

MS Program in Embedded Systems Design

with specialization in
Automation and Control Systems

Course Structure

	Code	Course Name	Credits*
BRIDGE	ESD001	Computer Architecture	
	ESD002	Signals & Systems	
	ESD003	Introduction to Programming Languages	
	MVD002	Introduction to Logic Design	
	NTC002	Computer Networks	
FOUNDATION	ACS501	Concepts of Instrumentation	3
	ACS502	Digital Control Theory	3
	ESD502	Microcomputer Based System Design	3
	ESD504	Advanced 'C' Programming	3
	ESD505	Theory of Operating System	3
	ESD506	Seminar Series - I	1
	ACS503	French Language -I	3
CORE	ACS601	Advanced sensors and Actuators Technologies	2
	ACS602	Virtual Instrumentation	3
	ACS603	Seminar Series - II	1
	ACS604	Automation and Control Networks	3
	MVD601	ASIC Modeling	2
	Elective-I		3
	Elective-II		3
ADVANCED	ESG701	EMC and Constraints	3
	ESG702	Embedded Linux	3
	ESG703	Communicant Embedded Systems	3
	ESG704	Transversal Conferences	3
	ESG705	French Language - II	5
	ESG706	Research Study	6
ELECTIVES	ACS801	Bio-Medical Instrumentation	3
	ACS802	Robotic Control Systems	3
	Elective(s) from Embedded Systems Design program		3
	Elective(s) from Automotive Engineering Program		3
	Elective(s) from Microelectronics & VLSI Design program		3
PROJECT	ACS901	Mini project	2
	ACS902	Final project	18

* 1 Credit Hr = 16 Class Hrs / 32 Lab Hrs in a semester

MS Program in Microelectronics and VLSI Design

An inadequate number of skilled engineers, due to lack of specialised technical course, poses a big barrier to the growth of India's VLSI Design business.

- ISA Study report

Ever since the invention of the transistor and especially after the advent of integrated circuits, semiconductor devices have kept expanding their role in our lives. Highly integrated transistor circuits entertain us, keep track of our money, make our home appliances smart and keep us connected to our beloved ones. New applications are emerging in the areas of networking and communication, control and automation, manufacturing, automobile and transportation, power controls, E-learning, medicine, signal processing and system securities. For many years the celebrated silicon technology has known a virtually one-dimensional path of development: reducing the minimal size of lithographic features. But, beyond CMOS, after 2010 to 2014, there will be new material challenges hence new approaches will be needed to develop devices with new processes using new materials. Hence, new architectures and new circuits will be the key to success. It is anticipated that future ULSI chips will have "chessboard" architecture. "Active Packaging" is going to play important role in designing such architectures. Worldwide semiconductor revenue totaled \$261.4 billion in 2006, an 11.3% increase from 2005 and revenue growth is expected to remain on track through 2007 with an estimated worldwide revenue increase of 12 percent. Indian market for analog IC's worth \$221million in 2005 is set to cross \$427 million by 2007. India is a growing market for electronic products and is expected to reach Rs.16, 45,116 crore (\$363 billion) by 2015 growing at a CAGR of nearly 30 percent. There is a strong link between semiconductors and electronics, with chips driving the innovation in electronic equipment. The Philips, ST Microelectronics and Motorola alliance has opened a joint R&D center in France, dedicated to future generation of nanoelectronics and semiconductor manufacturing on 300mm silicon wafers. Huge investments, by the three partners and other leading semiconductor companies, in the facility and planning, will create a number of job opportunities in the region and worldwide. This has increased the need to focus on core competencies, which leads to advanced specialization in VLSI design service market. VLSI Design is coming up very strongly on the Indian horizons, due to less initial investment cost. Most of the VLSI giants now have their design centers in India. IC designing, IP and EDA services constitute a big chunk of the Indian semiconductor sector. With all the leading IC design companies opening their design centers in India, there are many job opportunities emerging out in the field of microelectronics and VLSI design. According to one survey done by TCS and IIT Mumbai, there is a demand of around 2500 master's level candidates per year in India to meet the challenges raised by state-of-the-art system-on-chip design for emerging applications. Companies with skills in analog, mixed signal and RF domains are comparatively less in number to the skills available in digital domain. A gap exists between demand and supply of skilled manpower in this area. Short-term six-month courses are not in a position to develop the required skill sets. Identifying this huge gap and studying the reasons for this gap, I²IT has come-up with a unique program that can address all the issues in the field of microelectronics and VLSI design.

