Special Topics in Computer Science

This course is designed to encourage students to develop expertise in areas of personal interest in Computer Science/Information Technology. Students may study in the following areas: advanced programming, network administration, computer imaging, computer 2D/3D graphic animation, web page design/development, operating systems, advanced software applications and other topics with instructor approval. The requirements for this course can be satisfied through individual or team projects, mentorships, or independent study during class periods. Students leaving this course should be well prepared to perform self-directed investigation and study in the future.

Mastery Objectives

- Pursue areas of personal interest in Computer Science/Information Technology
- Set overall course direction, goals, and objectives through proposal creation and revision
- Perform self-directed, independent research within the area of their concentration (e.g. Web Design/Development, Computer Gaming, etc.)
- Identify, select, analyze, and utilize technology and other material resources (e.g. textbooks, network hardware, etc.) to meet stated goals and objectives and to complete tasks
- Utilize critical thinking skills, multiple processes, and diverse perspectives to solve problems, develop solutions, or complete projects
- Develop effective time management and organizational skills through both quarterly (i.e. marking period) and weekly goal setting and administration of daily activities
- Document and communicate progress through weekly status reports which measure progress against stated weekly goals
- Establish professional contacts to ensure use of current, industry-accepted practices

Standards

Standard 8. Technological Literacy

STANDARD 8.1 (Computer and information literacy) All students will use computer applications to gather and organize information and to solve problems. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:

A. Basic Computer Skills and Tools
1. Create a multi-page document with citations using word processing software in conjunction with other tools that demonstrates the ability to format, edit, and print.
2. Create documents including a resume and a business letter using professional format.
3. Construct a spreadsheet, enter data, use mathematical or logical functions to manipulate and process data, generate charts and graphs, and interpret the results.
4. Given a database, define fields, input data from multiple records, produce a report using sort and query, and interpret the data.
5. Produce a multimedia project using text, graphics, moving images, and sound.
6. Produce and edit page layouts in different formats using desktop publishing and graphics software.

7. Develop a document or file for inclusion into a website or web page.
8. Discuss and/or demonstrate the capability of emerging technologies and software in the creation of documents or files.
9. Merge information from one document to another.

B. Application of Productivity Tools
Social Aspects
1. Describe the potential and implications of contemporary and emerging computer applications for personal, social, lifelong learning, and workplace needs.
2. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Make informed choices among technology systems, resources, and services in a variety of contexts.
4. Use appropriate language when communicating with diverse audiences using computer and information literacy.

Information Access and Research
5. Select and use specialized databases for advanced research to solve real world problems.
6. Identify new technologies and other organizational tools to use in personal, home, and/or work environments for information retrieval, entry, and presentation.
7. Evaluate information sources for accuracy, relevance, and appropriateness.
8. Compose, send, and organize e-mail messages with and without attachments.

Problem Solving and Decision Making
9. Create and manipulate information, independently and/or collaboratively, to solve problems and design and develop products.
10. Identify, diagnose, and suggest solutions for non-functioning technology systems.
11. Identify a problem in a content area and formulate a strategy to solve the problem using brainstorming, flowcharting, and appropriate resources.
12. Integrate new information into an existing knowledge base and communicate the results in a project or presentation.

STANDARD 8.2 (Technology Education) All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment. Building upon knowledge and skills gained in preceding grades, by the end of **Grade 12**, students will:

A. Nature and Impact of Technology
1. Use appropriate data to discuss the full costs, benefits and trade-offs, and risks related to the use of technologies.
2. Explain how technological development is affected by competition through a variety of management activities associated with planning, organizing, and controlling the enterprise.
3. Provide various examples of how technological developments have shaped human history.

B. Design Process and Impact Assessment

1. Analyze a given technological product, system, or environment to understand how the engineering design process and design specification limitations influenced the final solution.
2. Evaluate the function, value, and appearance of technological products, systems, and environments from the perspective of the user and the producer.
3. Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities.
4. Use a computer assisted design (CAD) system in the development of an appropriate design solution.
5. Diagnose a malfunctioning product and system using appropriate critical thinking methods.
6. Create a technological product, system, or environment using given design specifications and constraints by applying design and engineering principles.

C. Systems in the Designed World
1. Explain the life cycle of a product from initial design to reuse, recycling, remanufacture, or final disposal, and its relationship to people, society, and the environment, including conservation and sustainability principles.
2. Analyze the factors that influence design of products, systems, and environments.
3. Compare and contrast the effectiveness of various products, systems, and environments associated with technological activities in energy, transportation, manufacturing, and information and communication.

