EES 111 2.0 Fundamentals of C Programming

Introduction, Structure of C Program, Writing the first C Program, File used in C Program, Compiling and Executing C Programs, Using Comments, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O Statements in C, Operators in C, Programming Examples, Type Conversion and Type Casting., Decision Control and Looping Statements, Introduction to Decision Control Statements, Conditional Branching Statements, Iterative Statements, Nested Loops, Break and Continue Statement, Functions, Introduction, using functions, Function declaration/ prototype, Function definition, function call, return statement, Passing parameters, Scope of variables, Storage Classes, Recursive function, Arrays, Introduction, Declaration of Arrays, accessing elements of the Array, Storing Values in Array, Calculating the length of the Array, Operations on Array, one dimensional array for inter-function communication, Two dimensional Arrays, Operations on Two Dimensional Arrays, Strings, Introduction String and Character functions, Pointers, Understanding Computer Memory, Introduction to Pointers, declaring Pointer Variables, Pointer Expressions and Pointer Arithmetic, Null Pointers, Generic Pointers, Passing Arguments to Functions using Pointer, Pointer and Arrays, Passing Array to Function, Structure, Union, and Enumerated Data Types, Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Unions, Enumerated Data Types, Files, Introduction to Files, Using Files in C, Reading Data from Files, Writing Data from Files, Detecting the End-of-file, Close a file, Random Access Files, Binary Files, Command line arguments, Graphics programming with C++

EES 112 2.0 Probability and Statistics

Introduction to Statistics, What is Statistics?, Data and Information, Distinguishing between Variables and Data, Population and Sample, Descriptive Statistics and Inferential Statistics, Classification of Variables, Data Collection, Steps in Data Collection, Primary and secondary data, Observational studies and Experimental studies, Sampling Methods, Descriptive Statistics, Organizing Qualitative Data and Quantitative Data, The frequency distribution, Graphical summary, Measures of Central Tendency, Measures of Dispersion, Measures of association/ correlation, Probability, Events, Event operations, Mutually exclusive events, Properties of probability, Calculation of probability, Classical method, Empirical method, Conditional probability, Independent events, Basic probability rules, Complement rule, Addition rule, Multiplication rule, Total probability law, Bayes' theorem, Probability Distributions, Introduction, Probability Distributions of Discrete Variables, The Binomial Distribution, The Poisson Distribution, Continuous Probability Distributions, The Normal Distribution, Sampling Distributions, Statistical Inference, Introduction, Hypothesis Testing, One Sample T-Tests, Two Sample T-Tests, Project and presentation.

EES118 1.0 Electronics and Embedded Systems Lab

Microcontroller IO programming (AVR PORTx, DDRx, PINx registers), ADC and Sensor Interfacing (Potential Divider, LDR, LM35 temperature sensor), UART Serial Communication, , interfacing external peripherals (SSDs, LCDs, Servo, LED 8x8 matrix, keyboard, LCD), Timer Programming (counting events, making delays, measuring time between two events), Hardware Interrupts, counting pulses, PWM and DC Motor Control (controlling DC motor via transistor with PWM, use of H-bridge to control DC motor direction), High Voltage Device Control (relays, optoisolators, triacs), Wireless Communication (Bluetooth, RF),Color identification and sorting, Feedback Control Systems (PID based systems)

EES 121 2.0 Embedded Linux Systems

Introduction to Linux: file system, kernel internals, kernel compilation, port communication, networking; device drivers: kernel and loadable device drivers, device driver development, bash scripting, Python development on Linux, Installation and Working with Python, Python variables and basic Operators, python blocks, Declaring and using Numeric data types, using string data type and string operations, Use of Tuple data type, Conditional blocks Simple for loops in python, string, list and dictionaries, use of while loops in python, Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block, organizing python codes using functions, Working with Python external packages, Introduction, Python File Operation, external packages, Numpy, Scipy, Pandas, matplotlib, python data visualizing using matplotlib, polynomial fitting to dataset, Embedded System Development I, ARM processor based single board computers (Raspberyy Pi, BeagleBone, STM32), GPIO programming with python, remote access, Embedded System Development II Sensor interfacing, ADC/DAC interfacing and communication protocols, Embedded Linux mini project

EES 106 1.0 Electrical Machines

Type of Electrical machines, Electrical machines for Industrial applications, Single phase and three phase DC motors, Speed torque characterization, electrical and mechanical properties, single phase and three phase DC generators, electrical parameters, single and three phase induction motors, induction generators, electrical parameters and applications for induction machines, Introduction to Synchronous machines, Armature reaction and space-time vector diagram of a synchronous generator, Operation and control of synchronous motors, Stability of synchronous machine.

