Syllabusof

Post Diploma

in

Electronic Product Design

ED100

(Online mode)

Duration	360 Hours (24 weeks)
Eligibility	Final year Diploma in Electronics / Communication / Instrumentation / Electrical or Equivalentor B.Sc. (Electronics) from a Recognized University
Course Fee	Rs.8000/- (Excluding tax)

Course Objective:

Post Diploma in Electronic Product Design Course is intended to impart practical skills essential for the design, Development, Assembling & Manufacturing of Electronic products using appropriate hardware and softwaretools.

This course will focus on circuit design, design of Power devices, Microcontroller based design, measurement and display devices, real time embedded systems, manufacturing technology etc. which will meet the industry requirement and makes the participant exactly suitable for Electronic manufacturing Industry.

Outcome of the Course:

On successful completion of the Course, the Participants shall

- Be able to specify, Design, Develop, Assemble, Manufacture and Test Electronic Products.
- Get exposure to Industrial Design of Electronic Products
- Enhances the skillsets and confidence for Electronic manufacturing Startups

Course Structure

Module Code	Subject	Duration (Hours / weeks)
ED-101	Analog& Digital Circuit Design	72 / 4
ED-102	Test & Measurement equipment, Sensors& Display devices	36 / 2
ED-103	Power Supply & Power Management Circuits	36 / 2
ED-104	Microcontroller based System Design.	72 / 4
ED-105	EDA Tools and Product Manufacturing.	72 / 4
ED-106	Project Work	72 / 8
	Total	360 / 24

Training can be given 18hr (Theory + practical) / week.

Assessment Evidence

Sl.No	Module Title	Duration (Hours / Credits)		
		Theory (Hrs / Credits)	**Practical (Hrs / Credits)**	**Total (Hrs / Credits)**
1	Analog& Digital Circuit Design	24 / 1.5	48 / 1.5	72 / 3
2	Test & Measurement equipments, Sensors, Display devices	24 / 1.5	12 / 0.5	36 / 2
3	Power Supply & Power Management Circuits	24 / 1.5	12 / 0.5	36 / 2
4	Microcontroller based System Design.	24 / 1.5	48 / 1.5	72 / 3
5	PCB Design Tools and Product manufacturing	24 / 1.5	48 / 1.5	72 / 3
6	Project	0	72 / 2	72 / 2
	Total Duration	**120 / 7.5**	**240 / 7.5**	**360 / 15**

Detailed Syllabus

Module 1: Analog & Digital Circuit Design.

Objective

The objective of the course is to provide a thorough understanding about the elements andtechniques for analog and digital system design.

Learning Outcomes

On successful completion of the module, the candidate shall be able to:

- Design and analyse analog and digital electronic systems.

Course Description:

Introduction to Analog Circuits: Overview of Passive components (Resistance, Capacitance & Inductance), High frequency response, coding and selection of passive components.Overview of active components, Diodes, types and selection of diodes, LEDs, Zener Diodes, Power diodes, BJTs, MOSFETs, IGBTs and their applicationsas switch and amplifier.

Operational Amplifiers: Basics of OP amp and their characteristics, Op Amp applications, Summing amplifiers, Instrumentation amplifiers, Comparators, Voltage to current convertors, sample and hold circuits, Frequency response of amplifiers, feedback theory.

ADCs and DACs: Introduction to ADC and DAC, ADC parameters, SAR type ADC, Flash ADC, Dual slope ADC, DAC parameters, weighted and R-2R ladder ADC. Designing of ADC and DAC with ADC0809 and DAC 0800.

Digital Concepts: Introduction to Logic families, Digital Voltage standards, Types, Logic signal Voltage Levels, Noise Margin, Switching Voltage Level standards, Level translators, Drivers, Transceivers , Interfacing between different logic families, Fan In, Fan out.CMOS Logic Design ,Combinational Circuit Design, Sequential Circuit Design, Memories, Design of controller and Data path units, State Machines, Design Examples & Case Studies.

Reading List:

1. Design of Analog CMOS ICs - Razavi. The best book available on CMOS analog.
2. Microelectronic circuits : Adel Sedra and Kenneth C. Smith
3. Franco S, Design with Operational Amplifiers and Analog Integrated Circutis
4. CMOS Analog circuit design - Allan and Holberg
5. Analog Integrated Circuit Design - Ken Martin and David Johns
6. Digital Design by Morris Mano & Michael D Ciletti
7. Digital Design: Principles and Practices by John F. Wakerly
8. Digital Design by Frank Vahid

Module 2:Test & Measurement Equipment,Sensors and Display Devices.

Objective

The objective of this module is to help the students and practicing engineers to enhance their knowledge and skills of using and select the appropriate test instrument for testing and troubleshooting.

Learning Outcomes

After successful completion of the module, the students shall be able to

- Understand how to operate test equipment like DSO, Logging multimeter, MSO, Harmonic Analyser etc.

Course Description:

Functional elements of an instrument; Static characteristics; Meaning of static calibration, accuracy, precision, bias, sensitivity, linearity, threshold, resolution, hysteresis and dead space.
Introduction to multimeter, Difference between Analog and Digital multimeter, logging multimeter, DSO, characteristics of DSO, Passive, Active & High voltage probes, MSO, Power Harmonic analyser.
Types of sensors, pressure, temperature, touch sensors.
LCD displays, TFT displays.

