

## Department of Electronics & Communication Engineering

### 1. VLSI and IC Design

VLSI and IC Design are closely related fields, with VLSI being a broader term that encompasses the entire process of designing and fabricating integrated circuits, while IC Design specifically refers to the process of creating the physical layout and design of the circuit.

Here's a detailed overview of the skills to be acquired, courses to be done, job prospects, salary expectations, and companies providing job opportunities for VLSI and IC Design professionals.

#### **Skills to be acquired:**

##### **Proficiency in VLSI and IC Design:**

Proficiency in VLSI and IC Design requires a strong foundation in electrical engineering, digital & analog circuit design, and semiconductor physics. The goal of both VLSI and IC Design is to create efficient, reliable, and high-performance electronic systems that can be used in a wide range of applications, from consumer electronics to aerospace and defense.

##### **Technical Knowledge:**

VLSI and IC Design require a deep understanding of CMOS Technology, Digital Design, Analog Design, Memory Design, Signal Integrity, Power Management and EDA (Electronic Design Automation) Tools.

##### **Problem-Solving Skills:**

Problem-solving skills are crucial for success in VLSI and IC Design it includes Critical thinking, Troubleshooting, Design optimization, Debugging, Decision-making, Creativity, Communication, Time management, and Attention to detail.

##### **Communication and Collaboration:**

The specific skills and practices that are important for communication and collaboration in VLSI and IC Design are clear communication is the ability to explain technical concepts in a clear and concise manner. Active listening is the ability to actively listen to others and understand their perspectives and concerns.

Collaboration: The ability to work effectively in a team environment, including the ability to share knowledge and expertise, provide and receive feedback, and resolve conflicts.

#### **Courses to be completed:**

##### **Proficiency in VLSI and IC Design:**

Proficiency in VLSI and IC Design requires a strong foundation in electrical engineering, digital & analog circuit design, and semiconductor physics. The goal of both VLSI and IC Design is to create efficient, reliable, and high-performance electronic systems that can be used in a wide range of applications, from consumer electronics to aerospace and defense.

##### **Technical Knowledge:**

---

## Department of Electronics & Communication Engineering

---

VLSI and IC Design require a deep understanding of CMOS Technology, Digital Design, Analog Design, Memory Design, Signal Integrity, Power Management and EDA (Electronic Design Automation) Tools.

### **Problem-Solving Skills:**

Problem-solving skills are crucial for success in VLSI and IC Design it includes Critical thinking, Troubleshooting, Design optimization, Debugging, Decision-making, Creativity, Communication, Time management, and Attention to detail.

### **Communication and Collaboration:**

The specific skills and practices that are important for communication and collaboration in VLSI and IC Design are clear communication is the ability to explain technical concepts in a clear and concise manner. Active listening is the ability to actively listen to others and understand their perspectives and concerns.

Collaboration: The ability to work effectively in a team environment, including the ability to share knowledge and expertise, provide and receive feedback, and resolve conflicts.

### **Courses to be completed:**

There are several courses that one can complete to gain proficiency in VLSI and IC Design. The fundamental concepts and practical skills in this field are obtained from the courses Digital Integrated Circuit Design, Analog Integrated Circuit Design, VLSI Design, Advanced Digital Integrated Circuit Design, RF Integrated Circuit Design, System-on-Chip Design, Embedded Systems Design, Semiconductor Device Physics and Computer-Aided Design (CAD) Tools for VLSI.

### **Job Prospects and Salary Expectations:**

**Job prospects:** For VLSI and IC Design professionals are very good, with opportunities available in various sectors, including semiconductor companies, electronics manufacturers, and IT services companies. Some of the popular job roles in this field include VLSI Design Engineer, Verification Engineer, Physical Design Engineer, Analog Design Engineer, and CAD Engineer.

**Salary Expectations:** According to industry reports, the average salary for VLSI and IC Design professionals is around Rs. 7-10 lakhs per annum for entry-level roles, with salaries increasing significantly for mid-level and senior-level roles. However, the salary may vary depending on the company, location, experience, and skills of the individual.

