

EXPLORING COMPUTER SCIENCE
COURSE CODE: 5023

COURSE DESCRIPTION: This course of study is designed to allow students to explore a variety of computer science topics, such as Web design, human computer interactions, programming, and problem solving. Optional topics include mobile applications, robotics, and digital animation. Students will develop critical thinking, logic, and problem solving skills relevant to today's technology.

OBJECTIVE: Given the necessary equipment, software, supplies, and facilities, the student will be able to successfully complete the following core standards for courses that grant one unit of credit.

RECOMMENDED GRADE LEVELS: 9-12 (Preference 9-10)

PREREQUISITE: Algebra I (or equivalent), and/or teacher recommendation

COURSE CREDIT: 1 Carnegie unit

Course Requirements:

Units A-H are required to be taught in the course, plus one of the optional units that are listed.

Course Suggestions for National Certification:

When the instructor uses the optional database unit that can be incorporated into the course, students will then be prepared to take the Microsoft Technology Associate (MTA) certification exam.

COMPUTER REQUIREMENT: One computer per student

Software

Each computer in the classroom should have a Web browser installed that allows students to perform searches and make use of a variety of Web sites and Internet tools. Teachers will need to install appropriate programming software for unit 4-Introduction to Programming and unit 6-Computing Applications.

Hardware

Each student should have access to a functioning computer. If the instructor is opting to utilize the Robotics unit in the course, then at least one of the Lego NXT Kits, Scribbler Kits (or equivalent types of kits) is required for every two students for use during the unit.

INSTRUCTIONAL RESOURCES:

CS Unplugged - <http://csunplugged.org/>

Exploring Computer Science -

- <http://www.exploringcs.org/curriculum>

- <http://csta.acm.org/Curriculum/sub/ExploringCS.html>

ISTE National Computer Science Standards -

- http://www.iste.org/Libraries/NETS_Refresh_Toolkit/NETS_for_Computer_Science_Educators.sflb.ashx

Finch Robots - <http://www.finchrobot.com/>

LEGO Robots - <http://mindstorms.lego.com/en-us/Products/default.aspx>

Alice 3D Animation - <http://www.alice.org/>

Scratch 2D Animation - <http://scratch.mit.edu/>

A. SAFETY AND ETHICS

1. Identify major causes of work-related accidents in offices.
2. Describe the threats to a computer network, methods of avoiding attacks, and options in dealing with virus attacks.
3. Identify potential abuse and unethical uses of computers and networks.
4. Explain the consequences of illegal, social, and unethical uses of information technologies, e.g., piracy; illegal downloading; licensing infringement; and inappropriate uses of software, hardware, and mobile devices.
5. Differentiate between freeware, shareware, and public domain software copyrights.
6. Discuss computer crimes, terms of use, and legal issues such as copyright laws, fair use laws, and ethics pertaining to scanned and downloaded clip art images, photographs, documents, video, recorded sounds and music, trademarks, and other elements for use in Web publications.
7. Identify netiquette including the use of email, social networking, blogs, texting, and chatting.
8. Describe ethical and legal practices in business professions such as safeguarding the confidentiality of business-related information.
9. Discuss the importance of cyber safety and the impact of cyber bullying.

B. EMPLOYABILITY SKILLS

1. Identify positive work practices (e.g., appropriate dress code for the workplace, personal grooming, punctuality, time management, and organization).
2. Demonstrate positive interpersonal skills (e.g., communication, respect, and teamwork).

C. STUDENT ORGANIZATIONS

1. Explain how related student organizations are integral parts of career and technology education courses.
2. Explain the goals and objectives of related student organizations.
3. List opportunities available to students through participation in related student organization conferences/competitions, community service, philanthropy, and other activities.
4. Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.

D. HUMAN COMPUTER INTERACTION

1. Identify the various functional components of a computer.
2. Match a list of computer terms and definitions/functions.
3. Describe the interaction of the various functional components of the computer.
4. Decide on a computer purchase recommendation for a given use (e.g., highly portable, gaming, video editing, student use).
5. List at least three strengths and weaknesses of each of the various Internet technologies such as mapping sites, encyclopedia sites, office automation online software, and cloud content creation.
6. Use at least two of these Internet technologies such as Mapping sites, encyclopedia sites, office automation online software, cloud content creation.
7. Discuss and create advanced searches using at least 3 search engines.
8. Evaluate the results of Web searches and reliability of information found on the Web.
9. Find real world examples where artificial intelligence can and cannot be used with current technology.
10. Describe three examples of the use of technology in non-technical professions through sources such as newspapers, magazines, through interviews, or the Internet.

