

PASSAIC COUNTY TECHNICAL INSTITUTE
45 Reinhardt Rd.
Wayne, NJ

COURSE TITLE: Computer Science IV (CS4)
COURSE NUMBER: 1027
CREDITS: 17.5
2018

I. COURSE DESCRIPTION

The Computer Science IV curriculum has a concentration in the following areas:

- **SQL FUNDAMENTALS:** Students will learn how to build simple statements to retrieve, store, or modify data; to write complex queries that draw information from multiple tables; to create or edit tables; and to work with unions, subqueries, self joins, cross joins, inner joins, and outer joins.
- **INTRODUCTION TO CYBERSECURITY:** Students will learn about cybersecurity, digital citizenship, cyber hygiene, cryptography, software security and basic system administration.
- **PROBLEM SOLVING USING PYTHON:** Students will be learning advanced topics in Python like: Simple Graphics, Image Processing, and Graphical User Interfaces. Hands-on laboratory work will be done to solidify each concept.
- **ARDUINO:** There will be a component of Arduino, microcontrollers and electrical circuits. This is intended to get students started with Arduino by creating projects. Concepts that will be covered include: Software setup, Input and Output, Analog and digital sensors, Sound, LCD screens.
- **PRESENTATIONS:** Professional presentations will be an integral part of this course. Every trimester there will be project presentations that will help students in their communication skills. Students will be encouraged to use variety of tools like Audacity, Movie maker, Animation maker, Power point etc.
- **COMPETITIONS:** Students will be encouraged to participate in different competitions. These competitions will give students the opportunity to showcase their knowledge and expertise.

In addition to learning about SQL, cybersecurity and problem solving materials, the students will learn to effectively use different learning strategies and materials. This includes effective use of knowledge resources -- reading documentation, asking and answering peer questions, consulting with more experienced persons, and searching on-line for answers. It also includes tools and methodology – testing to verify the correctness of code, use of an integrated development environment (IDE) and debugger, writing specifications and documentation.

II. UNITS:

UNIT 1

Content Area:	Computer Science IV	Grade(s)	12
Unit Plan Title:	SQL FUNDAMENTALS I. Introduction <ol style="list-style-type: none">1. Tables2. SQL3. Strings4. User Input II. Main clauses of select statement <ol style="list-style-type: none">1. Select2. From3. Where4. Order By III. Compound conditions in the Where clause <ol style="list-style-type: none">1. AND2. OR3. NOT IV. View <ol style="list-style-type: none">1. Creating a view2. Contrast between Table and View3. Inserting, deleting, updating data in a Table V. Transactions <ol style="list-style-type: none">1. Commit and Rollback commands2. Transactions3. Modify data in a table by working through a view VI. Create Tables <ol style="list-style-type: none">1. Creating and changing Tables2. Data types in Access3. Primary Key4. Making changes to Tables VII. Formats, Sequences, and Indexes		

1. Format of Dates
2. Date Functions
3. Using and creating sequence
4. Indexes

11 weeks are required for Unit 1.

NJSLS/CCTC Standard(s) Addressed

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.3. IT.2 Use product or service design processes and guidelines to produce a quality information technology (IT) product or service

9.3. IT-PRG.1 Analyze customer software needs and requirements.

9.3. IT-PRG.2 Demonstrate the use of industry standard strategies and project planning to meet customer specifications.

9.3. IT-PRG.5 Apply an appropriate software development process to design a software application.

9.3. IT-PRG.6 Program a computer application using the appropriate programming language.

9.3. IT-PRG.7 Demonstrate software testing procedures to ensure quality products.

9.3. IT-PRG.8 Perform quality assurance tasks as part of the software development cycle.

Essential Questions (3-5)

1. What is a relational database?
2. What are the similarities between Oracle and Access?
3. What is SQL?

Anchor Text(s)

SQL Fundamentals – Third Edition – John J. Patrick – Prentice Hall 2009 ISBN-13: 978-0137126026

Short & Informational Texts (3-5)

INFORMATIONAL MATERIAL

- “MS Access Tutorial?”
https://www.tutorialspoint.com/ms_access/index.htm
- “SQL Tutorial”
<https://www.tutorialspoint.com/sql/index.htm>
- “Code Academy”
<https://www.codecademy.com/articles/what-is-rdbms-sql>

Expected Proficiencies/Career and Life Skills

PROFICIENCIES:

- Build simple statements to retrieve, store, or modify data
- Craft complex queries to draw information from multiple tables
- Sort and summarize data
- Create and edit a table

LIFE SKILLS:

- Students will be able to write SQL queries that are easy to understand, verify, and extend

Formative & Summative Assessments

FORMATIVE:

- Hands-on lab work
- In-class discussions
- Quizzes
- Questioning and discussion

SUMMATIVE:

- Projects/Presentations
- End-of-unit or chapter tests

- End-of-term or semester exams

Resources (Websites, LMS, Google Classroom, documents, etc.)