EES 123 1.0 Seminar

This course gives students practice speaking in front of a scientific audience and to explore topics in detail. Students will research topics and organize presentations for faculty and other students. The topics may be any aspect of modern applications in Electronics, Embedded Systems, Robotics, IoT, Virtual Reality, Augmented Reality, and human-computer interaction.

EES128 1.0 Circuit Simulations and Design Lab

Perform transient analysis on RC, RL and RLC circuits, Design the series resonant and shunt resonator circuits, Design a half-wave and a full wave rectifier circuits, Design and obtain the voltage transfer characteristics of a positive, negative and double sided clippers and observe the time domain signals, Design different transistor biasing circuits, Obtain series and shunt feedback amplifiers-Frequency response, Input and output impedances, Measure the common mode rejection ratio of a differential amplifier, Design inverting, non-inverting amplifiers using an op-amp, Obtain the transfer characteristic of an op-amp in open loop and design a voltage reference circuit, Design active LPF and HPF using op-amp, Design a Schmitt trigger circuit and to design Wien bridge, oscillators using op-amp, Design astable and mono stable multi vibrator circuits using IC555 timer, Design LC filters and compare their magnitude and phase

responses, Design bi-stable and mono-stable and astable multi-vibrators using transistors, Creating PCB Project, Placing parts in a schematic, Electrical Rule Check, Footprint Assign & Create Netlist, PCB Editor, Components Placement, PCB routing, Design Rule Check, Silk Screen, Silkscreen Customization, Gerber Output, Bill of Materials, Etching process for final PCB, Drilling and soldering.

EES 201 1.0 Sensors and Actuators

Sensor Characteristics, Physical Principles of Sensing, Position, Displacement and Level Sensors, Velocity and Acceleration Sensors, Force, Strain, and Tactile Sensors, Pressure Sensors, Flow Sensors, Acoustic Sensors, Humidity and Moisture Sensors, Light Detectors, Temperature Sensors, Actuator Classification, Solenoids and Relays, DC Motors, Stepper Motors, Servo Motors, Hydraulic Actuators, Pneumatics

EES 209 1.0 Computer Integrated Control Systems

Introduction to control systems, Open loop control systems, closed loop control systems (feedback control systems), Mathematical modelling of control systems, Determination of transfer function, Laplace transformation, Time Response derivation of first order and second order system, stability criteria, Time Response analysis, Routh's Criterion, Root Lucas Method, Frequency Response analysis, Polar Plot, Bode plot, PID, and other controller types for Physical applications.

EES 211 2.0 Data Analysis and Modeling

Introduction to data analysis and modeling, Introduction to the R software, Importing and preparation of data in R, Data types and Operators in R, Data Structures in R, Functions in R, Basic Plots in R, handling errors in R, Introduction to Linear regression analysis, the least squares method, goodness of fit, residual values, fit optimization methods, coefficient of correlation, coefficient of determination, Linear regression analysis in R, Introduction to multiple regression analysis, Introduction to curve fitting, Curve fitting in R, Polynomial fitting, exponential and logarithmic curve fitting, extrapolation, inference in curve fitting, Data visualization, ggplot package, statistical distributions in R, Introduction to signal smoothing, moving average, triangular smoothing, Savitzky-Golay smoothing, Loess smooth function, Inferential statistics, Introduction to machine learning, multivariate plots, clustering.

EES 212 1.0 Embedded Systems Mini Challenge

Students are given a task related to electronics and embedded system to complete within a semester. This course provides the opportunity and guidance to students to design and build a small fully autonomous embedded system based on their knowledge and skills gained through the first three semesters. Students will get a chance to work on electronic circuitry, microcontroller programming, motor control, sensor interfacing, PCB designing, robot motion planning, and mechanical design of embedded systems. The course sets up a competitive learning environment to develop hands-on skills on electronics and embedded systems.

