



Professional Postgraduate Program in Advanced Electronic Systems Design (PPGP-AESD)

(Autonomous, full-time, 11 months, residential Program

with technical support from **ALTERA** and **UC Microsystems**)



UC Micro Systems

Advanced Embedded Systems Design has been at the forefront of electronic systems design methodologies for the last two decades. In India a large group of original equipment manufacturers and service providers are setting up design teams, indicating need of people with research as well as development abilities. As manufacturing opportunities in India are increasing, there is need to focus on developing skills required for end-to-end design. Present professional postgraduate curriculum has been formulated with emphasis on system design and development. Graduate students and professionals who wish to acquire key design and development skills in electronic systems design will find this eleven-month, four-term program exactly suiting their requirements. The Program is highly practice oriented and participants will be expected to have a focused hands-on attitude.

The first or foundation phase develops C/C++ programming, VHDL/Verilog programming concepts, Linux as well as analog and digital application skills. Topics in the second or core phase are more specific exposing students to micro-controllers, architecture of CPLDs/FPGAs, design cycle, analysis and testing of hardware/software. The third or advanced phase emphasis on hardware and software co-design, packaging technologies and Altera® integrated development environment. Final phase focuses on the development of an individualized project, which includes simulation and development.

This 11 month full-time Professional Postgraduate Program in Advanced Electronics Systems Design focuses on the following domains:

- Electronics Hardware Design
- Embedded Software Design
- System Design on and around FPGA
- Product Design Methodology

Distinctive Features

- Core aspects of electronics systems design covered with almost 50% lab practices
- Every student will be provided with product development kit
- Continuous assessment practices compatible with industry requirements
- Industry initiated Industry relevant hardware and software tools

Eligibility

- Candidate with minimum 50% score throughout.
- Graduates with a Bachelor's Degree in Engineering / Technology in Electronics / Communications / Computer Science / Information Technology / Electrical / Instrumentation / Mechatronics / MSc (Physics / Electronics / Computer Science).
- Diploma holders in relevant disciplines with three years professional experience may also apply.

Basic Courses:

CS001 / CS002 / CS003 Life Skills Development – I / II / III (Each 20 Hours): The Life Skills Development Program prepares students for communication and interaction in an organizational set-up. The focus would be on grammar, vocabulary, spoken English, remedial English, presentation skills, debates, group discussions, team building, time management, cross-cultural communication, creative and business writing. The ultimate objective of this course is to develop individuals with high intelligence and emotional quotients who are also competent speakers of English. At the end of the Life Skills Development Program the students would be well equipped with language skills, soft skills and life skills to enter the challenging corporate world.

Bridge Courses:

ESD001 Computer Architecture (15 hours): Hardware internals of computer Systems and sub systems. Parallelism. Pipelining. Cache and memory organization. Various I/O techniques. I/O controllers and interconnection structures.

MVD002 Introduction to Logic Design (15 hours): Basic digital circuit design. Combinational and Sequential circuits. K-maps. Flip-flops. Multiplexers. Decoders. Counters. Preliminary timing analysis. PLA. PAL. PLD. Various logic families. I/O standards. Bipolar based logics; ECL. Bi-CMOS. Memory; SRAM. DRAM. EEPROM. and I/O circuits.

Foundation Courses:

EPD501 Introduction to C/C++ Programming (70 Hours): Basic data types. Constants. Variables. Macros. Using simple libraries and user defined functions and header files. Bit wise operators. Classes. Objects. Inheritance. Virtual functions. Introduction to Compilers. Linkers and other utilities will be discussed with different variants.

ESD501 Analog and Digital System Design (70 Hours): Analog

components. Basic analog IC's. Need for Data Acquisition System. Operational amplifiers and their applications: linear and non-linear. Active filters. Converters; digital circuit. CMOS logic circuits. Combinational logic design. logic building blocks. Sequential logic design and timing analysis. Clocks. Synchronization. and finite state machines. Lab covers hardware experiments and system simulation with PROTEUS? system simulator.

EPD502 VHDL/Verilog HDL (70 Hours): VHDL: Introduction. Modeling digital systems. Simulation vs. synthesis. Basic language concepts: simulation. Basic language concepts: synthesis. Modeling behavior: simulation. Modeling behavior: synthesis. Modeling structure. Sub-programs. packages and libraries. Basic I/O. Identifiers. Data types and operators. Verilog HDL: Overview of digital design with verilog HDL. Hierarchical modeling concepts. Basic concepts. Modules and ports. gate-level modeling. Dataflow modeling. Behavioral modeling. Tasks and functions. Useful modeling techniques. Timing and delays. Switch-level modeling. User-defined primitives. Programming language interface. Logic synthesis with verilog HDL.