- Lynda.com
- Canvas
- YouTube videos
- w3schools.com

UNIT 2

Content Area:	Computer Science IV	Grade(s)	12
Unit Plan Title:	<p>INTRODUCTION TO CYBERSECURITY</p> <p>I. What is cybersecurity?</p> <ol style="list-style-type: none"> 1. Cybersecurity 2. Impact of cybersecurity <p>II. Digital Citizenship and Cyber Hygiene</p> <ol style="list-style-type: none"> 1. Digital Footprint and Reputation 2. Cyberbullying 3. Internet Safety 4. Copyright 5. Hacking Ethics <p>III. The ABCs of Cryptography</p> <ol style="list-style-type: none"> 1. Cryptography, Cryptology, Cryptanalysis 2. Caesar Cipher, Cracking Caesar 3. Hash Functions <p>IV. Software Security</p> <ol style="list-style-type: none"> 1. Inside Web Apps 2. Client. Server, Databases 3. Data Exposure <p>V. Network Fundamentals</p>		

1. Basic Networking Protocols
 2. Network Hacks
 3. Securing a Network
- VI. Basic system Administration**
1. Intro to the Shell
 2. System Admins and Security

11 weeks are required for Unit 2

NJSLS/CCTC Standard(s) Addressed

- CRP1.** Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP7. Employ valid and reliable research strategies.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
9.3. IT.4 Demonstrate positive cyber citizenry by applying industry accepted ethical practices and behaviors.
9.3. IT.8 Recognize and analyze potential IT security threats to develop and maintain security requirements.
9.3. IT.10 Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.
9.3. IT-NET.2 Analyze wired and wireless network systems to determine if they meet specifications (*e.g.*, IEEE, power and security).

Essential Questions (3-5)

1. Why is digital citizenship and cyber hygiene important?
2. Explain the difference between Cryptography, Cryptology, and Cryptanalysis?
3. What are the different ways of securing a network?
4. Why Cybersecurity is important in modern day society?

Anchor Text(s)

Code HS – <https://codehs.com/>

Reference Books:

- Network Security Essentials – volume 1 - second edition – ISECOM ISBN# 13:978-0978520700
Security Analysis Essentials – volume 2 – ISECOM ISBN# 13: 978-0978520724

Hacking Essentials – volume 3 – ISECOM ISBN# 13:978-0978520731

Short & Informational Texts (3-5)

INFORMATIONAL MATERIAL

- “Computer Security Tutorial”
https://www.tutorialspoint.com/computer_security/index.htm
- “Ethical Hacking and Cyber Security”
https://www.tutorialspoint.com/ethical_hacking_and_cyber_security/index.asp
- “Cyber Security Strategies”
https://www.tutorialspoint.com/information_security_cyber_law/cyber_security_strategies.htm

Expected Proficiencies/Career and Life Skills

PROFICIENCIES:

- Understand the impact of Cybersecurity
- Learn about hacking ethics
- Know the consequences of cyber bullying
- Familiar with Internet safety guidelines
- Learn about network hacks

LIFE SKILLS:

- Learn and reinforce essential security skills to protect themselves against hacking.
- Learn about cyber safety
- Protect themselves against cyberbullying.

Formative & Summative Assessments

FORMATIVE:

- Hands-on lab work
- In-class discussions

- Quizzes
- Questioning and discussion

SUMMATIVE:

- Projects/Presentations
- End-of-unit or chapter tests
- End-of-term or semester exams

Resources (Websites, LMS, Google Classroom, documents, etc.)

- Tutorialspoint.com
- geeksforgeeks.org
- Instructional Videos
- Canvas

UNIT 3

Content Area:	Computer Science IV	Grade(s)	12
Unit Plan Title:	ARDUINO <ul style="list-style-type: none"> I. Light Sensor Projects <ul style="list-style-type: none"> 1. Blink of LED 2. Potentiometer 3. Photometer 4. RGB Night -Light II. Sound Sensor Projects <ul style="list-style-type: none"> 1. Buzzer 2. Digital trumpet III. Motion Sensor projects <ul style="list-style-type: none"> 1. Servo Projects 		

- 2. Distance Sensor
 - 3. Motion Alarm
- IV. Display Sensor Projects**
- 1. LCD “Hello World”
 - 2. Temperature sensor

4 weeks are required for Unit 3.

