WTCS Repository

10-806-167 Science of Technology

Course Outcome Summary

Course Information

Description This course looks at the many devices we use in our everyday life and shows how they work. In the process, students learn the basic principles of science behind those devices, as well as how they are applied in other common objects. From levers to lasers, copy machines to computers, sensors to solenoids - virtually nothing is off limits in this class. Participants gain an awareness of the vast network of technology around them by exploring the history of technology, how technology affects society, great inventors and their inventions, as well as what the future can hold. When completed, students discover that devices don't work by "magic" but are carefully designed to take advantage of the behavior of matter and the laws of science. By exploring the world with this approach, you not only learn the basic principles of physics, but develop an understanding and appreciation of the many ways these principles may be applied.

In the process, students learn the basic principles of physics behind those devices, including:
(1) a basic understanding of how common devices work
(2) the underlying laws of nature these devices make use of.
(3) the method by which the laws of physics were originally formulated.
(4) to see similarities and common themes between objects and/or events.
(5) to think logically in order to solve problems.

Total Credits 3.00

Pre/Corequisites

Prerequisite Each Wisconsin Technical College determines the General Education course prerequisites used by their academic institution. If prerequisites for a course are determined to be appropriate, the final Course Outcome Summary must identify the prerequisites approved for use by the individual Technical College.

Course Competencies

1. Describe the process of scientific discovery.

Assessment Strategies

1.1. In a written exam.

Criteria

Performance will be satisfactory when:

1.1. learner describes the scientific method as it relates to: observing objects or events; describing objects or events; developing a hypothesis; and testing the hypothesis.

2. Apply the method of scientific discovery

Assessment Strategies

2.1. in a written exam.

Criteria

Performance will be satisfactory when:

2.1. learner applies the scientific method, specifically by: observing an object or event; describing objects or event; developing a hypothesis; and testing the hypothesis.

3. Demonstrate a knowledge of the motion and behavior of objects under applied forces.

Assessment Strategies

3.1. In a written exam.

Criteria

Performance will be satisfactory when:

3.1. Learner formulates the natural motion of objects and effect of forces by observing: (a)stationary objects, (b) objects moving at uniform velocity, (c) accelerating objects, (d) rotating objects

3.2. Learner formulates the effect of forces and concepts of mechanical advantage by observing: (a) ramps, (b)pulleys, (c) levers, (d) wheels, (e) screws, (f) hydraulics (g) gears

3.3. Learner formulates the concepts of momentum and energy (potential/kinetic/heat) and momentum/energy transfer by observing: (a) springs, (b) pendulums, (c) sliding objects, (d) rotating objects

3.4. Learner formulates the conepts of power as they relate to energy and torque/ RPM

4. Describe the early use of tools and perceive that these tools made cultures powerrful

Assessment Strategies

4.1. in a written exam and/or classroom demonstration

Criteria

Your performance will be successful when:

4.1. learner investigates the uses of fire

4.2. learner investigates the evolution and uses of the wheel

4.3. learner investigates the early uses of metals and the history of metallurgy

4.4. learner investigates the uses animals as beasts of burden

4.5. learner describes several individual technological advances in the history of mankind (printing press, gunpowder, steam engine, etc.)

4.6. learner describes several new technologies and/or new innovative techniques.

5. Observe and perceive that devices are engineered to accomplish a specific task

Assessment Strategies

5.1. in a written exam and/or classroom demonstration

Criteria

Your performance will be successful when:

5.1. learner describes the difference between a sensor and an actuator

5.2. learner observes and describes the workings of and uses of various sensors as they relate to position, displacement, motion, force, acoustic, temperature, chemicals, etc.

5.3. learner observes and describes the workings of and uses of various actuators (solenoids, piezoelectric crystals, etc.)

5.4. learner observes and describes the workings of devices that work off temperature differences/thermal energy (thermometers, bi-metal strips, thermostats)

5.5. learner observes and describes the workings of devices that work off pressure differences (check valves, vacuum systems, hydraulics, pumps, siphons)

5.6. learner observes and describes the workings of devices that work by gravity (water towers, pendulum clock, pile drivers)

5.7. learner observes and describes the workings of devices that work by elastic energy (bows, spring systems, pneumatic tools)

5.8. learner observes and describes the workings of devices that work from motion/acceleration and/or rotation (accelerometers, centrifugal governors, inertial switches, etc.)
5.9. learner describes the function of microcontrollers

6. Describe the nature and natural laws related to electricity and magnetism and how these principles are applied in common devices

Assessment Strategies

6.1. in a written exam and /or classroom demonstration

Criteria

Your performance will be successful when:

