Autonomous Program Structure of
Third Year B. Tech. Fifth Semester
(Electronics and Telecommunication Engineering)
Academic Year: 2022-2023 Onwards

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<th>Examination Scheme</th>
<th>Total Marks</th>
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**Programme Elective-I**

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**Programme Elective-I Lab**

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**Programme Elective-II***

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**Open Elective I (Humanities)**

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<td>20OEHS501B</td>
<td>Intellectual Property Rights</td>
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<td>3</td>
<td>20OEHS501C</td>
<td>Introduction to Digital Marketing</td>
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<td>20OEHS501D</td>
<td>Law for Engineers</td>
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<tr>
<td>6</td>
<td>20OEHS501F</td>
<td>Project Management</td>
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20EC501 DIGITAL SIGNAL PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial : 1 Hour/ Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 4

Prerequisite: 20EC302 Signals and Systems

Course Objectives:
1. To introduce basics of Digital Signal Processing (DSP), Analog to Digital and Digital to Analog conversion
2. To apply transform techniques for analysis of signals
3. To compare analog and digital filters and design digital filters
4. To understand practical DSP systems and their applications

Course Outcomes:
After completion of the course, students will be able to
CO1 Apply sampling theorem to obtain discrete time signals and sampling rate conversion for Multirate DSP systems
CO2 Apply Discrete Fourier Transform and Short Time Fourier Transform on discrete time signals
CO3 Design and build FIR, IIR and Multirate digital filters
CO4 Analyze signals in frequency domain and performance of DSP algorithms
CO5 Design and simulate real-world applications of DSP

Unit I: Introduction to Digital Signal Processing (08)
Basic elements of Digital Signal Processing (DSP) and their requirement, Advantages of Digital over Analog Signal Processing, Sampling of analog signals, Sampling theorem in time domain, Recovery of analog signals, Mapping between analog to digital frequency, Block diagram representation of DT LTI systems: Direct form (I and II), Cascade form, Parallel form, Linear phase structure.

Unit II: Discrete Fourier Transform (09)
Overview of Discrete Time Fourier Transform (DTFT), Frequency domain sampling, Discrete Fourier Transform (DFT), Properties of DFT, Circular convolution, Computation of linear convolution using circular convolution, Decimation in Time (DIT) and Decimation in Frequency (DIF) Radix-2 FFT algorithms, Computational complexity of FFT algorithms, Bit-reversal, In-place computation, Introduction to Short Time Fourier Transform (STFT), Applications of FFT: Spectrum analyzer, Spectrum analysis of non-stationary signals.
Unit III:  FIR Filter Design
Ideal filter requirements, Comparison of analog and digital filters, Frequency response of Linear phase Finite Impulse Response (FIR) filters, Types of FIR filter, Design of linear phase FIR filter using windowing method, Characteristics and comparison of different window functions, Finite word length effects in FIR filter design, Applications of FIR filter: Speech processing, Telecommunication systems.

Unit IV:  IIR Filter Design
Characteristics of ideal and practical frequency selective filters, Comparison of Butterworth, Chebyshev and Elliptic filters, Design of Infinite Impulse Response (IIR) filters from analog filters, IIR filter design by Impulse Invariance method, Bilinear Transformation, Frequency warping effect, Finite word length effects in IIR filter design, Applications of IIR filter: Biomedical Signal Processing, Image Processing.

Unit V:  Multirate Digital Signal Processing
Need of multirate systems, Interpolation by I factor, Decimation by D factor, Sampling rate conversion by I/D factor, Frequency domain analysis of multirate DSP system, Design of multirate filters, Polyphase implementation, Applications of multirate DSP: Audio systems, Sub-band coding.