EES 206 2.0 Advanced Analog and Digital Electronics

Thyristors, Op-amp circuits (Comparators, Differential amplifier, Instrumentation amplifiers), Active filters, Oscillators, Voltage Regulators, Finite state machines, Analysis of Synchronous Circuits, Design of Synchronous Circuits, Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic Devices (CPLDs), Field-Programmable Gate Arrays (FPGAs), Programmable Logic Software (VHDL)

EES 207 2.0 Data Acquisition and Signal Processing

Data Acquisition, Introduction, Signal conditioning, sample and hold, analogue to digital conversion, ADC process, sampling, quantization, ADC parameters, quantization error, quantization noise, Sampling theorem, Nyquist theorem, sampling time, sampling frequency, aliasing, anti-aliasing filters, aliasing effect demonstration with python, ADC and DAC circuits buffer amplifier, voltage attenuator, current-to-voltage converters, amplification, comparators, Weighted resistance DAC, R2R ladder DAC, DAC performance specifications, Integrated - circuit DAC, Counter ADC, Successive Approximation ADC, Flash ADC, Single slope integration ADC, double slope integration ADC, ADC performance and specifications, integrated circuit A/D converts, ADC804, ADC804-microcontroller interfacing, circuit simulations, Data Analysis and signal processing, Statistical properties of signals, Fourier analysis, time and frequency domain, Fourier series, Fourier transform, Discrete Fourier transform (DFT), Spectrum analysis, Inverse Fourier transform, FFT, convolution and correlation, time and frequency domain analysis with python, Analog Filters for data conversion Ideal filters vs realistic filters, antialiasing filters, Chebyshev, Butterworth, and Bessel filter circuits and parameters, higher order filter circuits, circuit simulations, frequency responses, step response, pulse response, Digital Filters, Operation of digital filters, gain filter, delay filter, two-terms difference filter, average filter, central difference filter, order of a digital filter, digital filter coefficients, recursive and non-recursive filters, moving average filter (time domain filter), frequency response

EES 208 1.0 Data Acquisition and Signal Processing Lab

ADC and DAC circuits, interfacing ADC and DAC IC to Microprocessor for data acquisition and Digital Signal Processing, Digital IR Distance Sensor Design, Dual Tone Multi Frequency (DTMF) Decoder (Time domain and frequency domain analysis), Bio Signal Processing (ECG – time domain and EEG frequency domain), Applications of Digital Filters and Analog Filters

EES 313 2.0 Microprocessors and Microcontrollers

CPU, internal components of a microprocessor, registers, ALU, bus interface, control unit, characteristics of a microprocessor (size of data/address buses, clock speed, speed of a instruction execution, instruction sets), fetch execute cycle, Assembly language, machine language, Motorola 6809 processor, interrupts, designing a computer with Motorola 6809,microprocessor support chips, peripheral interface adapter, address decoding, Intel 8088, IBM pc architecture, machine cycle, memory mapped I/O and dedicated I/O, AVR (ATMega32) architecture with Assembly programming, General purpose registers, AVR data

memory, AVR status register, Program Counter and ROM memory space, stack, AVR time delay and instruction pipeline, I/O port programming, Accessing EEPROM in AVR, AVR Timer programming, Counter Programming, AVR interrupt programming (Timer interrupts, External hardware interrupts), Interrupt priority, Serial port programming, Interfacing with RS232, ADC, DAC and sensor interfacing, Relays and optoisolators, stepper motor interfacing, DC motor interfacing and PWM, SPI bus protocol, I2C protocol, USB, bus topology, cable segments, speed, data encoding, IEEE 488 interface bus- general purpose interface bus (GPIB), ARM cortex Architecture

EES 302 1.0 Circuit Fault Diagnostics

Typical failure modes of electronic components, The Fault finding process, Test point voltages calculations and compare the real situations, Electronic test instruments, troubleshooting of analog circuits, small signal transistor amplifier, power supply circuits, oscillator circuits and time base circuits, Pulse and waveform shaping circuits, Troubleshooting Radio and Television, Digital system troubleshooting, troubleshooting synchronous logic circuits, Troubleshooting Microprocessor-Based Systems, Troubleshooting Embedded Microprocessor Systems

EES 303 1.0 Embedded Systems Development Lab

AVR, ARM, ESP32, and STM32 based embedded systems development will be conducted.

EES 304 2.0 Introduction to Internet of Things and Robotics

Introduction to IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks, Interoperability in IoT, Implementation of IoT with single board computer boards, Introduction to SDN, SDN for IoT, Data Handling and Analytics, Cloud Computing, Sensor-Cloud, IoT Security, Introduction to robotics, Configuration Space, Forward Kinematics, Velocity Kinematics and Statics, Inverse Kinematics, Kinematics of Closed Chains, Trajectory Generation, Motion Planning, Robot Control, Grasping and Manipulation, Wheeled Mobile Robots.

EES 305 1.0 Internet of Things and Robotics Lab

IoT base system development (agricultural monitoring system, healthcare system, automation system, data logger), Robot arm path planning, Obstacle avoiding robot, PID implemented (line following robot, Wall following robot), Maze solving, hexapod robot navigation