# Science & Technology · GS - III

**Advanced semiconductor technologies have emerged as critical determinants of economic competitiveness and national security. Examine the strategic significance of AI chips and discuss the challenges India faces in developing a competitive semiconductor ecosystem.**

| EXAM YEAR | PAPER | SUBJECT |
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| MARKS | WORD LIMIT |
|---|---|
| 10 | ~150 words |

## Answer Hint

**GPU architecture, parallel processing, CUDA ecosystem, AI infrastructure, semiconductor supply chains, export controls, technological sovereignty, fabrication capacity, skilled workforce, research and development.**

## Model Answer

### Introduction

Advanced AI chips have become essential for artificial intelligence, scientific research, defence applications and high-performance computing. Their strategic importance has intensified global competition over semiconductor technology.

### Strategic Significance

- **Economic competitiveness:** Powerful processors accelerate AI development, industrial automation and innovation.
- **National security:** Advanced computing supports defence research, cybersecurity, surveillance and strategic applications.

- **Technological influence:** Control over chip design, manufacturing and software ecosystems creates strategic advantages.
- **Supply-chain security:** Export restrictions and geopolitical tensions can disrupt access to critical computing technologies.

**Challenges for India**

- **Manufacturing limitations:** Advanced fabrication requires substantial capital, specialised infrastructure and technological expertise.
- **External dependence:** India remains dependent on international suppliers for several advanced semiconductor components.
- **Research gaps:** Limited domestic capabilities in advanced chip design, fabrication equipment and materials constrain innovation.
- **Skill shortages:** The sector requires specialised engineers and semiconductor researchers.

**Way Forward**

India should strengthen semiconductor missions, research institutions, chip-design capabilities, international partnerships and skilled workforce development.

**Conclusion**

Building a resilient semiconductor ecosystem is essential for India's technological sovereignty, economic growth and national security.

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