Text Books:

Reference Books:

Online Resources:
4. NPTEL Course on “Digital Signal Processing” https://nptel.ac.in/courses/108/105/108105055/
20EC502 VLSI DESIGN

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE : 50 Marks
ESE : 50 Marks
Credits: 3

Prerequisite: 20EC401 Digital Electronics

Course Objectives:
1. To introduce VLSI Design Flow
2. To explain the design hierarchy, syntax, lexical conventions, data types and modeling styles in Verilog
3. To illustrate the design and implementation of digital circuits using Verilog
4. To elaborate the FPGA architecture
5. To illustrate the design digital circuits using CMOS logic

Course Outcomes:
After completion of the course, students will be able to
CO1 Explain VLSI design flow
CO2 Design digital systems using Verilog HDL
CO3 Analyze the architecture of FPGA for logic synthesis
CO4 Realize digital circuits using CMOS logic

Unit I: Introduction to VLSI Design (07)
Philosophy of VLSI, Evolution of IC Technology (SSI to VLSI), VLSI Design flow, VLSI Based Integrated Circuit Architecture (Overview of Mobile SoC or Microcontroller SoC, logic, control, memory, interconnect, etc.), EDA Tools used in VLSI, VLSI Design Consideration, Application of VLSI IC.

Unit II: Physical IC Design Flow (07)
Hierarchical Modelling, Top-down and Bottom-up design methodology, Module Based Physical Design Flow, Floor-planning Steps, Netlist Binding, Timing and Clock Tree synthesis, clock net shielding, Power Planning, Routing and Design Rule Check, Parasitic Extraction, IC Fabrication process.

Unit III: Modeling Digital System using HDL (12)
Modules and Ports, Lexical conventions, Data types, System tasks, Compiler directives, Delay specification, Expressions, Operators, Operands in Verilog, Gate-Level Modeling, Modeling using basic Verilog gate primitives, Dataflow Modelling, Continuous assignments, Delay specification, Behavioral Modeling, Structured procedures, Initial and always, Blocking and non-blocking statements, Delay control, Conditional statements, Multiway branching, Loops, Sequential and parallel blocks, Task and function.
Unit IV: Design and Synthesis with FPGA (08)

Unit V: Digital CMOS Circuit (08)

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Hardware modeling using Verilog” https://nptel.ac.in/courses/106/105/106105165/
2. NPTEL Course “CMOS Digital VLSI Design” https://onlinecourses.nptel.ac.in/noc21_ee09/preview
20EC503 ADVANCED PROCESSOR

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Prerequisite: 20ES02 Fundamentals of Programming Language I, 20EC401 Digital Electronics, 20EC404 Embedded Systems

Course Objectives:
1. To introduce the architecture and features of ARM processor
2. To explain the applications of ARM based architecture
3. To interface I/O devices to ARM processor for real world applications
4. To explain hardware and software development tools

Course Outcomes:
After completion of the course, students will be able to
CO1 Explain architecture of ARM core
CO2 Develop program for on chip peripheral of ARM based processor.
CO3 Develop program for externally interfaced peripheral device to the ARM based processor
CO4 Explain Raspberry Pi module features, OS installation and programming

Unit I: Introduction to ARM CORE
ARM and RISC design philosophy, Introduction to ARM core and its versions, Multiple core concepts: dual, quad etc., ARM7, ARM9 and ARM11 features, Advantages and suitability in embedded applications, Registers: CPSR, SPSR, ARM7 data flow model, Programmers model, Modes of operations.

Unit II: Introduction to ARM7 Based Microprocessor
ARM7 based processor: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider), Memory Map, GPIO: Pin Connect Block (interfacing with LED), Serial communication programming for transmission and reception from computer, Programming for UART.

Unit III: On Chip Peripherals

Unit IV: Real World Interfacing – External Peripheral Interface
Interfacing of GSM, GPS, GLCD, KEYPAD, Bluetooth module, Wi-Fi module.

Unit V: ARM CORTEX
Introduction to ARM CORTEX series, Improvement over classical series and advantages for embedded system design, CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications, Need of operating system in developing complex applications in embedded system, Desired features of operating system and hardware support from processor, Firmware development using CMSIS standard for ARM Cortex.
Unit VI: Raspberry-Pi Development Board

Introduction of Raspberry-Pi (Features and processor used).
Different OS of Raspberry Pi board. Installation procedure of OS, Booting sequence, LCD interface.