Program

It is a hard fact that we are at a turning point in the evolution of the giant semiconductor and VLSI design industry. The program is exactly designed to meet all the challenges in VLSI market. This four semester, 24 months program of 72 Credits is designed to equip students to understand and accept; design, development and testing responsibilities in integrated circuit design. The bridge course ensures that every student attain the level of competency for further learning. The foundation course gives students a broad background in fundamentals with preliminary system design knowledge. Core and advanced course provides further in depth knowledge including: Fabrication technology, ASIC

modeling, Layout synthesis, ASIC Design Flow, Testing and a mini project using basic VLSI design tools. Specialization courses and main project focus on implementation of VLSI design flow using state-of-the art CAD tools in low power, mixed signal and RF IC design.

Program Structure

- ▲ Successful completion requires minimum 72 credits.
- ▲ To bridge the gap between theory and practice project work worth 18 credits in the last semester.
- ▲ The entire curriculum is distributed over six levels, which are aimed at transcending the students' level of understanding for corporate readiness. The levels are

respectively: Bridge, Foundation, Core, Advanced, Electives and Project.

- ▲ Student has to carry out one mini project in specified semester to consolidate the technical knowledge in the selected specialization stream.
- ▲ Students are expected to decide their specialization by choosing appropriate subjects from elective course.

Program Pedagogy

All courses are designed to address the key areas like theoretical foundation, practical relevance and the real life problem solving approach. To achieve that, courses will be delivered using collaborative learning process through class room lectures, laboratory sessions, assignments, student

seminars, lectures by industry experts, case studies, relevant industry visits and research/industry projects.

Distinctive Features

- ▲ Well-structured Theory and laboratory sessions to gain experience of practical situations in chip design for various applications.
- ▲ Collaboration with leading institutes and industry for FAB house exposure and curriculum updating to keep the pace with Industrial needs and requirements.
- ▲ Working with the latest VLSI CAD tools such as CADENCE suit, Mentor Graphics FPGA Advantage, Xilinx Web-Pack ISE, Model-Sim, Magic and Altera tools along with supportive downloading tools.
- ▲ An option to work on projects which require working with faculty members and students from other streams such as Advanced software technologies, embedded systems, Network Technology and management.
- ▲ Expert lectures, seminars and case studies by leading experts from industries.

Eligibility

- ▲ Graduates with a Bachelor's Degree (with minimum 50 percent marks) of at least four years' duration in Electrical / Electronics / Communication / Information Technology / Computer Science or equivalent
- ▲ Basic knowledge of Digital and Analog systems.
- ▲ See insert on 'Selection and Admission Procedure' for more details

Program Commencement

The program commences in July / October

Evaluation and Certification

- ▲ Continuous evaluation and performance improvement program
- ▲ Course-wise Credits
- ▲ Balanced assessment based on internal, laboratory and final theory examination and project
- ▲ Detailed transcripts along with certificate

Placement Assistance

- ▲ Career guidance at the institute
- ▲ Pre-placement facilitation / development
- ▲ and Campus interviews by leading industries
- ▲ Active interface with technology and user companies

Selection Process

The selection of an applicant for the course is based on the following:

- ▲ Application forms shall be scrutinized for academic profile in line with the eligibility criteria.
- ▲ Scores received at the Graduation level like BE / B Tech / M.Sc (Electronics) or equivalent.
- ▲ Scores received at the qualifying examinations like GRE / GATE & performance in the Entrance Test
- ▲ Personal interview

Basic Course

ICOM001: LIFE SKILLS DEVELOPMENT

This basic course prepares students for the rigors of the masters' level Program and professional careers that will follow. The course is divided into 9 sections, which will be conducted throughout the Program.

The Program stresses on: communication and presentation, leadership development, working in teams, time management, negotiation skills, stress management through yoga, multicultural and diversity management and offsite experiential learning. The ultimate objective of this course is to develop individuals with high Intelligence, Emotional and Spiritual Quotients (IQ, EQ and SQ).

COM002: FOREIGN LANGUAGE (LEVEL 1)

In order to equip students to take up global careers, a choice of foreign languages as a major subject is offered. Medium of instruction is English.

