*
* CPTR 1108 [NET-E02] Describe different network standards, components, and requirements of network protocols within a distributed computing setting. *(Network Protocol Technologies)*
* CPTR 1108 [NET-E03] Explain different main issues related to network management. *(Network Management)*
* CPTR 1108 [NET-S01] Contrast various networking topologies in terms of robustness, expandability, and throughput used within a cloud enterprise. *(Technologies)*

Platform Technologies [ ITE-PFT]

* CPTR 1122 [PFT-E01] Describe how the historical development of hardware and operating system computing platforms produced the computing systems we have today. *(Computing systems)*
* CPTR 1122 [PFT-E02] Choose the most effective operating system based on a computer’s intended use. *(Operating systems)*
* CPTR 1122 [PFT-E03] Diagram the main parts of a computer, including interconnections. *(Architecture and organization)*
* CPTR 1122 [PFT-S01] Perform at least one operating system installation on a computer. *(Operating systems)*
* CPTR 1122 [PFT-S02] Illustrate how to store and retrieve data using a computer. *(Architecture and organization)*

System Paradigms [ITE-SPA]

* CSEC 2204 [SPA-E01] Implement appropriate procedures and technologies to enforce administrative policies within a corporate environment. *(Operational activities)*
* CPTR 1122 [SPA-E02] Use appropriate and emerging technologies to improve the performance of computer systems. *(Performance analysis)*
* CSEC 2204 [SPA-S01] Implement effective and appropriate system administration policies with sensitivity to the goals and constraints of an organization. *(System governance)*

Software Fundamentals [ITE-SWF]

* CPTR 1001 [SWF-E01] Produce a program that implements an appropriate style, intended input behavior, correct program components, and includes descriptions of program functionality. *(App development practices)*
* CPTR 1001 [SWF-E02] Develop algorithms to solve a computational problem. *(Algorithm development)*
* CPTR 1001 [SWF-S01] Explain how programs implement algorithms in terms of instruction processing, program execution, and running processes. *(Algorithm development)*
* CPTR 1001 [SWF-S02] Implement appropriate data structures, while using multiple levels of abstraction, to create a new program that requires teamwork and is socially relevant. *(Program development)*
* CPTR 1170 [SWF-S03] Implement a mobile or web app with appropriate user experience design, functionality, and security analysis while using standard libraries, unit testing tools, and version control in a team environment. *(App development practices)*

User Experience Design [ITE-UXD]

* CPTR 1170 [UXD-E01] Develop a simple application that maximizes usability by using relevant tools and techniques, such as prototyping. *(Design tools and techniques)*
* CPTR 1170 [UXD-S01] Develop an interactive application that optimizes usability while applying a user-centered design cycle with related tools and techniques. *(Design tools and techniques)*

Web and Mobile Systems [ITE-WMS]

* CPTR 1170 [WMS-E01] Describe the major components of a web system and how they function together, including the web server, database, analytics, and front end. *(Web system infrastructure)*
* CPTR 1170 [WMS-S01] Analyze how a responsive web application utilizes a web framework and presentation technologies in support of a diverse online community. *(Web application development)*
* CPTR 1170 [WMS-S02] Develop a mobile app that is usable, efficient, and secure on more than one device. *(Mobile app development)*
* CPTR 1170 [WMS-S03] Analyze a web or mobile system and correct security vulnerabilities. *(Web and mobile security)*
* CPTR 1170 [WMS-S04] Implement storage, transfer, and retrieval of digital media with appropriate file, database, or streaming formats. *(Digital media storage and transfer)*

Applied Networks [ITS-ANE]

* CPTR 1108 [ANE-S01] Investigate security and performance issues related to wireless networks. *(Security and performance)*

Cloud Computing [ITS-CCO]

* CPTR 2245 [CCO-E01] Discuss various concepts and technologies related to cloud computing. *(Technologies)*
* CPTR 2245 [CCO-S01] Distinguish cloud service categories, including public, private, and hybrid clouds, and be aware of privacy regulation impact on cloud application requirements. *(Legal and Design)*
* CPTR 2245 [CCO-S02] Discuss various factors, including basic architecture, that affect the performance of cloud applications. *(Technology)*

Cybersecurity Emerging Challenges [ITS-CEC]

* CPTR 1236 [CEC-E01] Implement common standards, procedures, and applications used to protect the confidentiality, integrity and availability of information and information systems. *(System integrity)*
* CPTR 1236 [CEC-E02] Analyze human facets that enable the exploitation of computing-based systems. *(Human dynamics)*
* CPTR 1122 [CEC-S01] Perform common malware analysis procedures on mobile and desktop computer systems. *(Malware and forensic analysis)*

Data Scalability and Analytics [ITS-DSA]

* CSCI 1110 [DSA-S01] Use appropriate data analysis methods to solve real-world problems. *(Requirements and development)*

Internet of Things [ITS-IOT]

* CPTR 1122 [IOT-S01] Use wireless sensors within an ad-hoc network architecture to capture data within a multimedia system. *(Wireless data acquisition)*

Mobile Applications [ITS-MAP]

* CPTR 1170 [MAP-S01] Discuss various implementation strategies for web applications, including an application programming interface (API) and a platform-independent interpreted code. *(Technologies)*
* CPTR 1170 [MAP-S02] Produce a functional server-side application using several techniques for server-side programming. *(Design and Development)*

Software Development and Management [ITS-SDM]

* CPTR 1001 [SDM-S01] Use tools and services to develop computing systems that consider platform constraints, support version control, track requirements and bugs, and automate building. *(Development)*

Social Responsibility [ITS-SRE]

* CSCI 1110 [SRE-E01] Discuss the roles that teamwork, ethics, and legal considerations play in an IT organization. *(Teamwork, legal and ethical considerations)*
* CSCI 1110 [SRE-E02] Summarize how governmental and environmental regulations affect an organization's environment. *(Government and environment)*
* CPTR 1236 [SRE-S01] Evaluate various security breaches and their effect on business operations. *(Risk management)*

Virtual Systems and Services [ITS-VSS]

* CPTR 2245 [VSS-E01] Contrast virtualized and non-virtualized platforms. *(Technologies)*
* CPTR 2245 [VSS-E02] Implement virtualization for desktops and servers. *(Install technologies)*
* CPTR 2245 [VSS-S01] Implement a storage environment and use performance measurement tools. *(Technologies and performance)*
* CPTR 2245 [VSS-S02] Explain virtualization for applications and network platforms. *(Install technologies)*

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