Text Books:

Reference Books:

Online Resources:
1. LPC 214x User manual (UM10139) :- www.nxp.com
2. LPC 17xx User manual (UM10360) :- www.nxp.com
3. ARM architecture reference manual: - www.arm.com
4. NPTEL course “Embedded System Design with ARM”,
   https://onlinecourses.nptel.ac.in/noc20_cs15/preview
5. NPTEL course “ARM based development”,
   https://nptel.ac.in/courses/117/106/117106111/
20PEEC501A INFORMATION THEORY AND CODING TECHNIQUES

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Prerequisite:
20BSEC301 Calculus and Probability, 20BS01 Linear algebra and Univariate Calculus

Course Objectives:
1. To introduce the basic concepts of information theory
2. To demonstrate channel capacity for types of channels
3. To explain source coding techniques for data compression
4. To demonstrate the error detection and correction capability of block codes, cyclic codes, BCH, RS codes and Convolution codes

Course Outcomes:
After completion of the course, students will be able to
CO1 Explain and measure entropy, mutual information and channel capacity for Channel models
CO2 Apply Shannon-Fano, Huffman and Lempel-Ziv technique for data compression
CO3 Analyse Hamming distance, error-correcting and error detecting capability for block codes, cyclic codes, BCH, and RS codes
CO4 Design and apply convolution encoding and decoding for error correction

Unit I: Information Theory and Source Coding
Introduction to information theory, Entropy and its properties, Discrete memoryless channels and Mutual information, Source coding theorem, Huffman coding, Shannon-Fano coding, Lempel-Ziv algorithm, Run Length Encoding, Arithmetic coding.

Unit II: Information Capacity and Channel Coding
Channel capacity, Discrete memoryless channel, Channel coding theorem, Information capacity theorem, Linear Block codes: Matrix description, Error detection and correction capability, Encoding and decoding circuit, Single parity check codes, Repetition codes, Hamming code and Interleaved code.

Unit III: Cyclic Codes
Galois field, Primitive element, Primitive polynomial, Minimal polynomial and generator polynomial, Cyclic Codes: Encoding for systematic and non-systematic cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic codes.

Unit IV: BCH and RS Codes
Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes.

Unit V: Convolution Code
Text Books:

Reference Books:

Online Resources:
1. NPTEL “An introduction to Coding theory”
   https://nptel.ac.in/courses/108/104/108104092/
2. NPTEL “Error Control Coding: An Introduction to Convolutional Codes”
   https://nptel.ac.in/courses/117/104/117104120/
20PEEC501B MECHATRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Prerequisite: 20ES 01 Basic Electrical and Electronics, 20EC301 Electronics Circuit and Applications

Course Objectives:
1. To discuss the concepts and key elements of Mechatronics system
2. To explain principles and characteristics of Sensors and Transducers
3. To describe working principle of Hydraulic and Pneumatic systems and its applications
4. To give example of applications of Mechatronics Systems

Course Outcomes:
After completion of the course, students will be able to:
CO1 Classify, Compare and Explain functionality of components used to develop Mechatronics systems
CO2 Select specific component such as sensors/transducers and actuators used to develop Mechatronics systems
CO3 Analyze performance, approaches, procedures and results related to components used in Mechatronics Systems
CO4 Design signal conditioning circuit from the given components for specific task
CO5 Interface Hydraulics and Pneumatics circuit from the given components for specific task
CO6 Design a Mechatronics system for a given task

Unit I: Elements of Mechatronics Systems
Introduction to Mechatronics, Key element/components, Level of Mechatronics system, Phases of Mechatronics design process, Integrated design approach, Advantages, and Disadvantages of Mechatronics systems, Mechanical components: Cam, Gears, Gear-train, Servomechanism and its application.

Unit II: Sensors and Transducers

Unit III: Signal Conditioning
Signal conditioning: its necessity, Amplification, Filtering and Impedance Matching, Protection, 4-20mA Transmitters and receivers. Design of signal conditioning circuits for sensors and transducers.
Unit IV: Hydraulic and Pneumatic System (06)
Introduction to Hydraulic and Pneumatic Actuating system, Physical Components of Hydraulic and Pneumatic systems, Types of Actuators/Cylinders and their applications, Comparison of hydraulic and pneumatic systems, Pressure relief Valve, Pressure regulator valve and Directional Control Valve.