Bridge Courses

Keeping in view the diverse background of students, variety of subjects is offered as bridge program to attain the requisite level of competency for further learning. Duration of the bridge program is 3 to 4 weeks prior to the beginning of the academic term. Performance in the bridge course count

towards partial waitage in the relevant foundation course

MVD001: INTRODUCTION TO CIRCUIT THEORY

The course covers KCL, KVL, Ohms law, Thevenin's and Norton's theorem, energy & power relationships, time domain and frequency domain analysis of RLC circuits, steady state and transient response analysis. It also covers transmission line theory and concepts, passive filter design, lab experiments using circuit simulation tool.

ESD001: COMPUTER ARCHITECTURE

It focuses on the study of the hardware structure of computer system and subsystems. The topics in computer architecture include processor architecture, parallelism and pipelining, cache and memory organization, I/O controllers and interconnection structures.

MVD002: INTRODUCTION TO LOGIC DESIGN

This course covers binary, non binary systems, Boolean algebra, digital design techniques, logic gates, combinational circuits, K maps, flip-flops, sequential circuits and state machine theory, preliminary timing analysis, digital circuit building blocks such as multiplexers, decoders, and counters. The course further covers PLA, PAL, SPLD, Various logic families, I/O standards; Bipolar based logic; ECL, BiCMOS, Memory; SRAM, DRAM, EEPROM, I/O circuits and interfacing between different logic families.

NTC002: COMPUTER NETWORKS

This course shall emphasis on developing on understanding of the underlying principle of computer networking. Students will learn fundamental concepts of communication protocol stacks: OSI and TCP / IP, IP addressing schemes, subnetting, LAN, MAN, WAN fundamentals, circuit and packets switching, networking devices, network protocols, standards, Internet Intranet, network security and allied technologies

ESD002: SIGNALS AND SYSTEMS

This course deals with the representations of the signals and systems, system properties, mathematical models of continuous-time and discrete-time signals and systems, time domain and frequency

domain concepts, sampling, Laplace and z-transforms, transfer functions and frequency response, convolution, stability, Fourier series and Fourier transform, probability and description of random signals.

Foundation Courses

Note1: If student is willing to opt for DSP with FPGA from Advanced Course, they should undergo additional mandatory course on DSP (Offered by Department of Embedded system design) as a prerequisite.

MVD501: OVERVIEW OF MICROELECTRONICS TECHNOLOGY (1 Credit T=1, L=0)

Experts from industry and academia provide an introduction to advances and possibilities in the advanced technology. Students are given a bird's eye view of multiple technological frontiers From the field of microelectronics and VLSI Design technology.

MVD502: ELECTRONIC DEVICE PHYSICS AND MODELING (3 Credits T= 3, L=0)

This course focuses on P-N junction, metal semiconductor junctions, Ohmic and Schottky contacts, BJT, FET, small signal models and piecewise analysis of nonlinear circuits, analysis and design of basic single stage transistor amplifiers. The course also addresses issues in formulation of circuit equations, equivalent circuits, bias stabilization techniques, gain bandwidth product and frequency response, power analysis, introduction to operational amplifier based circuits, lab experiments using circuit simulation tool.

MVD503: MICROELECTRONICS FABRICATION TECHNOLOGY (3 Credits T=2, L=1)

The course addresses the issues in processing of silicon for manufacture of VLSI. It covers fundamentals of materials processing like phase diagrams, nucleation and growth. It also covers principles and manufacturing practices of VLSI fabrication processes like crystal growth, epitaxy and CVD, diffusion, ion implantation, oxidation, deposition of thin film, nitrides and silicides, lithography and etching, MOS fabrication, interconnects, contacts and dielectrics, IC process integration, IC packaging,

reliability, yield and MEMS fabrication. (The Course will be offered in association with CEERI Pilani)

MVD504: DIGITAL IC DESIGN (3 Credits T=2, L=1)

This course covers the IC fabrication overview, design and analysis of static CMOS inverter, long channel I-V characteristics including velocity saturation, mobility degradation, hot carriers gate depletion, short channel effects, scaling strategies, complex combinational logic gates, dynamic logic families, pass transistor logic, ratioed logic, sequential elements (latches, flip-flops), complete circuit analysis for speed space and power using basic MOSFET model and interconnects effects, fast adder, multipliers and barrel shifter circuits, use of CAD tool for MOSFET based circuit simulation (SPICE).