NJSLS/CCTC Standard(s) Addressed

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

9.3. IT.2 Use product or service design processes and guidelines to produce a quality information technology (IT) product or service

9.3. IT-PRG.1 Analyze customer software needs and requirements.

9.3. IT-PRG.2 Demonstrate the use of industry standard strategies and project planning to meet customer specifications.

9.3. IT-PRG.5 Apply an appropriate software development process to design a software application.

9.3. IT-PRG.6 Program a computer application using the appropriate programming language.

9.3. IT-PRG.7 Demonstrate software testing procedures to ensure quality products.

9.3. SIT-PRG.8 Perform quality assurance tasks as part of the software development cycle.

Essential Questions (3-5)

- 1. What is embedded electronics?
- 2. How to program embedded systems?
- 3. What are the differences and similarities between Arduino and Raspberry Pi

Anchor Text(s)

Spark Fun Inventor’s Kit Experiment Guide 4.0 <https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide>

Short & Informational Texts (3-5)

INFORMATIONAL MATERIAL

- “Arduino Tutorial”
https://www.tutorialspoint.com/arduino/arduino_tutorial.pdf
- “Introduction to Arduino”
<https://www.introarduino.com/downloads/IntroArduinoBook.pdf>

Expected Proficiencies/Career and Life Skills**PROFICIENCIES:**

- Become familiar with Arduino
- Be able to do projects using light, sound, motion and display sensor

LIFE SKILLS:

- Acquire the know how to create countless new projects using Arduino

Formative & Summative Assessments**FORMATIVE:**

- Hands-on lab work
- In-class discussions
- Quizzes
- Questioning and discussion

SUMMATIVE:

- Projects/Presentations
- End-of-unit or chapter tests
- End-of-term or semester exams

Resources (Websites, LMS, Google Classroom, documents, etc.)

- Lynda.com
- Canvas
- YouTube videos

- Learn.sparkfun.com
- Tutorialpoint.com

UNIT 4

Content Area:	Computer Science IV	Grade(s)	12
Unit Plan Title:	<p>PROBLEM SOLVING WITH PYTHON</p> <p>I. Simple Graphics and Image Processing</p> <ol style="list-style-type: none"> 1. Overview of Turtle graphics 2. Drawing Two-Dimensional shapes 3. Colors and RGB System 4. Sampling and digitizing images 5. Image Manipulation <p>II. Graphical User Interfaces</p> <ol style="list-style-type: none"> 1. GUI based programs 2. Windows components 3. Buttons and Boxes <p>10 weeks are required for Unit 4</p>		
NJSLS/CCTC Standard(s) Addressed			
<p>CRP2. Apply appropriate academic and technical skills.</p> <p>CRP4. Communicate clearly and effectively and with reason</p> <p>CRP6. Demonstrate creativity and innovation.</p> <p>CRP7. Employ valid and reliable research strategies.</p> <p>CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p>CRP11. Use technology to enhance productivity.</p> <p>9.3. IT.2 Use product or service design processes and guidelines to produce a quality information technology (IT) product or service</p>			

- 9.3. IT-PRG.1** Analyze customer software needs and requirements.
- 9.3. IT-PRG.2** Demonstrate the use of industry standard strategies and project planning to meet customer specifications.
- 9.3. IT-PRG.5** Apply an appropriate software development process to design a software application.
- 9.3. IT-PRG.6** Program a computer application using the appropriate programming language.
- 9.3. IT-PRG.7** Demonstrate software testing procedures to ensure quality products.
- 9.3. IT-PRG.8** Perform quality assurance tasks as part of the software development cycle.

Essential Questions (3-5)

1. What are the advantages and disadvantages of lossless and lossy file-compression schemes?
2. When would you make a data field read-only, and how would you do this?
3. What are event handlers?

Anchor Text(s)

Fundamentals of Python First Programs: 2nd edition – Kenneth A. Lambert ISBN# ISBN-10: 133756009X

Short & Informational Texts (3-5)

INFORMATIONAL MATERIAL

- “Digital Image Processing”
<https://www.tutorialspoint.com/dip/index.htm>
- “Python – GUI Programming”
http://www.tutorialspoint.com/python/python_gui_programming.htm
- “GUI Tutorial”
<https://pythonspot.com/gui/>

Expected Proficiencies/Career and Life Skills

PROFICIENCIES:

- Use the concepts of object-oriented programming to solve a problem
- Use the RGB system to create colors in graphics applications
- Modify pixels in images

- Design and code a GUI-based program
- Instantiate different types of window components such as labels, entry fields, buttons
- Define methods to handle events

LIFE SKILLS:

- Students will be able to design and code a Graphical User Interface
- Students will be able to use object oriented concepts to solve a problem
- Students will be able to modify pixels in images

Formative & Summative Assessments

FORMATIVE:

- Hands-on lab work
- In-class discussions
- Quizzes
- Questioning and discussion

SUMMATIVE:

- Projects/Presentations
- End-of-unit or chapter tests
- End-of-term or semester exams

Resources (Websites, LMS, Google Classroom, documents, etc.)

