

Department of Electrical and Electronics Engineering

1. Industrial Automation

Industrial automation is the control of machinery and processes used in various industries by autonomous systems using technologies like robotics and computer software with the goal of automating production. Today, industrial automation is a wide range of machines, actuators, sensors, processors, and networks that work to connect an industrial environment. From PLCs, AI, Machine Learning, and IoT devices, modern industrial automation is focusing on the best way to leverage technology.

Skills to be acquired:

Proficiency in PLC and SCADA: To become an Industrial Automation Engineer, one needs to have a good understanding of Electrical and Electronic Engineering principles. Proficiency in PLC and SCADA is must. PLC is essentially a Hardware and SCADA is a software. The PLC (Programmable Logical Controller) unit consists of the following hardware components Central processing unit (CPU), Input (I) and output modules (O) (Analog type and Digital type), Power supply (PS), Back plane, Communication modules (depending upon the type of PLC), Ethernet switches, Media converters (depends on the requirements) and Ethernet cables (depends on the type of communications). The PLC unit consists of the following useful 5 software PLC languages:

Ladder diagram or ladder logic (LD)

Structure text (ST)

Function block diagram (FBD)

Sequential function charts (SFC)

Instruction list (IL).

Communication protocols for the communication between PLC and SCADA (SCADA Supervisory Control and Data Acquisition Systems) like Ethernet TCP/IP, Modbus RTU etc.,

Technical Knowledge:

Knowledge of Electrical and Electronics circuits, computer, programming, communication systems, and network technologies, control panels, P&ID drawings, network drawings, electrical power distribution drawings, PL, PLC programming, HMI, SCADA, DCS, etc. Knowledge of Electrical and Industrial devices, e.g. isolators, boilers, pumps, Variable Frequency and Adjustable Speed Drives, transmitters, valves, etc. Knowledge of Analog and digital signal, system dynamics, sensors, measurement and instrumentation engineering and control systems.

Problem-Solving Skills:

Logical thinking, mathematics, imagination, troubleshooting, decision making is essential. Industrial Automation engineers need to be skilled at problem-solving, finding solutions, and coming to conclusions using technical concepts. They must be able to solve design

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problems, improve designs for performance, and make sure that designs adhere to production restrictions and functional specifications.

Communication and Collaboration:

Automation engineers work in teams and need to effectively communicate their ideas, designs, and solutions to other engineers, professionals, and stakeholders. Data analysis, report writing, and presentation are prerequisite. Further, Excellent communication and collaboration skills are essential for successful Industrial Automation engineering careers.

Course to be done:

Advanced Courses in Industrial Automation: The list of advanced courses are: Certified Automation Engineer Course, Certified IoT Engineer Courses, Industrial IoT Courses, Post Graduate Diploma in Industrial Automation (PGDIA), Factory Automation with TIA Portal, DCS Courses -Distributed Control System and Masters in Industrial Automation.

Professional Development Courses: These courses are designed to polish the individual's expertise in any given area. ISA Certified Automation Professional (CAP) certification is a mark of career excellence that affirms your commitment to quality and demonstrates your expertise and knowledge of automation and controls.

Job Prospects and Salary Expectations:

Job Prospects: In India, Job opportunities in industrial automation are excellent with tremendously promising employment growth. Some of the most in-demand roles include Automation Engineer, Control Engineer, Robotics Engineer, and Process Engineer. The entry-level roles involve getting into PLC programming, system installation, project commissioning, etc.

Salary Expectations: The salary expectations for these roles vary depending on the company, job location, and experience level. Typically, for entry level engineers, pay ranges between INR 4 to 5 Lakhs per year. However, experienced professionals who work on large and complex systems may earn an annual salary of more than 8-10 Lakhs.