Reading List:

1. Electronic Test Instruments : Analog and Digital Measurements by Robert Writte
2. Modern Electronic Test and Measuring Instruments by N Kularatna.
3. Electronic Instrument Handbook by Clyde F. Coombs.
4. Encyclopaedia of Sensors 10 Vols. Set By Grimes C A.
5. Electronic Display Devices by Shoichi Matsumoto.

Module3: Power supply and power management circuits

Objective

The objective of this module is to help the students and practicing engineers to enhance their knowledge and skills of Power supply and Power Management design for Portable and mains powered Electronic products.

Learning Outcomes

After successful completion of the module, the students shall be able to

- Understand the design, development & troubleshooting of Power supply and regulators in Electronic Product.

Course Description:

Introduction to Power supply, characteristics of power supply, Transformer based power supply, half wave and full wave, Design of power supply.
Regulators, characteristics, Line and Load regulation, linear regulators, LDO, Switching regulators, buck, boost, fly back regulators, Point of load (POL) concept.
Introduction to batteries, Li Ion Battery, Battery charging,charging profile, Introduction to solar cell, portable solar powered products, Low power design techniques, Power management circuits.
Trouble shooting

Reading list:

1. Handbook of Power Management Circuits by Haruo Kobayashi Nabeshima.
2. Power supply Cookbook by Marty Brown.
3. Power Management Integrated Circuits by Mona.M.Hella& Patrick Mercier.
4. Principles of Solar Cells, LEDs and Related Devices by Kitai A.
5. Energy Conversion Efficiency of Solar Cells 2020 Edition by Takashi Kita, Yukihiro Harada, Shigeo Asahi , Springer.
6. Lithium-Ion Battery Chemistries by John T Warner.

Module 4: Microcontroller based system design

Objective

This module aims at familiarizing the students in Embedded concepts, programming in 'C'andARM Architecture.

Learning Outcomes

After successful completion of the module, the students shall be able to understand:

- Development of Embedded applications using Embedded C
- Usage of ARM Cortex Microcontrollers with Embedded C Programming for ApplicationDevelopment

Course Description:

Introduction to ARM cortex Processor architecture, Interrupt mechanisms and Exception handling, Programming using Embedded C, Cross compilation, Tool chains and Development environments.
Peripheral Interfacing: Switches, LCD, Keyboard, GPIO programming, etc. through processor ports, Generating delays and PWM using timers, Watchdog, UART, I2C,SPI etc. Interacting with real world using ADC and DAC.

Reading list:

1. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK.
2. Let us C by YashwantKanetkar.
3. The Definitive Guide to the ARM Cortex M3, Joseph Yiu, Newnes.
4. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill.
5. 'Embedded C, Pont, Michael J
6. Embedded Systems an Integrated Approach: Lyla B Das, Pearson
7. C Programming language, Kernighan, Brian W, Ritchie, Dennis M
8. Art of C Programming, JONES, ROBIN,STEWART, IAN
9. ARM System Developer's Guide - Designing and Optimizing System Software by: Andrew N Sloss, Dominic Symes, Chris Wright; 2004, Elseiver.
10. ARM Cortex M3 Reference manual.
11. STM32Ldiscovery datasheets, reference manuals & Application notes.

Module 5: PCB Design tools and Product Manufacturing

Objective

The objective of this module is to help the students and practicing engineers to enhance theirknowledge and skills of industrial product design covering the various aspects of productdevelopment process and design of an Industrial Electronics Product.

Learning Outcomes

After successful completion of the module, the students shall be able to

- Understand the design and development process of an Industrial Electronics Product.
- Apply product development process for realization of a product.

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Course Description:

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.

Printed Circuit Boards: Evolution and Classification of Printed Circuit Boards, Modern PCBDesign and Manufacturing, PCB fabricationmethodologies(SSB, DSB and multilayer board), PCB design considerations/ design rules for analog, digital and power applications, PCB Design standards.

PCB Assembling and soldering methods, board tracing and trouble shooting, board bring up.

EMI / EMC: Electromagnetic interference and its compatibility in electronic systems. Conducted and radiated emissions, cross talk and reflection behavior of the circuit in time domain.

Thermal management of electronic devices and systems, IP rating of Electronic products.

3D Printing: Introduction to Additive Manufacturing, Process Chart of AM, Classification of AM, Materials used in AM, Application of AM.

Reading list:

1. Product Design & Development - Karl T Ulrich & Steven D. Eppinger; McGraw Hill
2. Printed Circuit Boards Design, Fabrication and Testing by Khandpur, Tata McGraw Hill
3. Semiconductor Packaging: Materials interaction and reliability by Andrea Chen &Randy.
4. Complete PCB Design using OrCAD Capture and Layout by Kraig Mitzner& Bob doe.
5. IPC design standards manual.
6. Relevant Data sheets and application notes
7. Complete guide to IP ratings.
8. Additive Manufacturing-Principles, technologies and Applications. By C.P Paul & A.N Jinoop.