Unit V: Electric Actuators (05)
Selection criteria and specifications of stepper motors, DC motors, Servomotors, Solenoid valves, Solid State relays and Electromechanical relays, Electro-Pneumatic and Electro-Hydraulics Directional Control Valve, Driving circuit for electric actuators and interfacing with microcontrollers.

Unit VI: Mechatronics Systems Applications (04)
Mechatronics Systems in Automobile, Engine Management systems, Antilock Brake systems (ABS), Washing machine, Pick and place robot, Mobile robot, and Case studies on real life application.

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Mechatronics”
   http://nptel.ac.in/courses/112103174/
2. NPTEL Course “ Mechatronics”
   https://nptel.ac.in/courses/112/107/112107298/
20PEEC501C DIGITAL IMAGE PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Prerequisite: 20BSEC301 Calculus and Probability. 20EC302 Signals and Systems.

Course Objectives:
1. To understand the basic concepts of image processing like relations between pixels, distance measures, statistical parameters, colour models, noise models and operations on images
2. To study different image enhancement, segmentation, representation and restoration techniques
3. To study image analysis in spatial and transform domains for image compression and filtering
4. To study different applications of Image processing

Course Outcomes:
After completion of the course, students will be able to
CO1 Explain basic concepts of image processing, transform domain filtering, image restoration, color models and compression basics
CO2 Compute distance measures and perform arithmetic, logical, geometric, set and spatial transformation operations on images
CO3 Apply and analyze spatial domain image enhancement and compression techniques
CO4 Perform image representation, image segmentation and image classification techniques
CO5 Apply morphological operations on an image and select appropriate image processing modules to develop an image processing application

Unit I: Digital Image Fundamentals and Operations on Images (08)
Components of Image Processing System, Basic image processing classes, Element of Visual Perception, Sampling and Quantization, Relationship between pixels and Distance Measures, Statistical parameters, Basic operations on images, Morphological image processing, dilation, erosion, opening, closing.

Unit II: Image Enhancement (09)
Image Enhancement in Spatial Domain, Point, mask and global operations, Basic Gray Level transformations, Histogram, histogram equalization, Basics of Spatial Filtering, Smoothing, linear and non-linear filters, Sharpening filters, First and Second order derivatives, Image filtering in Frequency Domain, Low pass, High pass, Correspondence between Filtering in Spatial and Frequency Domain.

Unit III: Image Transforms and Colour Models (08)
Unit IV:  Image Segmentation, Representation and Classification  
(09)
Image analysis, Detection of discontinuities, edge linking and boundary detection, thresholding, region-based segmentation, image representation, boundary representation by chain codes, Fourier descriptors, Shape number, Signatures, Types of classification algorithms, K-Nearest Neighbours, K-means, Decision Tree.

Unit V:  Image Restoration and Applications of Image Processing  
(08)
Image restoration, Restoration model, Degradation causes, Noise models, Inverse filter, Weiner filter, Fingerprint recognition, Character recognition, Face recognition, Medical applications, Remote sensing, CBIR.

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Digital Image Processing”  
http://nptel.ac.in/courses/117/105/117105135/
2. NPTEL Course “ Digital Image Processing” https://nptel.ac.in/courses/117/105/117105079/
20PEEC501D INTRODUCTION TO INTERNET OF THINGS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Prerequisite: 20EC404 Embedded Systems

Course Objectives:
1. To explore various components of Internet of Things such as Sensors, internetworking and cyber space
2. To design Internet of Things circuits and solutions

Course Outcomes:
After completion of the course, students will be able to
CO1 Analyse various Machine to Machine and Internet of Things architectures.
CO2 Interpret logical and physical design of IOT enabling technologies.
CO3 Identify various devices, sensors and applications.
CO4 Apply design concept to IoT solutions.