Standard 9. Career Education and Consumer, Family and Life Skills
STANDARD 9.1 (Career and Technical Education) All students will develop career awareness and planning, employability skills, and foundational knowledge necessary for success in the workplace. Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:

A. Career Awareness/Preparation
1. Re-evaluate personal interests, abilities, and skills through various measures including self-assessments.
2. Evaluate academic and career skills needed in various career clusters.
3. Analyze factors that can impact an individual's career.
4. Review and update their career plan and include the plan in a portfolio.
5. Research current advances in technology that apply to a selected occupational career cluster.

B. Employability Skills
1. Assess personal qualities that are needed to obtain and retain a job related to career clusters.
2. Communicate and comprehend written and verbal thoughts, ideas, directions, and information relative to educational and occupational settings.
3. Select and utilize appropriate technology in the design and implementation of teacher-approved projects relevant to occupations and/or higher educational settings.
4. Evaluate the following academic and career skills as they relate to home, school, community, and employment:
    o Communication

- o Punctuality
- o Time management
- o Organization
- o Decision making
- o Goal setting
- o Resources allocation
- o Fair and equitable competition
- o Safety
- o Employment application skills
- o Teamwork

5. Demonstrate teamwork and leadership skills that include student participation in real world applications of career and technical education skills.

All students electing further study in career and technical education will also:

1. Participate in a structured learning experience that demonstrates interpersonal communication, teamwork, and leadership skills.
2. Participate in simulated industry assessments, when and where appropriate.
3. Prepare industry-specific technical reports/projects that incorporate graphic aids, when and where appropriate.
4. Demonstrate occupational health and safety skills related to industry-specific activities.

Materials and Resources

As students have numerous areas of study that may be pursued, there are no recommended textbooks/resources for this course. Students will need unrestricted access (i.e. Administrator rights) to a dedicated computer, as well as access to the Internet (through normal, filtered school channels) for research and weekly plan/status reporting purposes. Students should be encouraged to use open-source, shareware, or freeware resources whenever possible, and any innovations, modifications, etc. to these resources should be reported back to the open-source community. Software and hardware purchases will need to be assessed on a case-by-case basis and cannot be guaranteed.

Interdisciplinary Project-Based Learning Scenarios

[Project Based Learning (PBL)](#) is an effective strategy that supports the implementation of the revised standards through integration of 21st century content and skills and themes (global awareness; financial, economic, business and entrepreneurial literacy; civic literacy; and health literacy) into all core content areas.

To assist educators with the implementation of the standards using PBL as a tool, a project entitled *Standards and Professional Development: Critical Links in Preparing Global Citizens in New Jersey*, funded by the [Longview Foundation](#), was developed by content area teams of NJ educators in collaboration with the [Peace Corps Coverdell World Wise Schools](#). Other project partners include [NJPSA](#), [NJASCD](#) and the [Center for Innovative Education at Kean University](#).

The project offers interdisciplinary, project-based learning scenarios at the elementary, middle school and high school levels. PBL scenarios reflect the criteria outlined by the [Buck Institute for Education](#) that distinguish PBL from extended classroom activities:

- Recognize students' inherent drive to learn, their capability to do important work, and their need to be taken seriously by putting them at the center of the learning process.
- Engage students in the central concepts and principles of a discipline. The project work is central rather than peripheral to the curriculum.
- Highlight provocative issues or questions that lead students to in-depth exploration of authentic and important topics.
- Require the use of essential tools and skills, including technology, for learning, self-management, and project management.
- Specify products that solve problems, explain dilemmas, or present information generated through investigation, research, or reasoning.
- Include multiple products that permit frequent feedback and consistent opportunities for students to learn from experience.
- Use performance-based assessments that communicate high expectations, present rigorous challenges, and require a range of skills and knowledge.
- Encourage collaboration in some form, either through small groups, student-led presentations, or whole-class evaluations of project results.

Student Project Examples

Mobile Game Development – Using Google's Android mobile development framework, a student designed and developed a dynamic Sudoku game capable of running on any platform utilizing the Android operating system. The game lets you choose from three levels (easy, medium, and hard) and dynamically generates a puzzle within the chosen difficulty range.

Flash Animation – Using Adobe's Flash, a student designed, animated, directed, and voiced a two minute, original short film. During the initial part of the independent study, emphasis was placed upon animation techniques, shading, lip synching, and character development and voicing. Once a foundation was developed, the student input his animations into the computer, synchronized the lip movements to a script, and recorded all character voices in the school's recording studio.