EPD503 Theory of Operating Systems and Linux (50 Hours): Basic theory of operating systems. Examples from windows and Linux. Process. Thread management. Inter-process communication. Signals. Memory management concepts. Virtual memory. File system. I/O subsystem.

Core Courses:

ESD502 Micro-controller based System Design (70 Hours): 8-bit microcontroller like 8051. AVR. PIC. Internal organization with special reference to basic concepts like UART. Watchdog timer. PWM. WDT. RISC/CISC. Harvard and Princeton architecture. Interfacing techniques. Interfacing LEDs. Switches. LCD. Keypad. ADC. RTC will be covered. Programming in assembly and C.

EPD601 CPLD/FPGA Architecture (70 Hours): Programmable logic devices. Max II CPLDs: Features. Architecture. JTAG and In-system programmability. Using user flash memory in Max II devices. Understanding timing in Max II devices. Understanding and evaluating power in Max II devices. Cyclone II FPGAs: Features. Architecture. PLLs in Cyclone II devices. Cyclone II memory blocks. Embedded multipliers in Cyclone II devices. Configuring Cyclone II devices. Stratix II GX FPGAs: Features. Architecture. PLLs in Stratix II GX devices. Transceiver block architecture. Memory blocks. DSP blocks. Configuring Stratix II GX devices.

EPD602 Embedded Systems Design around FPGA (70 Hours): Quartus II development software. Introduction to Modelsim AE simulation software. Design flow. Design guidelines. Synthesis. Scripting and constrain entry. I/O and PCB tools. Area. Timing and power optimization. Simulation. Timing analysis. Power estimation and analysis. Signal integrity. In-system design debugging. Formal verification. Device programming. SoPC Builder features. Building systems with SoPC Builder. Interconnect components. Off-chip interface peripherals. On-chip storage peripherals. Transport and communication. Test and debug peripherals. Clock control

peripherals.

EPD603 Seminar (20 Hours): Seminars by experts from industry. Academia providing introduction to advances and possibilities in the advanced technology. Students are given bird's eye view of multiple technological frontiers. Enclosure and Product design cycle
Advanced Courses:

EPD701 Hardware/software Co-design and Partitioning (50 Hours): Introduction to different computational models. System architecture. Techniques and methods for Co-Design. Architectures for Co-Design. Prototyping. System verification Process.

EPD702 Enclosure and Product Design Methodology (70 Hours): Types of enclosure for electronics equipments. Enclosure design considerations. Product aesthetics. Ergonomic considerations. Product design aspects such as information collection. User Survey. Market Survey. Formulation of design brief. Concept development Refinement up to model making and prototype.

EPD703 Altera Integrated Development Environment (80 Hours): Processor features. Processor architecture. Programming model. Instantiating the Nios II processor in SOPC Builder. Nios II integrated development environment. The hardware abstraction

layer. Advanced programming topics. Embedded peripherals. Developing Nios II software. Debugging Nios II designs. Memory system design. Hardware acceleration and coprocessing. Verification and board bring-up.

EPD704 Industry Perspective Seminar (20 Hours): Students are required to present a seminar on relevant topics in electronic system design applications for campus-wide audience.

Project:

EPD801 Project (400 Hours): Students take up an industry-sponsored project or in-house project as one of the requirements of this program. For industry-sponsored projects, the Career Management Cell facilitates interaction between students and the industry. The students can also take-up the in-house projects under the guidance of the faculty and/or industry experts in their area of expertise. Students are encouraged to work on projects that will enhance their understanding in certain technology domains in real-life scenario. The project report has to be submitted to the Institute in the prescribed format, which will be examined by experts nominated by the Institute. The project is the culmination of the student's learning in the Institute and is expected to be of the high standards demanded by the industry.

Program Structure			
Level	Subject Code	Subject Name	Hours
Basic	CS001	Life Skill Development – I	20
	CS002	Life Skill Development – II	20
	CS003	Life Skill Development – III	20
Bridge	ESD001	Computer Architecture	15
	MVD002	Introduction to Logic Design	15
Foundation	EPD501	Introduction to C/C++ Programming	70
	ESD501	Analog and Digital Systems Design	70
	EPD502	VHDL/Verilog HDL	70
	EPD503	Theory of Operating Systems and Linux	50
Core	ESD502	Microcontroller based System Design	70
	EPD601	CPLD/FPGA Architecture	70
	EPD602	Embedded System Design around FPGA	70
	EPD603	Seminar	20
Advanced	EPD701	Hardware/software Co-design and Partitioning	50
	EPD702	Enclosure and Product Design Methodology	70
	EPD703	Altera Integrated development environment	80
	EPD704	Industry Perspective Seminar	20
Project	EPD801	Project	400
			Total hours: 1200