- Lynda.com
- Canvas
- YouTube videos
- Tutorialpoint.com

III. INSTRUCTIONAL STRATEGIES

- Lectures

- Cooperative learning
- Hands-on learning
- Researching information
- Homework and practice
- Debating
- Discussions
- Project-based learning
- Instructional videos (YouTube, Lynda.com)
- Technical writing
- Student goal setting
- Differentiated instruction
 - Assess students' learning using formative assessment
 - Recognition of diverse learners
 - Create a PowerPoint presentation summarizing the lesson.
 - Ongoing, formative assessment
 - Write to explore, think, learn, and improve comprehension.

IV. SCOPE AND SEQUENCE:

I = Introduce D = Develop R = Reinforce M = Master	
Apply appropriate academic and technical skills.	I, D, R
Communicate clearly and effectively and with reason.	I, D, R
Demonstrate creativity and innovation.	I, D
Employ valid and reliable research strategies	I, D
Utilize critical thinking to make sense of problems and persevere in solving them.	I, D
Use technology to enhance productivity.	I, D, R
Work productively in teams while using cultural global competence.	I, D, R
Demonstrate effective professional communication skills and practices that enable positive customer relationships.	I, D
Use product or service design processes and guidelines to produce a quality information technology (IT) product or service	I, D
Analyze customer software needs and requirements.	I, D
Demonstrate the use of industry standard strategies and project planning to meet customer specifications.	I, D
Apply an appropriate software development process to design a software application	I, D
Program a computer application using the appropriate programming language.	I
Demonstrate software testing procedures to ensure quality products.	I, D
Perform quality assurance tasks as part of the software development cycle.	I, D
Design, create and maintain a database.	I, D

V. COURSE TEXTBOOKS, INSTRUCTIONAL RESOURCES AND SOFTWARE:

Unit 1:

SQL Fundamentals – Third Edition – John J. Patrick – Prentice Hall 2009 ISBN-13: 978-0137126026

Unit 2:

Code HS – <https://codehs.com/>

Reference Books:

Network Security Essentials – volume 1 - second edition – ISECOM ISBN# 13:978-0978520700

Security Analysis Essentials – volume 2 – ISECOM ISBN# 13: 978-0978520724

Hacking Essentials – volume 3 – ISECOM ISBN# 13:978-0978520731

Unit 3:

Spark Fun Inventor's kit Experiment Guide 4.0 <https://learn.sparkfun.com/tutorials/sparkfun-inventors-kit-experiment-guide>

Unit 4:

Fundamentals of Python First Programs: 2nd edition – Kenneth A. Lambert ISBN# ISBN-10: 133756009X

VI. STUDENT HANDOUT:

The goal of Computer Science IV is to give the students an in-depth understanding of SQL programming, and cyber security. This course also encompasses many different types of open-ended problems of a mathematical or business nature. Students will work on embedded systems like Arduino. All students will demonstrate the following skills:

- Critical thinking
- Decision making
- Software engineering
- Use of technologies
- Self-management skills
- Time-management skills
- Teamwork
- Divide and conquer

In order to apply these skills, the instructional strategies will incorporate solving a number of Lab Assignments.

Proficiencies

- Build simple statements to retrieve, store, or modify data
- Craft complex queries to draw information from multiple tables
- Sort and summarize data
- Create and edit a table
- Be able to write SQL queries that are easy to understand, verify, and extend
- Understand the impact of Cybersecurity
- Understand hacking ethics
- Know the consequences of cyber bullying
- Familiar with Internet safety guidelines
- Understands network hacks
- Be able to protect them against hacking.
- Understands cyber safety
- Be able to protect them against cyberbullying.
- Become familiar with Arduino
- Be able to do projects using light, sound, motion and display sensor
- Be able to create new projects using Arduino
- Use the concepts of object-oriented programming to solve a problem
- Use the RGB system to create colors in graphics applications
- Modify pixels in images
- Design and code a GUI-based program
- Instantiate different types of window components such as labels, entry fields, buttons
- Define methods to handle events
- Apply object oriented concepts to solve a problem
- Be able to modify pixels in images