

ODE TECHNOLOGY GUIDELINES

~GRADE 10~

Nature of Technology—Students develop an understanding of technology, its characteristics, scope, core concepts and relationships between technologies and other fields.

Benchmark A: Synthesize information, evaluate and make decisions about technologies.

- ____ 1. Describe how the rate of technological development and diffusion is increasing rapidly (e.g., a computer system chip has been adapted for use in toys and greeting cards).
- ____ 2. Articulate how inventions and innovations are results of specific goal-directed research (e.g., companies have research and development offices to guide new product development).
- ____ 3. Explain how technological development is influenced by many factors, including profit incentive and market economy.

Benchmark B: Apply technological knowledge in decision-making.

- ____ 1. Describe situations in which the selection of resources involves tradeoffs between competing values, such as availability, desirability, cost and waste (e.g., use of plastic in manufacturing has many advantages, but may put the environment at risk and deplete natural resources).

Benchmark C: Examine the synergy between and among technologies and other fields of study when solving technological problems.

- ____ 1. Analyze technology transfer scenarios.
- ____ 2. Describe how technological innovation often results when ideas, knowledge or skills are shared within a technology.
- ____ 3. Define examples of how technological progress is integral to the advancement of science, mathematics and other fields of study.

Technology and Society Interaction—Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.

Benchmark A: Interpret and practice responsible citizenship relative to technology.

- ____ 1. Understand that the development of technology may be influenced by societal opinions and demands, in addition to corporate cultures.
- ____ 2. Contrast ethical considerations and how they are important in the development, selection and use of technologies.
- ____ 3. Provide examples of how transfer of a technology from one society to another can cause cultural, social, economic and political changes affecting both societies to varying degrees (e.g., World War II industrial mobilization drew women into the work force).
- ____ 4. Identify capabilities and limitations of contemporary and emerging technology resources and assess the potential of these systems and services to address personal, lifelong learning and workplace needs.
- ____ 5. Analyze advantages and disadvantages of widespread use and reliance on technology in the workplace and in society as a whole.

Benchmark B: Demonstrate the relationship among people technology and the environment.

- ____ 1. Explain how, with the aid of technology, various aspects of the environment can be monitored to provide information for decision-making (e.g., satellites can be used to monitor wetlands in order to control disease spread by mosquitoes).
- ____ 2. Understand that the appropriate design of

technological devices and systems maximizes performance and reduces negative impacts on the environment (e.g., design vehicle components for ease of recycling after use).

Benchmark C: Interpret and evaluate the influence of technology throughout history, and predict its impact on the future.

- ____ 1. Examine the social/economic climate for invention and innovation in different periods of history.
- ____ 2. Explain how the evolution of civilization has been directly affected by, and has affected, the development and use of tools and materials.

Benchmark D: Analyze ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.

- ____ 1. Describe/discuss the ethical considerations involved in the development or deployment of a technology.
- ____ 2. Analyze technology law, legislation and policy in context of user rights and responsibilities.
- ____ 3. Understand the importance of diverse information and access to information in a democratic society.

Benchmark E: Forecast the impact of technological products and systems.

- ____ 1. Synthesize data, analyze trends and draw conclusions regarding the effect of technology on the individual, society and environment (e.g., current and historical time periods).
- ____ 2. Produce graphs and/or charts to describe trends and visualize data.
- ____ 3. Describe how a technological change has affected the local community (e.g., how a new highway has changed traffic and building patterns).

Technology for Productivity Applications—Students learn the operations of technology through the usage of technology and productivity tools.

Benchmark A: *Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.*

- ___1. Examine current and past devices for storing data and predict potential devices for the future.
- ___2. Analyze various types of connectivity and list pros and cons of each.
- ___3. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use.

Benchmark B: *Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.*

- ___1. Utilize advanced word processing and desktop publishing features and programs.
- ___2. Use equipment related to computer and multimedia technology imaging (e.g., digitalization, optical character recognition, scanning, computerized microscopes).
- ___3. Identify/recognize state-of-the-art technology tools for solving problems and managing personal/professional information.

Technology and Communication

Applications—Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.

Benchmark A: *Apply appropriate communication design principles in published and presented projects.*

- ___1. Identify and incorporate common organizational techniques used in electronic communication (e.g., cause and effect, compare and contrast, problem and solution strategies).
- ___2. Manipulate communication design elements (image, language, sound and motion) based on intent of the message (e.g., inform or persuade).
- ___3. Verify accessibility components of the communication product and adapt as needed.
- ___4. Compare and contrast the accuracy of the message/communication product with the audience results (e.g., was the audience influenced by

inaccurate information?).

Benchmark B: *Create, publish and present information, utilizing formats appropriate to the content and audience.*

- ___1. Publish information in printed and electronic version appropriate publication format (e.g., paper, Web, video).
- ___2. Evaluate communication products.