With the growing demand for skilled VLSI and IC Design professionals, the job prospects and salary expectations in this field are expected to remain strong in the coming years. Moreover, with the Indian government's push towards domestic semiconductor manufacturing, the demand for VLSI and IC Design professionals is expected to grow even further.

### **Companies providing the job opportunities for VLSI Engineers:**

There are many companies in India that provide job opportunities for VLSI and IC Design professionals. Some of the top companies in this field include:

---

## Department of Electronics & Communication Engineering

---

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.

Apart from these companies, there are many other smaller and mid-sized companies in India that provide job opportunities for VLSI and IC Design professionals. Additionally, there are many Indian startups in this field that offer exciting job opportunities and innovative work culture.

---

**Department of Electronics & Communication Engineering**

---

**2. Data Engineering**

A data engineer is a professional responsible for designing, building, and maintaining the infrastructure and systems required for collecting, storing, processing, and analyzing large volumes of data. The role of a data engineer is critical in ensuring that data is accessible, reliable, and prepared for analysis by data scientists and other stakeholders

**Proficiency in Data Engineering Tools and Technologies****1) Technical Knowledge:**

- **Programming Languages:** Proficiency in Python, Java, and Scala., Knowledge of SQL for querying and managing relational databases.
- **Database Systems:** Experience with relational databases like PostgreSQL, MySQL, and SQL Server. Familiarity with NoSQL databases such as MongoDB, Cassandra, and Redis.
- **Data Warehousing Solutions:** Knowledge of cloud-based data warehouses like Amazon Redshift, Google BigQuery, and Snowflake. Understanding of traditional data warehousing concepts and tools.
- **Big Data Technologies:** Proficiency in Hadoop ecosystem components. Experience with Apache Spark for large-scale data processing. Understanding of real-time data streaming and message queue systems.
- **Cloud Platforms:** Familiarity with AWS, Azure, and Google Cloud Platform. Knowledge of cloud-based data storage and processing services.
- **Data Modeling:** Skills in data modeling techniques (e.g., star schema, snowflake schema).
- **Data Quality and Governance:** Implementing data validation, cleansing, and governance practices to ensure data accuracy and compliance.

**2) Problem-Solving Skills:**

- Strong logical thinking, mathematics, and troubleshooting abilities.
- Ability to diagnose issues, optimize processes, and develop efficient solutions.
- Creativity and imagination in solving complex data-related problems.
- Decision-making skills to improve designs for performance and ensure adherence to production restrictions and functional specifications.

**3) Communication and Collaboration:**

- Effective communication with cross-functional teams to understand data requirements and convey technical concepts.
- Data analysis, report writing, and presentation skills.
- Excellent communication and collaboration skills to work with data scientists, analysts, and software engineers.

**4) Course to be done**

## Department of Electronics & Communication Engineering

### Advanced Courses in Data Engineering

**Certified Data Engineer Courses:** Courses on Coursera, edX, Udacity, and DataCamp.

Certifications from cloud providers (e.g., AWS Certified Data Analytics, Google Professional Data Engineer, Azure Data Engineer Associate).

**Specialized Data Engineering Programs:** Post Graduate Diploma in Data Engineering.

Advanced courses in Big Data, Data Warehousing, and Cloud Data Solutions.

**Professional Certification:** Certifications like Cloudera Certified Professional (CCP) Data Engineer and IBM Certified Data Engineer.

### 5) Job Prospects and Salary Expectations

#### Job Prospects:

- Excellent job opportunities in the data engineering field with promising employment growth.
- In-demand roles include Data Engineer, Big Data Engineer, Data Architect, and ETL Developer.
- Entry-level roles involve tasks such as data pipeline development, database management, and data integration.

#### Salary Expectations:

- Entry-level data engineers typically earn between INR 4 to 6 Lakhs per year in India.
- Experienced professionals working on large and complex systems can earn annual salaries of more than INR 10-15 Lakhs.
- Salaries vary depending on the company, job location, and experience level.