Unit I: Introduction to Internet of Things

Unit II: Machine to Machine to Internet of Things
The Vision-Introduction, From machine to machine (M2M) to Internet of Things (IoT), M2M towards IoT-the global context, Case study, Differing characteristics between M2M and IoT, Definitions, M2M Value Chains, Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards consideration, IoT Value Chains, Industrial IoT (IIoT).

Unit III: IOT Physical Devices and Objects

Unit IV: IOT Networking and Addressing techniques

Unit V: IOT Protocols and Cloud offerings
IOT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN, MQTT protocol, Introduction to cloud storage models and communication API’s, web services for IoT.
Unit VI: Domain Specific Applications of Internet of Things

Home automation - hardware approach - Industry applications, Surveillance applications.

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Introduction to IOT”
   https://nptel.ac.in/courses/106/105/106105166/
20EC501L DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Oral: 25 Marks
Credits: 1

Course Objectives:
1. To apply sampling theorem on CT signals to find DT signals
2. To interpret the spectral representation of signals
3. To verify digital filter design and its performance
4. To perform sampling rate conversion on DT signals
5. To build programming skills for performing signal processing operations

Course Outcomes:
After completion of the course, students will be able to
CO1 Apply sampling theorem and select the appropriate sampling to avoid aliasing
CO2 Develop programs to implement DFT and convolution operation
CO3 Analyze spectral representation of signals and window functions
CO4 Simulate the design of digital filters for given specifications, verify with theoretical results and analyze finite word length effects on design of digital filters
CO5 Demonstrate effect of sampling rate conversion

List of Experiments:
1. Verify sampling theorem and study aliasing effects.
2. Implement a function to find the DFT of a discrete time sequence.
3. Compute linear and circular convolution between sequences.
4. Analyze characteristics of different window functions.
5. Design FIR filter (LP/HP/BP/BS) for the given specifications using windowing method.
8. Apply sampling rate conversion (up-sampling/down-sampling) on discrete time signals and analyze the time and frequency domain effects.
20EC502L VLSI DESIGN LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Oral: 25 Marks
Credits: 1

Course Objective
1. To explore HDL based design approach
2. To simulate, synthesize and prototype design using PLD
3. To elaborate CMOS logic based design approach
4. To prepare layout using suitable CMOS process
5. To verify the DRC and simulate the layout for different performance parameter

Course Outcomes
After completion of the course, students will be able to
CO1 Model and simulate digital systems using Verilog HDL
CO2 Implement digital systems using suitable PLD
CO3 Design CMOS layout for given digital logic
CO4 Apply lambda rules to verify the designed layout

List of Experiments:
1. Model a Combinational circuit using Verilog HDL and implement it using PLD.
2. Model a Sequential circuit using Verilog HDL and implement it using PLD.
3. Model SRAM / FIFO using Verilog HDL and implement it using PLD.
4. Write a Verilog Code for LCD and interface it with PLD.
5. Design a layout for Inverter and Universal logic gates using selected CMOS technology.
6. Design a layout for Multiplexer using selected CMOS technology.
7. Design a layout for Boolean expression selected CMOS technology.
8. Design a layout for 1-bit RAM cell using selected CMOS technology.
9. Open Ended Assignment
20EC503L ADVANCED PROCESSOR LAB

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Practical :25 Marks
Credits: 2

Course Objective
1. To develop hardware interfacing skill
2. To develop software skill in embedded domain
3. To develop skill of designing embedded system using sensors
4. To explore cortex-based card size hardware system
5. To explore multicore programming

Course Outcomes:
After completion of the course, students will be able to
CO1 Apply software development tools for ARM based applications.
CO2 Develop program for on chip peripherals.
CO3 Develop a program for externally interfaced peripheral device.
CO4 Install OS on cortex-based card size hardware system and interface external device.