Benchmark C: *Identify communication needs, select appropriate communication tools and design collaborative interactive projects and activities to communicate with others, incorporating emerging technologies.*

- ___1. Contribute to organized e-mail discussions (e.g., discussion list, list serv, threaded discussion list, courseware discussion).
- ___2. Employ online communication capabilities to make inquiries, do research and disseminate results (e.g., develop dialogues on issues in U.S. government).
- ___3. Implement online-structured learning experiences (e.g., tutorials, virtual classes, industry certification courses).

Technology and Information Literacy—Students engage in information literacy strategies, use the Internet, technology tools and resources, and apply information-management skills to answer questions and expand knowledge.

Benchmark A: *Determine and apply an evaluative process to all information sources chosen for a project.*

- ___1. Examine information for its accuracy and relevance to an information need (e.g., for a report on pollution, find information from sources that have correct and current information related to the topic).
- ___2. Identify relevant facts, check facts for accuracy and record appropriate information (e.g., follow a standard

procedure to check information sources used in a paper).

- ___3. Create a bibliography of sources in an electronic format.
- ___4. Select appropriate information on two sides of an issue (e.g., identify the author of each information source and their expertise and/or bias).

Benchmark B: *Apply a research process model to conduct research and meet information needs.*

- ___1. Select the essential question to be examined by the research.
- ___2. Identify sources most likely to have the needed information and determine subjects and keywords to be used in searching magazine databases and other electronic reference resources.
- ___3. Evaluate information and select relevant and pertinent information found in each source, and maintain accurate records of sources used.
- ___4. Organize and analyze information, finding connections that lead to a final product.
- ___5. Follow copyright law and use standard bibliographic format to list sources.
- ___6. Assess whether the essential questions are answered, gather more information and data and modify search terms as needed. Edit the product.
- ___7. Review and evaluate research process and the resources used (e.g., how can the research process be improved?).

Benchmark C: *Formulate advanced search strategies, demonstrating an understanding of the strengths and limitations of the Internet, and evaluate the quality and appropriate use of Internet resources.*

- ___1. Construct an effective search strategy to retrieve relevant information through multiple search engines, directories and Internet resources.
- ___2. Narrow or broaden the search strategy by modifying the keywords entered in the original search strategy.
- ___3. Employ a systematic approach to judge the validity of a Web information match against the defined information need (e.g., researching an author through the Web requires finding

biographical information plus criticisms of the author's works).

4. Examine the information retrieved through Internet searching for authenticity of information, bias, currency, relevance and appropriateness.

Benchmark D: Evaluate choices of electronic resources and determine their strengths and limitations.

1. Choose a topic and identify appropriate electronic resources to use, citing the name and date of the resource database archive collection.
2. Research and critique information in different types of subscription (fee-based) electronic resources to locate information for a curricular need.
3. Investigate tools within electronic resources to generate search strategies (e.g., use a thesaurus to identify subject terms for improved retrieval of information).

Design—Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.

Benchmark A: Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

1. Solve an inventive problem that contains a technical contradiction (e.g., analyze the technical system, state the technical contradiction and resolve the technical contradiction).
2. Apply common statistical tools to solve problems (e.g., statistical process control).
3. Describe quality and how it is evaluated in a product or system.
4. Select and use simulation in the design process.
5. Apply the conceptual and technical principles that underpin design processes (e.g., analyze characteristics of technical systems that affect performance and identify principles that resolve design contradictions).
6. Discuss how requirements of a design, such as criteria, constraints and efficiency, sometimes compete with each other.
7. Identify criteria and constraints for a design

problem and determine how they will affect the design process (e.g., factors such as concept generation, development, production, marketing, fiscal matters, use, and disposability of a product or system).

8. Understand the role of outsourcing in the engineering process and how effective communication is essential.
9. Describe several systems archetypes and how they explain the behavior of systems.
10. Describe how trademarks, patents and copyrights are obtained.

Benchmark B: Recognize the role of teamwork in engineering design and of prototyping in the design process.

1. Build a prototype to test a design concept and make actual observations and necessary design adjustments.
2. Design a prototype using quality control measures (e.g., measuring, checking, testing, feedback).
3. Evaluate a design using established design principles to collect data on the design's effectiveness, and suggest improvements (e.g., how can bicycles be made safer?).
4. Explain how established design principles are used to evaluate existing designs, collect data and guide the design process.
5. Explain how engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
6. Explain how gender-bias, racial-bias and other forms of stereotyping and discrimination can affect communication within an engineering team.
7. Identify where statistical tools might be used to identify problems in a system.
8. Use multimedia to communicate a design solution between technological systems.

Benchmark C: Understand and apply research, development and experimentation to problem-solving.