### 6) Companies Providing Job Opportunities

Several companies in India offer job opportunities for Data Engineers. Some of the well-known companies include:

- **Tech Giants:** Google, Microsoft, Amazon, and IBM.
- **Consulting Firms:** Deloitte, Accenture, and PwC.
- **IT and Software Services:** TCS, Infosys, Wipro, and HCL Technologies.
- **E-commerce and Fintech:** Flipkart, Paytm, and Zomato.
- **Startups and Emerging Companies:** Swiggy, Ola, and Freshworks.

## Department of Electronics & Communication Engineering

### 3. Applied Machine Learning

Applied Machine Learning involves the practical application of machine learning algorithms and techniques to solve real-world problems. Unlike theoretical machine learning, which focuses on the development of new algorithms and models, applied machine learning emphasizes the use of existing models and methods to create tangible solutions across various industries. This field integrates data analysis, statistical modeling, and computational algorithms to develop systems that can learn from data and make predictions or decisions without being explicitly programmed for every task.

#### Proficiency in Machine Learning Tools and Technologies

##### 1) Technical Knowledge:

- **Programming Languages:** Proficiency in Python and R, commonly used for machine learning tasks. Knowledge of Java, Scala, or Julia can be beneficial.
- **Machine Learning Frameworks and Libraries:** Scikit-learn: Essential for basic machine learning algorithms and data preprocessing. TensorFlow and Keras: Widely used for building and deploying deep learning models. PyTorch: Popular for research and development in deep learning. XGBoost and LightGBM: Effective for gradient boosting and tree-based models.
- **Data Manipulation and Analysis:** Proficiency in using libraries such as Pandas and NumPy for data manipulation. Experience with data visualization tools like Matplotlib, Seaborn, and Plotly.
- **Model Evaluation and Validation:** Knowledge of cross-validation techniques, metrics for model evaluation (e.g., accuracy, precision, recall, F1 score, AUC-ROC). Understanding of hyperparameter tuning methods such as Grid Search and Random Search.
- **Natural Language Processing (NLP):** Familiarity with libraries like NLTK, SpaCy, and Hugging Face Transformers. Understanding of text preprocessing, tokenization, and sentiment analysis.
- **Computer Vision:** Knowledge of OpenCV and deep learning frameworks for image processing and computer vision tasks.
- **Big Data Technologies:** Experience with big data tools like Apache Spark and Hadoop for handling large datasets.
- **Database Systems:** Familiarity with SQL and NoSQL databases for data storage and retrieval. Knowledge of distributed databases like MongoDB and Cassandra.
- **Cloud Platforms:** Experience with cloud services like AWS, Azure, and Google Cloud for deploying machine learning models. Knowledge of cloud-based machine learning services.

##### 2) Problem-Solving Skills:

- Strong analytical and problem-solving abilities.
- Ability to diagnose issues, optimize models, and develop efficient solutions.

## Department of Electronics & Communication Engineering

- Creativity in applying machine learning techniques to solve real-world problems.
- Decision-making skills to improve model performance and ensure practical applicability.

### 3) Communication and Collaboration:

- Effective communication with cross-functional teams to understand project requirements and convey technical concepts.
- Data analysis, report writing, and presentation skills.
- Excellent communication and collaboration skills to work with data scientists, engineers, and business stakeholders.

### 4) Advanced Courses in Applied Machine Learning

**Certified Machine Learning Courses:** Courses on Coursera, edX, Udacity, and DataCamp.  
**Specialized Machine Learning Programs:** Post Graduate Diploma in Machine Learning and AI. Advanced courses in Deep Learning, NLP, and Computer Vision.

**Professional Certification:** Certifications like TensorFlow Developer Certificate, AWS Certified Machine Learning – Specialty.

Applied machine learning tracks in professional organizations like the Data Science Council of America (DASCA).

### 5) Job Prospects and Salary Expectations

#### Job Prospects:

Excellent job opportunities in the machine learning field with promising employment growth. In-demand roles include Machine Learning Engineer, Data Scientist, AI Engineer, and Research Scientist.

Entry-level roles involve tasks such as model development, data preprocessing, and model evaluation.