Companies Providing Job Opportunities:

Several companies in India provide job opportunities for Automation Engineers. Some of the well-known companies that hire include:

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| 1. General Electric, Rockwell Automation | 2. Siemens India Ltd |
| 3. Honeywell Automation India Ltd | 4. ABB India Ltd. |
| 5. Larsen and Toubro Pvt Ltd. | 6. Schneider Electric |
| 7. Honeywell process solutions | 8. Yokogawa electric |
| 9. Adarsha Automation & Controls | |

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2. VLSI Design

Very Large-Scale Integration (VLSI) design refers to the process of designing complex circuits by integrating millions of electronic components onto a single chip. It involves a range of tasks from designing, simulating, testing, and fabricating the chip. VLSI design is a field of electronics engineering that involves designing and fabricating integrated circuits (ICs) that contain millions of transistors, capacitors and other electronic components on a single chip. It has revolutionized the way electronic devices are designed and manufactured by reducing the size, cost and power consumption of electronic systems. Overall, VLSI design requires a strong understanding of digital and analog circuit design, semiconductor physics, computer-aided design tools, and fabrication processes. It is a challenging and exciting field that is constantly evolving as new technologies and design methodologies are developed.

Skills to be acquired:

Proficiency in VLSI Design

VLSI Design is all about designing complex ICs, so it is important to have a strong foundation in basic electronics such as circuit analysis, semiconductor physics, and digital electronics.

- Analog Electronics: This course covers the basics of analog circuits, such as amplifiers, filters, and op-amps.
- Semiconductor Physics: This course covers the basic principles of semiconductor devices, such as diodes, transistors, and MOSFETs..
- Digital Electronics: This course covers the basics of digital circuits, Boolean algebra, logic gates, and combinational and sequential circuits.

Technical Knowledge

One should be proficient in programming languages such as C/C++, Python, and Perl, as they are widely used in VLSI Design. Analytical and problem-solving skills. One needs to have a good understanding of the VLSI Design tools such as Verilog, VHDL, and System Verilog, and the design methodologies such as RTL coding, testbench development, and verification techniques.

Problem-Solving Skills

Designing complex ICs requires strong analytical and problem-solving skills, as one needs to identify and fix design issues that arise during the design process.

Communication and Collaboration

Strong communication skills are essential for VLSI Designers as they need to interact with team members, managers, and customers to understand their requirements and provide status updates.

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Courses to be Done:

Certificate courses: There are several certificate courses available in VLSI Design that provides specialized knowledge in specific areas of VLSI Design. Some of the popular certificate courses include RTL Design, ASIC Design, FPGA Design, and SoC Design.

Industry-specific courses: Many semiconductor companies provide specialized training programs to their employees to upgrade their skills in VLSI Design. These courses cover specific areas such as design methodologies, EDA tools, and verification techniques.

Job Prospects and Salary Expectations:

Job Prospects: The job prospects for VLSI Design engineers are excellent, with opportunities available in companies that design and manufacture ICs, data storage devices, and communication systems. Here are some of the job roles that a VLSI Design engineer can take up:

IC Design Engineer: IC design engineers are responsible for designing digital and analog circuits that are used in ICs. They work on RTL coding, simulation, synthesis, and verification of the circuits.

Verification Engineer: Verification engineers are responsible for testing and verifying the functionality of ICs. They use various tools and techniques to ensure that the ICs meet the design specifications.

Physical Design Engineer: Physical design engineers are responsible for laying out the transistors, capacitors, and other components on the chip and routing the wires that connect them together.

System Design Engineer: System design engineers are responsible for designing complex electronic systems that involve both digital and analog circuits.

Salary Expectations: According to industry reports, the average salary package is around 7 to 10 Lakhs per annum. The salary expectations for VLSI Design engineers vary depending on their experience, skill level, and job role. However, the salary can vary depending on the location, company, and other factors. Overall, VLSI Design is a highly rewarding career path with excellent job prospects and good salary expectations.