E. PROBLEM SOLVING

1. List and describe the four steps of the Polya problem solving process.
2. Apply and evaluate the problem solving process using a variety of strategies (diagram/picture, systematic lists, divide and conquer, find the pattern, guess and check, etc.).
3. Write algorithms that use simple and complex logic statements (relational operators and Boolean operators).
4. Demonstrate counting in binary and convert between decimal and binary numbers.
5. Describe and analyze selected searching and sorting algorithms.

6. Describe how minimal spanning trees and graph concepts are used to solve problems.

F. WEB DESIGN

1. Describe issues of social responsibility in Web use and the relative merits of the influence of the Web on society, personal lives, and education.
2. Identify and demonstrate the use of basic HTML.
3. Demonstrate image editing skills for the Web using an image editor.
4. Identify and demonstrate the use of basic CSS structures.
5. Identify and describe a variety of page layout styles.
6. Identify and use a variety of Web page elements (e.g. tables, graphics, video, sound, navigation).
7. Implement additional functionality using DHTML code snippets.
8. Create and present a Web project using HTML, CSS, and JavaScript.

G. INTRODUCTION TO PROGRAMMING

1. Plan, code, test, and execute a program that:
 - a) manipulates and modifies text and numbers.
 - b) utilizes various appropriate data types.
 - c) utilizes objects.
 - d) includes mouse and/or keyboard inputs and accompanying screen outputs.
 - e) uses decision structures.
 - f) uses repetition structures.
 - g) uses multiple scripts/methods/functions within an object.
2. Explain the benefits of consistent, well organized programming style.
3. Convert a word problem into code using top-down design.

H. SOFTWARE DEVELOPMENT USING HIGH LEVEL LANGUAGE (e.g., Java, C++, Visual Basic, Python)

1. Create a basic graphical application.
2. Write an application using pair programming concepts.
3. Use basic Input/Output concepts.
4. Use the concepts of software development activities, models and design teams.
5. Identify and use data types and math operations.
6. Identify and use procedures (sub routines, functions, methods, etc.)
7. Identify and use conditional control statements.
8. Identify and use common looping structures.
9. Identify and use lists.
10. Write and present an application using loops, conditionals and lists.

OPTIONAL TOPICS (MUST COMPLETE ONE OF THE FOLLOWING UNITS)

A. ROBOTICS

1. Determine if an object is a robot by identifying the features of a robot.
2. Describe the steps that happen when a computer processes an instruction.
3. Match the actions of the robot to the corresponding parts of the program.
4. Code and test a robot to solve a stated problem.
5. List and explain ways in which different sensors affect the function of a machine.
6. Compare/contrast multiple ways to program a robot to achieve a goal.

B. MOBILE COMPUTING

1. Describe mobile applications and the constraints of mobile devices.
2. Design a user interface/screen layout for a mobile application.
3. Identify and implement the use of maps and location awareness in mobile applications.
4. Identify and implement the use of multimedia (i.e. audio, video, etc.) in mobile applications.
5. Identify and implement the use of device based sensors and actuators in mobile applications.
6. Identify and implement the use of information applications (e.g., address book, calendar) in mobile applications.
7. Code and test a mobile application that solves a stated problem.

C. DATABASE DESIGN AND PROGRAMMING

1. Relate the importance of databases to everyday life.
2. Distinguish between data and information and give examples of each
3. Explain how data becomes information.
4. Describe the importance of identifying information requirements.
5. Define and use database design terms (entities, attributes, relationships, UUIDs)
6. Distinguish between an entity and an instance of an entity.
7. Name and describe attributes, distinguish between an attribute and its value.
8. Identify mandatory and optional attributes; explain attribute volatility.
9. Define the purpose of normalization in database design.
10. Define and compose database business rules and assumptions.
11. Define database table terms, including row, column, field, primary key, and foreign key.
12. Create and modify database tables using SQL.
13. Identify and use basic data types.
14. Create basic query statements using SELECT and FROM clauses.
15. Use the correct SQL syntax to select specific rows and/or columns in a table, modify the way data is displayed, and perform calculations using arithmetic expressions and operators.

16. Define and use comparison conditions including BETWEEN, IN, LIKE, and NULL.
17. Design, create, modify, and query a simple relational database.

FUTURE UNITS (UNDER DISCUSSION)

- D. GIS TECHNOLOGIES**
- E. CYBER SECURITY**
- F. COMPUTER FORENSICS**
- G. NETWORKING SYSTEMS**