

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