6.1. learner investigates fundamental nature of matter and electric charges
6.2. learner applies these concepts to describe the workings of photocopiers, laser printers, batteries, etc.
6.3. learner describes the concepts of voltage, current, resistance and how they are related (Ohm's Law)
6.4. learner describes the design and properties of capacitors as it relates to charge, voltage, plate area, plate separation and dielectric
6.5. learner describes the uses of capacitors in electronics (camera flash, surge protection, microphones, etc.)
6.6. learner describes the design and uses of capacitors as a sensing device (occupation/stud sensor, humidity sensor, position sensor, etc., by altering plate separation, surface area or dielectric)
6.7. learner investigates devices that make use of changes in electrical resistance . . . including touch screens, thermal resistors, rheostats, etc.
6.8. learner describes the properties and uses of piezoelectric crystals
6.9. learner describes the properties and uses of pyroelectric crystals
6.10. learner investigates the nature of electromagnetism and the ways moving electric charges are affected by external magnetic fields
6.11. learner applies these concepts to describe the workings of devices such as solenoids, relays, motors, CRT, monitors, Hall sensors, etc.
6.12. learner describes the properties of household electric current as well as the various ways our electric power is generated and manipulated for household use
6.13. learner describes the function and uses of transistors as an amplifier as well as an on/off switch
6.14. learner investigates the relationship between light and electricity
6.15. learner describes the properties of semiconductors and their usefulness in such devices as diodes and transistors
6.16. learner applies these concepts to describe the workings of devices such as photovoltaic cells, LED's, and photo sensors (and their application in fax machines, digital cameras and scanners).

7. Explain the basic operation of several common objects (several of which are listed below but not limited to)

Assessment Strategies

7.1. in a written exam and/or classroom demonstration

Criteria

Your performance will be successful when:

7.1. learner investigates the principles of governing the basic operation of combustion engines (2 stroke, 4 cycle, and diesel) as well as alternative engines such as the hybrid, rotary and sterling engine)
7.2. learner identifies natural laws pertaining to heat, temperature, thermodynamics, phase changes, latent heat, efficiency, and entropy
7.3. learner recognizes several instances where the concept is applied in other instances (refrigerator, air conditioners, and heat pumps)
7.4. learner investigates the principles governing the basic operation of airplanes
7.5. learner identifies natural laws (Bernoulli Effects) pertaining to fluids and their motion
7.6. learner recognizes several instances where the concept is applied in other instances (atomizers, carburetors, etc.)
7.7. learner investigates the principles governing the basic operation of: a. incandescent light bulbs b. fluorescent lights c. lasers d. LCD (liquid crystal displays)
7.8. learner identifies natural laws pertaining to the electromagnetic spectrum, atomic structure, coherent light (using a simple Bohr model of the atom)

7.9. learner identifies the nature of waves as it relates to wavelength, frequency, and energy in both sound and the electromagnetic spectrum
7.10. learner investigates the principles governing the basic operation of: a. microwave ovens b. speakers c. microphones d. MRI e. Radio transmitters and receivers
7.11. learner recognizes several instances where waves are used as probes (seismology, X Rays, radar, Doppler radar, etc.)
7.12. learner identifies the natural laws pertaining to amplitude and frequency modulations, radio wave transmission and reception
7.13. learner recognizes several instances where the concept is applied in other instances (a. cameras, b. telescopes, c. microscopes, d. slide and screen projectors, e. flashlights, f. fiber optics)
7.14. learner describes several applications of nanotechnology related to materials, electronics, communications, etc.

8. Explain the basic operation of computers

Assessment Strategies

8.1. in a written exam and/or classroom demonstration

Criteria

Your performance will be successful when:

8.1. learner investigates the principles of binary numbers, specifically: a. describes numbers in binary notation; b. performs binary additions manually; c. identifies common prefixes such as kilo, mega, and gig as they pertain to storage capacity; d. describes how binary numbers are stored in conventional RAM, the hard drive, flash drives, and on CD's; e. describes some cutting edge technologies related to memory and storage
8.2. learner investigates the function of computer parts, specifically: a. Common input devices b. Common output devices c. The processor d. Memory e. The bus
8.3. learner investigates how specific computer parts work, specifically: a. Hard Drives and floppy disks b. CD ROMS & CD burners c. RAM
8.4. learner identifies past and present PC operating systems (DOS, Windows XP, past and present CPU chip design (AMD Athlon, Celeron, Pentium class, etc.), typical RAM requirements and typical hard drive capacities of current desktop PC systems
8.5. learner investigates how specific computer parts work, specifically: a. Hard drives and floppy disks b. CD/DVD ROMS and CD/DVD burners c. Conventional RAM d. Cache memory e. Flash memory
8.6. learner investigates how digital information is processed, specifically: a. Converting between binary and decimal numbers b. ASCII tables c. Analog to binary converters (modem, video adaptors, etc.) d. Algorithms for storing digital sounds and pictures e. Processing numbers using logic elements (gates) in digital circuits (using the logic gates of a full adder)
8.7. learner investigates the infrastructure of the internet including its history and evolution to the present, how e-mail works, etc.