

**Department:** Science

**Course Name:** Digital Engineering

**Course Description:**

Students will learn about digital engineering in common and rapidly advancing technologies of digital sound, images, and computer networking. The course emphasizes a hands-on connection between computer programming and application of programming in the real world. Students will gain a working knowledge of the LabVIEW graphical programming language used by professional engineers for digital signal processing, control, monitoring, robotics, testing and simulation of dynamical systems. Students will learn the fundamental of mechatronics through experiments and project development with Arduino technology kits, which incorporate basic electronics circuit construction, sensors/motors/LEDs/LCD displays/etc., and C/C++ programming in the Arduino IDE. Students will learn how to develop 3D CAD models using Google Sketchup. Students will work with Lego Mindstorms technology kits to build and program robots using sensors (light, color, touch, ultrasonic, Bluetooth) and motors to solve multiple robotics challenges. Prerequisite math Algebra-II or higher.

**Content:**

The Engineering Method  
Digital Music using LabView  
Digital Images using LabView  
Math You Can Hear and See (Digital Sound and Image Effects)  
Digitizing the World  
Boolean Logic and Arithmetic  
C++ Programming through Arduino Sketches  
3D CAD Modeling with Google Sketchup

**Skills:**

Collaborate with others  
Understand fundamentals of LabVIEW programming  
Construct and program Lego Mindstorms NXT robots  
Produce and analyze analog and digital sound and visual effects with LabVIEW  
Utilize digital signal processing and digital image processing hardware and software  
Build, program, test, and debug Arduino UNO circuit board projects  
(both TinkerCad virtual simulation, and physical device construction with kit components)

**Text and Materials:**

Geoffrey C. Orsak et al., Engineering Our Digital Future (Pearson Prentice Hall, 2004)  
Geoffrey C. Orsak et al., Infinity Project Lab Manual (PDF file)  
Programming Electronics Academy (PEA) student training videos and example code  
National Instruments (NI) LabVIEW training videos and example code  
Student Edition of LabVIEW 8.2 home computer installation program  
TinkerCad (free online account) Arduino simulator and 3D CAD modeling program  
Google SketchUp (free online account) 3D CAD modeling program

**Methods of Instruction:**

Utilize a Learning management system for accessing content, assignments, and assignment submission  
Discuss quarter project, topics, guidelines, resources, and examples  
Real time (live) demonstrations

Internet videos and tutorials  
Laboratory experiments  
Lab partner project and lab collaboration  
LabVIEW lab exercises  
LabVIEW programming tutorials  
Theory class discussion

**Methods of Evaluation:**

Laboratory experiments comprehension  
Laboratory experiments collaboration  
Procedure accountability  
Data analysis comprehension  
Classwork productivity  
Quarter project presentations  
Robot challenges  
Class activity reports