MVD505: ANALOG IC DESIGN (3 Credits T=2, L=1)

This course introduces Analog MOSFET device physics and SPICE models, CMOS Process technology and Layout design rules, current sources and simple voltage sources, amplifiers and level shifters, noise analysis of analog amplifiers, design procedures of CMOS based OP-Amps, passive components and passive switches, Band gap references and Sample and Hold circuits.

Core Courses

MVD601: ASIC MODELING (3 Credits T=1, L=2)

This course focuses on design specification v/s implementation, introduction to VHDL and Verilog, modeling combinational and sequential circuits, path delays and bus architecture. The course covers basic constructs and modeling features in VHDL, Verilog, data types and operators, library and package concepts. The course further covers synthesis issues and writing synthesizable HDL codes.

MVD602: SYSTEM ON PROGRAMMABLE CHIP DESIGN (3 Credits T=1, L=2)

This course focuses on implementation, testing of digital blocks on targeted CPLD / FPGA to form a complete system. The course covers techniques to implement and synchronize basic computational blocks on

CPLD / FPGA. It further covers implementation of hardware drivers for basic peripheral devices such as UART, I2C compatible devices, RAM, ADC, LCD, Printer etc along with how to set the constraints for proper implementation of logic. It also introduces to implementation of analog system using FPAA.

MVD603: FUNCTIONAL AND FORMAL VERIFICATION (3 Credits T=1, L=2)

This course focuses on verification of complex logic designs modeled using HDL's. The course covers various issues in verification, like verification Plan, methodology, Verification strategy for FPGA / ASIC, bus functional models and writing directed test benches. The course further covers formal verification concepts, verification automation, advantages and limitations of formal verification.

MVD604: ASIC DESIGN FLOW AND CAD FOR VLSI (3 Credits T=2, L=1)

This course introduces the algorithms and techniques underlying today's integrated design approaches, rapid implementation of VLSI circuits, aspects of modern design flow: specification to GDS-II tape out, design entry tools, synthesis tools, logic optimization tools, logic and circuit simulation tools, timing verification of combinational and sequential circuits, clock schedule optimization, physical design, layout, design rule checking, design flows for the microelectronics industry, ASIC and SOC design concepts.

MVD605: PCB DESIGN TECHNOLOGY (2 Credit T=0, L=2)

This course focuses on lay-out planning, general rules, design rules for digital circuit, high frequency PCB design, analog and mixed signal PCB design, PCBs in power and microwave applications, PCB fabrication process, PCB technology trends, multi-layer boards, CAD tool for PCB artwork and layout, soldering and assembly techniques.

MVD606: RESEARCH STUDY (3 Credits)

The subject aims to impart detailed knowledge of a highly specialized topic within the field of VLSI Design. The directed reading and independent research will involve an in-depth study of an advanced VLSI technology and its application to chip design under the guidance of faculty member. The subject will be chosen in

consultation with the supervisor.

MS Program in Microelectronics and VLSI Design

MS Program in Microelectronics and VLSI Design

Course Structure

	Code	Course Name	Credits*
BRIDGE	MVD 001	Introduction to Circuit Theory	0
	ESD 001	Computer Architecture	0
	MVD 002	Introduction to Logic Design	0
	NTC 002	Computer Networks	0
	ESD 002	Signals and Systems	0
FOUNDATION	MVD 501	Overview of Microelectronics Technology	1
	MVD 502	Electronic Device Physics and Modeling	3
	MVD 503	Microelectronics Fabrication Technology	3
	MVD 504	Digital IC Design	3
	MVD 505	Analog IC Design	3
CORE	MVD 601	ASIC Modeling	3
	MVD 602	System on Programmable Chip Design	3
	MVD 603	Functional and Formal Verification	3
	MVD 604	ASIC Design Flow and CAD for VLSI	3
	MVD 605	PCB Design Technology	2
	MVD 606	Research Study	3
ADVANCED	MVD 701	Microcomputer Architecture Modeling	3
	MVD 702	Logic Synthesis and Optimization	3
	MVD 703	Layout Synthesis and Optimization	3
	MVD 704	Testing and Design for Testability	3
	ESD 704	Technology and IP Management	1
	MVD 705	Microelectronic Packaging	3
	ESD 705	Digital Signal Processing with FPGA	3
	MVD 706	Chip-Multiprocessor Architecture	3
ELECTIVES	MVD 801	Low Power IC Design	3
	MVD 802	Mixed Signal IC Design	3
	MVD 803	RF IC Design	3
	MVD 804	Embedded System Design around Chip-Multiprocessor Architectures	3
	MVD 805	MEMS	3
	MVD 806	Nano Technology	3
PROJECT	MVD 901	Mini Project	2
	MVD 902	Project	18

* 1 Credit Hr = 16 Class Hrs / 32 Lab Hrs in a semester

MBA Program in Management

With specialization streams in:

General Management, Financial Management, Marketing Management, Human Resource Management and Production and Operations Management.

