

## Course Outline – Grade 11

Investigate the world of electronics in greater depth. Labs range from simple digital circuits involving inverters and logic gates, to analog transistor applications and software programming. Explore how circuits work by simulating and changing them with engineering software. Produce a printed circuit board mask with design software, and a laser-thermal process, then build your project. Use test instruments, such as a digital multimeter and an oscilloscope to troubleshoot and repair circuits. Self-paced learning is supported with online tutorials. The career preparation in electronics, a separate four-credit course offering hands-on work experience, is strongly recommended.

### 1. Objectives

You will

- build, test, and modify simple circuits using passive and active devices
- write programs in C with Arduino then compile and install them on microcontrollers
- test your software by using it to control electronic circuits and your projects.
- use Ohm's, Power, and Kirchoff's Laws to solve circuit problems
- predict an outcome in a circuit which has predetermined component changes
- measure AC and DC waveforms with an oscilloscope
- adapt 74HC04 CMOS circuits to solve practical applications (combination lock)
- troubleshoot, and determine logic levels with an oscilloscope and a digital multimeter
- apply the decimal, binary, and hexadecimal numbering systems to circuit operation
- identify and describe logic gates and devices: AND, NAND, OR, and NOR
- use engineering software to test and simulate circuits and design pcb masks
- research component specifications and other topics with an Internet browser.

### 2. Practical Skills

Refine your safe work practices. Advance your knowledge of circuit theory, schematics, breadboarding, printed circuit board layout, project assembly, troubleshooting, and programming.

### 3. Projects

Electronic projects enhance skills and theoretical insights. Choose to build either a Gnat walking robot, mini-sumo robot, Insectronic, Hexatron, Humanoid, bicycle persistence of vision display (POV), Churbie mousebot, iambic keyer, MP3 Amplifier, Minty Boost USB charger, TV-B-Gone, 12 volt variable power supply with 7-segment display, or mini-roulette – from basic parts and materials.

*Please turn over...*

With teacher approval, students may select an original circuit. All projects are discussed in advance with the teacher. Each is breadboarded.

#### **4. Requirements**

Bring these items to every class: 1.) three-ring binder containing notes, portfolio information, labs, and activity sheets, and 2.) a pencil, eraser, and pen.

Create a portfolio for each project. The portfolio includes a cover page with graphics, circuit description, schematic, printed circuit board layout, parts placement diagram, schedule of component prices, and a fully dimensioned drawing of the project enclosure.

#### **5. Parts and Materials Fee**

A materials and parts fee of \$35.00 helps to cover the cost of the project. This amount is due in early September. Students who build a project that requires expensive components may need to cover the additional cost. Estimate the extra costs before beginning each project.

#### **6. Evaluation**

Your attendance, courtesy, and dedication will be considered during evaluation. You are encouraged to cooperate closely with other members of the class. Help them when you can. However, avoid providing too much help. We learn best when we are challenged.

Marks may also be earned by assisting with class projects. These projects benefit all students of electronics. Among many examples, are the repair and manufacture of test leads, the service and repair of test instruments, and the manufacture of pre-cut parts for project enclosures.

Computer, computer network, software and programming support are additional categories in which technical support credits may be earned. These marks are recorded under the “technical support” category. They will be included in the end-of-term and end-of-year accumulated percentages.

You are responsible for identifying which class work you have missed. Any missed work must be made up, including tests and labs. The work should be completed during the same week, either before or after school, through mutual agreement. (This topic is discussed fully in the information sheet, *Evaluation*.)

*For project photographs, circuits, pcb designs, labs and tutorials visit our website.*

**[www.swcelectronics.com](http://www.swcelectronics.com)**