#### Salary Expectations:

Entry-level machine learning engineers typically earn between INR 6 to 8 Lakhs per year in India.

Experienced professionals working on advanced machine learning systems can earn annual salaries of more than INR 15-20 Lakhs.

Salaries vary depending on the company, job location, and experience level.

### 6) Companies Providing Job Opportunities

Several companies in India offer job opportunities for Machine Learning professionals. Some of the well-known companies include:

**Tech Giants:** Google, Microsoft, Amazon, and IBM.

**Consulting Firms:** Deloitte, Accenture, and PwC.

**IT and Software Services:** TCS, Infosys, Wipro, and HCL Technologies.





---

## Department of Electronics & Communication Engineering

---

**E-commerce and Fintech:** Flipkart, Paytm, and Zomato.

**Startups and Emerging Companies:** Swiggy, Ola, Freshworks, and numerous AI-focused startups.



## Department of Electronics & Communication Engineering

### 4. Ethical Hacking

Ethical Hacking, also known as penetration testing or white-hat hacking, is the authorized practice of bypassing system security to identify potential data breaches and threats in a network. Ethical hackers use their skills to help organizations strengthen their security posture by finding vulnerabilities before malicious attackers can exploit them.

Here's a detailed overview of the skills to be acquired, courses to be done, job prospects, salary expectations, and companies providing job opportunities for Ethical Hacking professionals.

#### **Skills to be acquired:**

##### **Proficiency in Ethical Hacking:**

Proficiency in Ethical Hacking requires a strong understanding of computer networks, operating systems, web applications, and security protocols. The primary goal is to identify security loopholes, test system defenses, and recommend measures to prevent unauthorized access.

##### **Technical Knowledge:**

Ethical hacking requires expertise in:

- Networking concepts (TCP/IP, DNS, HTTP/HTTPS, VPNs, firewalls).
- Operating systems (Windows, Linux, macOS) and their security configurations.
- Cybersecurity tools such as Nmap, Metasploit, Wireshark, Burp Suite, and OWASP ZAP.
- Knowledge of cryptography, authentication methods, and encryption algorithms.
- Familiarity with web application vulnerabilities (SQL Injection, Cross-Site Scripting, CSRF, etc.).
- Scripting skills in Python, Bash, or PowerShell for automating security tasks.

##### **Problem-Solving Skills:**

Problem-solving skills are essential in Ethical Hacking, including analytical thinking, vulnerability assessment, penetration test planning, risk analysis, decision-making, creativity, communication, time management, and attention to detail.

##### **Communication and Collaboration:**

In Ethical Hacking, the ability to explain technical security findings in simple terms is critical. Active listening helps in understanding the security requirements of clients and organizations. Collaboration skills enable ethical hackers to work effectively with IT, development, and management teams, share expertise, provide actionable recommendations, and assist in incident response.

## Department of Electronics & Communication Engineering

### Courses to be completed:

There are several courses that one can complete to gain proficiency in Ethical Hacking. The fundamental concepts and hands-on skills in this field are obtained from:

- Certified Ethical Hacker (CEH) – EC-Council.
- Offensive Security Certified Professional (OSCP).
- CompTIA Security+ and CompTIA PenTest+.
- GIAC Penetration Tester (GPEN).
- Advanced Web Application Security Testing.
- Cybersecurity specializations offered on Coursera, edX, and Udemy.

### Job Prospects and Salary Expectations:

**Job prospects:** For Ethical Hacking professionals, job prospects are excellent, with opportunities available in IT security firms, government agencies, defence organizations, financial institutions, and multinational corporations. Popular job roles in this field include Penetration Tester, Security Analyst, Vulnerability Assessment Specialist, Cyber security Consultant, and Incident Responder.

**Salary Expectations:** According to industry reports, entry-level ethical hackers typically earn INR 4–6 lakhs per annum, with experienced and certified professionals earning INR 10–18 lakhs or more per annum. Salaries may vary depending on the company, location, certifications, and individual expertise.