List of Experiments:
1 Introduction to ARM development board and KEIL Micro vision - 5 IDE development tools.
2 Write a program to flash LEDs interfaced to GPIO.
3 Write a program to receive and transmit data on serial communication.
4 Interface GSM with ARM processor for sending and receiving messages, call connection.
5 Interface GPS to ARM processor and extract Latitude and Longitude from the string.
6 Write a program to generate waveform using on chip DAC.
7 Interface GLCD module to GPIO of ARM processor and write a program to display images.
8 Interface sensor to ADC and write a program to display calibrated data on LCD as well as serial port.
9 Write a program to toggle GPIO port with fixed time interval using on chip timer (without interrupt).
10 Write a program to toggle GPIO port with fixed time interval using on chip timer (with interrupt).
11 Install OS in Raspberry Pi. Write C Program and compile using GCC.
12 Interface LCD to Raspberry Pi.
13 Interface camera and write program to capture images and create video.
   OR
   Multi-core programming in Raspberry Pi.
14 Open ended assignment *

Department of Electronics and Telecommunication Engineering
20EC504L MINI PROJECT

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Oral: 25 Marks
Credits: 1

Course Objectives:
1. Explain the Product Development Cycle through the mini project
2. Inculcate electronic hardware implementation skills by:
   a) Learning PCB artwork design using an appropriate EDA tool
   b) Learning soldering and effective troubleshooting practices
   c) Understanding the significance of aesthetics and ergonomics while designing electronic products
3. Demonstration and Technical documentation of mini project in a team

Course Outcomes:
After completion of the course, students will be able to,
CO1 Identify and formulate a real life problem statement
CO2 Select an appropriate methodology to solve the identified problem
CO3 Design and validate the solution by using EDA tools
CO4 Estimate the time and cost budget required for developing the working model
CO5 Build a working model by analyzing / troubleshooting and testing the circuit in a team.
CO6 Draft a technical report, deliver a seminar and demonstrate/discuss the working model in a team

Guidelines:
1. Project group shall consist of not more than 3 students per group.
2. Project design ideas should be adopted from recent society/community based issues.
3. Application notes from well known component manufacturers may also be referred for designing.
4. Hardware components are mandatory.
5. Layout versus schematic verification is mandatory.

6. Engineering Design Consideration(s) should be from one of these areas:-
   • Societal
   • Environmental
   • Ethical
   • Health/Safety

Sustainability

Domains for projects may be from the following, but not limited to:
   • Electronic Communication Systems
   • Power Electronics
   • Biomedical Electronics
   • Audio, Video Systems
   • Mechatronics Systems
   • Embedded Systems
   • Instrumentation and Control
Monitoring: (for students and teachers both)
Suggested Plan for various activities to be monitored by the teacher.

** Formation of groups of students. Students should interact with the community/stakeholders to identify the problem statements.

Text Books:

Reference Books:

Online Resources:
1. [https://www.electronicsforum.com/](https://www.electronicsforum.com/)
3. [http://www.edn.com](http://www.edn.com)
4. Application notes of IC manufacturers
20PEEC501LA INFORMATION THEORY AND CODING TECHNIQUES LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Practical: 25 Marks
Credits: 1

Course Objectives:
1. To determine entropy and channel capacity of noisy and noiseless channel
2. To explore source coding techniques for data compression
3. To develop the error detection and correction capability of block codes, cyclic codes, BCH, and RS codes.
4. To understand encoding and decoding of convolution codes

Course Outcomes:
After completion of the course, students will be able to
CO1 Develop program to calculate entropy, mutual information and channel capacity of noisy and noiseless channel
CO2 Develop program for source coding techniques for data compression
CO3 Develop program for error detection and correction linear block codes and cyclic codes
CO4 Develop program for channel performance improvement against burst errors with BCH codes
CO5 Simulate convolution encoding and decoding for error correction
CO6 Implementation of encoding and decoding of real life signals

List of Experiments:
1. Write a program for determination of various entropies, mutual information and compare channel capacity of channel Noise free channel, Binary symmetric channel and Noisy channel. (Programming in C)
2. Write a program for generation and evaluation of variable length source coding using Shannon – Fano coding and decoding / Huffman Coding and decoding / Lempel Ziv Coding and decoding
3. Implement algorithms for coding and decoding of Linear Block Code (LBC).
4. Implement algorithms for coding and decoding of Cyclic Codes.
5. Implement algorithms for Encoding with Convolution codes.
6. Implement algorithms for decoding of convolution codes.
7. Implement algorithms for encoding of BCH (Bose-Chaudhuri Hocquenghem) algorithm.
8. Mini project: Implementation of algorithms for encoding and decoding of real life signals