"The real voyage of discovery consists not in seeking new lands, but in seeing with new eyes."

**- Marcel Proust,
the renowned 19th century French Novelist**

Information and communication technology has influenced every aspect of life including the way in which businesses are conducted throughout the world. Consequently, businesses have transformed themselves from the conventional models into technology-enabled models. Business administration has therefore become technology enabled.

Earlier, business education focused on the functional areas of Production, Marketing, HR, and Finance. With the advent and the use of IT in businesses, it has become necessary to manage enterprises from an IT perspective and integrate IT in all the functional areas. Business managers of today are expected to run their business based on skills derived from IT and ITeS coupled with the conventional norms and practices of a business enterprise.

Studies forecast that India's exports will grow to more than US \$ 57 billions by 2008 in the IT services and IT-enabled Services Industry. This industry currently boasts of a turnover of US \$ 20 billion, and will continue to grow consistently. Today, one in four Fortune 1000 companies outsource their software requirements to India. IT enabled Services (ITeS) has emerged as the key IT growth driver with 10.6% of the total IT software and service industry revenues.

The MBA Program at I²IT concentrates on educating, training and developing tomorrow's managers by equipping them with the knowledge base, skill sets and behavioural perspective essential to operate successfully in the IT enabled world of the 21st Century.

Program

This autonomous 24-month, full-time, residential program is designed to address the diverse needs of the 21st century managers of a wide variety of organizations. It provides solid instruction in the basic conceptual areas that form the foundations of modern managerial theory, followed by wide ranging exposure to all the functional areas of business. Entrants will also receive a strong grounding in Managerial Communication and then go on an internship for 2 months. With knowledge gained about the real world through internships and the help of individual faculty counselors each student will choose one of the above streams to specialize in. They will gain in-depth knowledge in their stream of specialization and hands-on practice of some of the latest software applications in that stream. The program will be capped off with analytical modeling and research methodology courses and case studies in Policy and Strategy as well as the specialization stream.

Program Structure

- ▲ Total Semesters: 4
- ▲ Total Credits: Minimum of 78 credits.
- ▲ 8 Foundation courses of 3 credits each for

a total of 24 credits.

- ▲ 5 Core courses of 3 credits each for a total of 15 credits.
- ▲ 7 Advanced courses of 3 credits each for a total of 21 credits.
- ▲ 5 Elective courses of 3 credits each for a total of 15 credits in a specialization area of the student's choice.
- ▲ 1 Internship / Mini-Project of 3 credits.
- ▲ 26 courses of 3 credits each for a total of 78 credits.

Program Pedagogy

- ▲ The student has to select the courses in consultation with guide as indicated. Internal or full-time students should take any courses offered by the institute under the regular on-campus programs.
- ▲ For the working student, if the situation demands, the institute can offer these courses on-campus on weekends or in the evening or through distance education program.
- ▲ The institute reserves the right to decide the mode of delivery of the course and the pedagogy.

Distinctive Features

- ▲ Emphasis on good communication skills
- ▲ Emphasis on group study and team work

- ▲ Hands-on exposure to Enterprise Resource Planning software applications
- ▲ Hands-on exposure to software applications in specialization stream
- ▲ Development of analytical and presentation skills
- ▲ Extensive case studies
- ▲ Diverse pedagogical approaches including traditional lectures, laboratory exercises, field work, internship, guided research and the case method.
- ▲ Students with a quizzical eye and a questioning mind will find this program most rewarding.

Eligibility

Graduates with any recognized Bachelors Degree of minimum three years duration in any field with at least 60% marks at the graduation level. Graduates in Commerce, Economics, Mathematics, Statistics, the Sciences, Engineering and Technology are preferred. Proficiency in C / C++ programming will also be very useful.

Program Commencement

The program commences in July / October.

Selection Process

The selection of an applicant for the course