Computer Engineering Roadmap (Hardware + Software Focus)

1. Core Foundation (Ongoing - Beginner to Intermediate)

- Mathematics: Discrete math, linear algebra, probability, logic.
- Physics: Especially electricity, magnetism, and basic electronics.
- Computer Basics: Binary, hexadecimal, logic gates, number systems.
- Programming Basics: Python (focus), C (secondary).
- Linux: Basic shell commands, file systems, scripting.

2. Software Engineering Track

- Programming Mastery:
- Intermediate Python (OOP, modules, file handling)
- C/C++ (Pointers, memory management)
- JavaScript (for full-stack or IoT projects)
- Web Development:
- HTML, CSS, JavaScript
- Django or Flask (Backend)
- REST APIs (Build + consume)
- Database:
- SQL (PostgreSQL, MySQL)
- NoSQL (MongoDB, Redis - optional)
- Version Control:
- Git, GitHub, GitLab
- Testing & Deployment:
- Unit testing (pytest/unittest)

- Docker basics

- CI/CD pipelines

- Security:

- Basic web and system security

- JWT, HTTPS, OAuth basics

3. Hardware Engineering Track

- Digital Electronics:

- Logic gates, flip flops, counters, registers

- Breadboarding and logic ICs

- Microcontrollers:

- Arduino

- ESP32 or Raspberry Pi (for embedded systems)

- C/C++ and MicroPython

- Circuit Design:

- Schematic and PCB design with KiCad or Fritzing

- Computer Architecture:

- CPU design basics, ALU, registers, instruction sets

- Operating Systems overview

- Networking:

- TCP/IP, LAN/WAN, routing, switches

- Wireshark for packet inspection

4. Advanced Topics (Pick a Path)

- Embedded Systems

- Robotics

- Cybersecurity

- AI/ML with hardware acceleration (e.g. Jetson Nano, TPU)

- Cloud DevOps for deployment

5. Projects & Portfolio (Always!)

- Build full-stack apps

- Contribute to open source

- Hardware + software integration (IoT projects)

- Create a GitHub portfolio

6. Soft Skills & Continuous Learning

- Learn how to learn

- Read documentation

- Participate in online forums (Stack Overflow, Reddit, GitHub)

- Attend meetups, hackathons, and build a network