With the increasing number of cyber-attacks worldwide, the demand for skilled ethical hackers is expected to grow rapidly. Organizations across all sectors are investing heavily in cyber security to protect their digital assets, creating consistent career opportunities in this domain.

### Companies providing the job opportunities for Ethical Hackers:

Many companies in India and globally hire ethical hacking professionals. Some of the top employers include:

1. Google
2. Microsoft
3. Amazon
4. IBM
5. Palo Alto Networks
6. Deloitte

---

## Department of Electronics & Communication Engineering

---

7. PwC
8. Infosys
9. TCS
10. Wipro

Apart from these, specialized cyber security firms like Kaspersky, Lucideus, Quick Heal, and numerous start-ups also provide promising job opportunities for ethical hackers

---

## Department of Electronics & Communication Engineering

---

### 5. Immersive Technology

Immersive Technology, particularly Virtual Reality (VR), is a computer-generated simulation that allows users to interact with 3D environments in a way that feels real and engaging. VR applications are increasingly used in gaming, simulation training, education, architecture, healthcare, and industrial design, making it one of the fastest-growing technological domains.

Here's a detailed overview of the skills to be acquired, courses to be done, job prospects, salary expectations, and companies providing job opportunities for Immersive Technology professionals.

#### **Skills to be acquired:**

##### **Proficiency in Immersive Technology:**

Proficiency in VR development requires strong programming knowledge, 3D design skills, and an understanding of human-computer interaction. The goal is to create realistic, interactive, and high-performance immersive environments that serve entertainment, educational, or operational purposes.

##### **Technical Knowledge:**

Immersive Technology professionals require expertise in:

- VR development platforms like Unity3D and Unreal Engine.
- 3D modeling, animation, and texturing using Blender, Autodesk Maya, or 3ds Max.
- Programming skills in C#, C++, and Python.
- Understanding of VR hardware (Oculus Rift, HTC Vive, PlayStation VR, Meta Quest).
- Knowledge of immersive audio design and 360° video production.
- Basics of Augmented Reality (AR) and Mixed Reality (MR) integration.
- Optimization techniques for VR performance and cross-platform deployment.

##### **Problem-Solving Skills:**

Problem-solving in VR involves creative thinking for designing interactive experiences, debugging complex visual and performance issues, optimizing application responsiveness, and ensuring intuitive user experiences.

##### **Communication and Collaboration:**

Effective VR development requires collaboration with artists, UI/UX designers, and software engineers. Strong communication skills help in translating client requirements into functional VR applications and presenting technical capabilities to non-technical stakeholders.

## Department of Electronics & Communication Engineering

### Courses to be completed:

To gain proficiency in Immersive Technology, students can undertake courses such as:

- Introduction to Virtual Reality (Coursera, Udemy, edX).
- Unity Certified VR Developer.
- Unreal Engine VR Development Certification.
- Advanced 3D Modelling and Animation.
- Human-Computer Interaction and UX for VR.
- AR/VR Specialization from professional XR bootcamps.

### Job Prospects and Salary Expectations:

**Job prospects:** Immersive Technology professionals are in demand in gaming studios, simulation training providers, industrial design companies, and healthcare simulation projects. Popular roles include VR Developer, 3D Artist, VR UX Designer, Simulation Engineer, and AR/VR Content Creator.

**Salary Expectations:** Entry-level VR developers typically earn INR 4–6 lakhs per annum. Experienced professionals with strong portfolios and specialization in AR/VR can earn INR 10–15 lakhs per annum or more. Salaries depend on the domain of application, organization, and expertise. With the rapid adoption of immersive technologies across industries, the job market for VR professionals is expected to grow exponentially in the coming years.

### Companies providing the job opportunities for VR Professionals:

Some leading employers in this field include:

1. Meta
2. Google
3. Microsoft
4. Apple
5. Ubisoft
6. Electronic Arts
7. Tesseract
8. Simulans
9. Meraki
10. Scapic

Additionally, numerous startups in India are innovating in VR training, architecture visualization, and simulation-based solutions, providing exciting opportunities for skilled professionals.