Companies Providing Job Opportunities:

There are many companies that recruit VLSI Design engineers. Here is the list of some of the top recruiters for VLSI Design:

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| 1. Intel Technology India Pvt. Ltd. | 2. Qualcomm India Pvt. Ltd. |
| 3. Samsung Semiconductor R&D India Pvt. Ltd. | 4. Texas Instruments India Pvt. Ltd. |
| 5. Broadcom India Pvt. Ltd. | 6. Synopsys India Pvt. Ltd. |
| 7. Cadence Design Systems India Pvt. Ltd. | 8. NVIDIA Graphics Pvt. Ltd. |
| 9. STMicroelectronics India Pvt. Ltd. | 10. Infineon Technologies India Pvt. Ltd. |

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3. Embedded Systems

Embedded systems are computer systems that are designed to perform specific functions within a larger system or product. They are typically small, low-power devices that are integrated into other products, such as smartphones, automobiles, medical devices, and household appliances.

Embedded systems rely on a combination of hardware and software to perform their functions. The hardware typically includes a microcontroller or microprocessor, memory, input/output interfaces, and other components that are specific to the product or application. The software is designed to run on the hardware and control its behavior, typically through a real-time operating system.

Skills to be acquired:

Proficiency in Embedded Systems

A solid understanding of digital and analog circuits, microprocessor/microcontroller architectures, and electronic design is necessary. Microcontrollers/microprocessors are the heart of any embedded system. You need to be familiar with their operation, programming, and interfacing.

Technical Knowledge

Technical proficiency in programming languages such as C, C++, Python, and Assembly is essential for embedded system development. Real-time operating systems (RTOS) are required for most embedded systems.

Problem-Solving Skills

Debugging skills are essential to diagnose and fix issues in embedded systems. You need to know how to develop unit tests and system tests to ensure that the embedded system functions correctly.

Communication and Collaboration

Students should have good understanding of communication protocols such as UART, SPI, I2C, and CAN. You should be familiar with firmware development tools such as compilers, debuggers, and emulators.

Courses to be done:

Here are courses available to help student to become an embedded systems engineer.

1. Embedded Systems Design: This course covers the basics of embedded systems, including microcontrollers, sensors, communication protocols, and real-time operating systems. It is a great starting point for beginners.
2. Embedded Software Engineering: This course focuses on the software side of embedded systems, including programming, debugging, and testing.

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3. Advanced Embedded Systems Design: This course provides a deeper dive into embedded systems design, covering topics such as power management, memory management, and system integration.

4. Real-Time Operating Systems for Embedded Systems: This course covers the fundamentals of real-time operating systems, including scheduling, synchronization, and interrupt handling.

5. Embedded Systems Development with ARM Cortex-M Microcontrollers: This course focuses on the ARM Cortex-M architecture, which is commonly used in embedded systems. It covers programming, debugging, and interfacing with peripherals.

Job Prospects and Salary Expectations:

Job Prospects: The job outlook for embedded system engineers is very positive in today's job market. Embedded system engineers work in a wide range of industries, including automotive, medical devices, consumer electronics, and aerospace, among others. As more and more systems become automated in these industries, the demand for skilled embedded system engineers will continue to grow.

Salary Expectations: The salary expectations for embedded system engineers vary depending on the company, location, and level of experience. The average salary for an embedded system engineer in the India is around Rs 4 Lakhs per year and more than 15 Lakhs for a senior-level position. The salary can also vary based on the industry, with industries such as aerospace and defense, automotive, and medical devices generally offering higher salaries. Overall, the field of embedded systems offers competitive salaries and good job prospects for those with the necessary skills and experience.

Companies Providing Job Opportunities:

There are many companies that provide job opportunities for embedded system engineers. Here are some examples:

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| 1. Intel Technology India Pvt. Ltd. | 2. Qualcomm India Pvt. Ltd. |
| 3. Samsung Semiconductor R&D India Pvt. Ltd. | 4. Texas Instruments India Pvt. Ltd. |
| 5. Samsung Electronics India Pvt Ltd | 6. Bosch Electronics Company India |
| 7. General Electric India | |

These are just a few examples of the many companies that hire embedded system engineers. In addition, there are many startups and smaller companies that specialize in embedded systems development. Some other companies that are involved in the development of embedded systems include medical device manufacturers, aerospace and defense companies, and robotics companies.