Note: - 3 to 7 simulation using MATLAB
**20PEEC501LB MECHATRONICS LAB**

**Teaching Scheme**
Practical: 2 Hours / Week

**Examination Scheme**
ISE: 25 Marks
ESE: Practical: 25 Marks
Credits: 1

**Course Objectives:**
1. To Measure displacement, velocity, liquid level, liquid flow using sensors
2. To identify and interface components of electro-hydraulic/electro-pneumatic and hydraulic/pneumatic systems
3. To explore real life application of Mechatronics Systems

**Course Outcomes:**
After completion of the course, students will be able to
CO1 Measure load, velocity, flow and level using analog and digital sensors
CO2 Analyze characteristic and performance of sensors and actuators
CO3 Interface components of electro-hydraulic/electro-pneumatic and hydraulic/pneumatic to build circuits
CO4 Develop and demonstrate application of Mechatronics system using suitable hardware

**List of Experiments:**
1. Weight measurement using Load Cell.
2. Velocity and Angular Displacement measurement using optical encoder.
3. Liquid flow measurement using Turbine flow sensor.
4. Liquid level measurement using capacitance sensor.
5. Design of Signal Conditioning Circuit for Load Cell
6. Design 4 to 20mA current transmitter.
7. Interface hydraulic/ electro - hydraulic system component to actuate single acting and double acting cylinders.
8. Interface pneumatic/ electro-pneumatic system component to actuate single acting and double acting cylinders.
9. Design and implement Mechatronics system for any application.
20PEEC501 LC DIGITAL IMAGE PROCESSING LAB

Teaching Scheme
Lectures: 2 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Practical: 25 Marks
Credits: 1

Course Objective
1. To practice the basic image processing techniques
2. To explore digital image enhancement techniques in spatial and transform domain
3. To understand image compression, colour model conversions, segmentation and restoration techniques
4. To explore the applications using image processing techniques

Course Outcome
After completion of the course, students will be able to
   CO1 Perform basic operations and computations on images
   CO2 Implement algorithms for image enhancement and image filtering
   CO3 Perform image compression and colour model conversion
   CO4 Apply image segmentation and restoration techniques
   CO5 Develop an algorithm/application using various image processing techniques

List of Experiments: Matlab/Python
1. Perform basic operations on images (Create image/operations/distance measures).
2. Perform a) Histogram equalization b) Spatial domain filtering.
3. Perform a) DCT of an image b) Colour model conversion.
4. Perform Image segmentation (thresholding/region based) techniques
5. Perform Morphological operations on images / Wiener filtering.
6. Implement a Mini project (Application/algorithm) in image processing.
INTRODUCTION TO IOT LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Practical: 25 Marks
Credits: 1

Course Objectives
1. To learn use of sensors and actuators in IOT
2. To learn IOT devices and protocols
3. To build an IOT application

Course Outcome
After completion of the course, students will be able to
CO1 Select sensors and actuators in IOT application
CO2 Experiment with an IOT device in an IOT application
CO3 Implement IOT protocols
CO4 Develop an IOT application

List of Experiments:
1. Introduction to various sensors and various actuators & its Application.
   a) PIR Motion Sensor.
   b) Float Sensor.
   c) Moisture Sensor.
   d) Temperature Sensor.
   e) Touch Sensor.
   f) Infrared Sensor.
   g) Servo Motor
   h) RFID Sensor
   i) Humidity sensor
2. Write a program to read sensor data using ESP 8266
3. Implement a local server using WiFi of ESP8266
4. Write a program to log data to PC using serial communication
5. Write a program to measure distance of any object using an ultrasonic sensor.
6. Write a program to control servo motor using ESP 8266
7. Develop a web application to display the sensor values available through ESP8266
8. OPEN Ended problem: