Syllabus of PD 900

PD 901: Industrial Design of Electronic Products (2 Weeks)

- **Product Development Process:** Product Planning, Product requirements and specifications, Concept development, Product Architecture, Project Management
- **Industrial Design:** Aesthetic, Ergonomic, Manufacturing, Cost, Thermal, EMI/EMC,
- **Quality and Testing:** DFMA, DFT, Prototyping, Patents & IPR, Product Development Economics, Quality Concepts, QFD, ISO9000, Reliability, DFMEA, Standards, certifications, regulatory compliance testing and Documentation

PD 902: Electronic Circuit Design (3 Weeks)

- **Electronics Fundamentals:** Material classification based on conductivity, basic Semi-conductor, Diodes, Characteristics of Diodes, Classification of Diodes, Transistors, Classification of Transistors, BJT characteristics, JFET & MOSFET Characteristics, Transistor Amplification Circuits, OP Amp, Basic Characteristics of OP Amp, Feedback circuits, Introductions to Digital circuits.
- **Fundamentals of Circuit Design:** Basic circuit laws , Current & voltage division Rules, Introduction to Linear and Non-linear elements, Classification of sources, Equivalent Impedance Calculations in series & parallel circuits, Basic Network Theorems, Current, voltage and Power calculations in a circuit, Diode applications, Clipping and Clamping Circuits with Diodes, Rectifier Circuits, Transistors, Selection and analysis of Components, sensing devices and display devices.
- **Power Supply design:** Introduction to low power design techniques and methodologies. Introduction to various types of power supplies. Estimation of power supply requirements and power loss in electronic products. Selection of appropriate power supplies for the given primary power sources (230VAC/Battery). Design of power scheduler, power management unit of an electronic product.

PD: 903 Electronic Board Design and Bring up (4 Weeks)

- Evolution and Classification of Printed Circuit Boards, Challenges in Morden PCB, Design and Manufacturing, PCB fabrication, methodologies(SSB, DSB and multilayer board), PCB design considerations/ design rules for analog, digital and power applications, Electromagnetic interference in electronic systems and its impact Analysis of electronic circuit from noise emission point of view (both conducted and radiated emission) cross talk and reflection behaviour of the circuit in time domain, Thermal management of electronic devices and systems.
- **Semiconductor Packages:** Single chip packages or modules. (SCM) Commonly used packages and advanced packages; Materials in packages, Current trends in Packaging, Multichip modules (MCM) - types; System-in package (SIP); Packaging roadmaps; Hybrid circuits.
- Introduction to high speed PCB design, Signal Integrity, Power Integrity and Thermal Analysis, Power distribution and noise, Signalling convention, terminations,

Multilayer PCB design guide lines, Design of Multilayer PCB stackup, Differential pair routing, Length matching, Generation of different types of reports.

PD 904: Processor based System Design (5 Weeks)

- **C Programming:** Introduction, Data Types and storage classes, Operators, Control Statements, Arrays, Strings
- **Cortex ARM:** Introduction to ARM cortex Processor architecture and programmer's model, Introduction to Processor Instruction Set Architecture, Interrupt mechanisms and Exception handling, Cross compilation, Tool chains and Development environments, Programming using Assembly, C and Mixing the Assembly and C programming.
- Introduction to STM32 Cortex M3 hardware, Introduction to CMSIS, JTAG/ SWIM based debugging using ST-LINK/V2, Introduction to STM32 Cube MX graphical configuration and generating the code in KEIL / TrueStudio.
- **Interfacing:** switches, LCD, Keyboard, IO programming, etc. through processor ports, Generating delays and PWM using timers, and Watchdog mechanism, Working with PC and RS-232, Peripheral interfacing through I2C,SPI etc, Interfacing with Memory, Providing Reset and Clock on a board, Interacting with real world using ADC and DAC.
- **Mid Term Project:** Students will be given 1 week to complete their midterm project.

PD 905: Networking & IOT (4 Weeks)

- **Networking & Communication Technologies:** Networking basics, Topologies and OSI model introduction, Transport Layer Protocols, Socket Programming, Packet Sniffing and analysis. Wifi – IEEE 802.11 standard, Wifi programming, Bluetooth – Standard, BlueZ Stack, Bluetooth Programming, Zigbee – Understanding Protocol, Target board programming with Zigbee, Wireless Security Threats.
- **IoT**: IoT Entities, IoT standards, IoT application development with embedded hardware.
- **Mobile Programming Languages**: Design & Development of Mobile User Interfaces, Mobile Application Development & Debugging, Customizing of Android Platform, Hardware Abstraction Layers, Android Framework
- **Python:** Introduction to Python, Basic Syntax, Data Types, Variables, Operators, Input/output, Flow of Control (Modules, Branching), Function and Methods, Dictionaries, Functions and Functional Programming, Object Oriented, OOPs concept, Class and object, Python Libraries
- **Introduction to Image Processing**: Introduction to Image Processing toolkit of MATLAB: Image Read/Write, Histogram Equalization, Smoothing, Filtering, thresholding, Edge Detection and Segmentation, Image processing in Open CV, Features detection and description and Video Analysis

PD 906: Project (6 Weeks)

- Done as a group project where the trainees will be working on a real life problem sourced from industry/ start-ups and developing a complete product; right from identifying customer requirements and translating them into product specifications and realization of the product specifications through electronic, mechanical and industrial design within the cost and time constraints.

PD 907: Internship (24 Weeks)

- This course is offered with an objective to develop trained manpower for ESDM industry and provide the participant with knowledge and hands on exposure in various dimensions of Electronics Product Design and Manufacture. To fulfil this objective, students will require to undergone to a 6 month internship at an electronic sector industry/company and submit a work report. Students may utilize the NIELIT's collaboration with Maker Village and complete the internship at startups listed with Maker Village or at its associated industries.