1. Explain why technological problems must be researched before they can be solved.
2. Research previous solutions to a technological problem and redesign an alternative solution.
3. Select and apply emerging technology in consultation with experts, for research, information analysis, problem-solving and decision-making in content learning.
4. Categorize inventions in each of the technological systems as one of the five levels of innovation (e.g., apparent or conventional solution, small invention inside paradigm, substantial invention inside technology, invention outside technology, discovery).
5. Use computers, calculators, instruments and devices to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate to group members (e.g., CAD—computer-aided design, software, library resources, the Internet, word processing, CBLs—calculator based labs, laser measuring tools and spreadsheet software).

Designed World—Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.

Benchmark A: Classify, demonstrate, examine, and appraise energy and power technologies.

1. Differentiate between open (e.g., irrigation, forced hot air system) and closed (e.g., forced hot water system, hydroponics) fluid systems and their components such as valves, controlling devices and metering devices.
2. Understand that all energy delivery systems need an infrastructure (e.g., identify features of natural gas and gasoline pipeline distribution systems across Ohio).
3. Safely use the tools and processes of energy and power technological systems.

- ___4. Explain the relationship between resistance, voltage and current (Ohm's Law).
- ___5. Build energy and power devices using the appropriate technological tools, machines, equipment, materials and technical processes to solve a problem in the community.
- ___6. Identify the sources of energy, conversion process, and load in a variety of power systems (e.g., tractor, electrical grid, elevator).
- ___7. Differentiate among conduction, convection, and radiation in a thermal system (e.g., heating and cooling a house, cooking).
- ___8. Identify and explain the components of a circuit including a source, conductor, load and controllers (controllers are switches, relays, diodes, transistors, integrated circuits).

Benchmark B: *Classify, demonstrate, examine and appraise transportation technologies.*

- ___1. Describe how transportation services and methods have led to a population that is regularly on the move.
- ___2. Describe the factors that influence the cost of producing technological products and systems in transportation technologies.

Benchmark C: *Classify, demonstrate, examine and appraise manufacturing technologies.*

- ___1. Explain the manufacturing processes of casting and molding, forming, separating, conditioning, assembling and finishing.
- ___2. Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.
- ___3. Identify and investigate modern production technology practices and equipment in manufacturing technologies (e.g., just-in-time, lean production, six-sigma, new automation processes, systems, materials, tools).
- ___4. Demonstrate how the interchangeability of parts increases the effectiveness of manufacturing processes (e.g., manufacture a product using interchangeable parts; repair a product using replacement parts).
- ___5. Use marketing to establish a product's viability and identity, conduct research on its potential, advertise it, package it, distribute it and sell it.

Benchmark D: *Classify, demonstrate, examine, and appraise construction technologies.*

- ___1. Identify and explain the engineering properties of materials used in structures (e.g., elasticity, plasticity, thermal conductivity, density).
- ___2. Identify and investigate modern production technology practices and equipment in construction technologies (e.g., new building techniques, materials, tools).
- ___3. Construct a structure using a variety of processes and procedures (e.g., material use, how it is assembled, and skill level of worker).
- ___4. Describe how structures can include prefabricated materials (e.g., residences, bridges, commercial buildings).
- ___5. Identify and explain the purposes of common tools and measurement devices used in construction (e.g., spirit level, laser transit, framing square, plumb bob, spring scale, tape measure, strain gauge, venturi meter, Pitot tube).
- ___6. Demonstrate the ability to acquire, store, allocate, and use materials or space efficiently.

Benchmark E: *Classify, demonstrate, examine, and appraise information and communication technologies.*

- ___1. Use multiple ways to communicate information, such as graphic and electronic means (e.g., graphic—printing and photochemical processes; electronic—computers, DVD players, digital audiotapes, MP3 players, cell and satellite phones; multimedia—audio, video, data).
- ___2. Communicate technological knowledge and processes using symbols, measurement, conventions, icons, graphic images and languages that incorporate a variety of visual, auditory and tactile stimuli.

- ___3. Identify and explain the applications of light in communications (e.g., reflection, refractions, additive and subtractive color theory).
- ___4. Compare the difference between digital and analog communication devices.

Benchmark F: *Classify, demonstrate, examine and appraise medical technologies.*

- ___1. Describe how technology has impacted medicine in the areas of prevention, diagnostic, therapeutic treatment and forensics (e.g., medical tools, instruments, materials, monitoring equipment).
- ___2. Describe how medicines and treatments have both positive and negative effects.
- ___3. Safely use the tools and processes of medical technological systems (e.g., virtual dissection software).

Benchmark G: *Classify, demonstrate, examine, and appraise agricultural and related biotechnologies.*

- ___1. Explain the conservation practices of controlling soil erosion, reducing sediment (contamination) in waterways, conserving water, and improving water quality (e.g., terraces as used in gardens and farmland).
- ___2. Grow a plant using both hydroponics and traditional methods and compare the results.
- ___3. Prioritize and apply appropriate safety measures when working with agricultural and related biotechnologies.