Science & Technology · GS - III

The strategic importance of artificial intelligence is increasingly linked to control over advanced computing hardware and the software ecosystem. Discuss.

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 22/11/2026	GS - III	Science & Technology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

AI infrastructure, GPUs and specialised accelerators, semiconductor supply chains, model optimisation, energy efficiency, technological dependence, digital sovereignty, indigenous R&D.

Model Answer

Introduction

Artificial intelligence is no longer dependent solely on algorithmic innovation. Its advancement increasingly requires specialised semiconductor hardware, efficient software and large-scale computing infrastructure, making technological control a strategic economic and geopolitical concern.

Strategic Importance

1. **Computational capability:** GPUs and specialised AI accelerators enable large-scale parallel processing required for training and deploying advanced models.
2. **Hardware–software integration:** Model optimisation, quantisation and efficient compilers improve computing performance while reducing energy and memory requirements.
3. **Economic competitiveness:** Control over AI infrastructure strengthens productivity, innovation and the competitiveness of digital industries.

4. **Strategic autonomy:** Dependence on a limited number of foreign chip suppliers creates vulnerabilities in technology access and supply chains.
5. **National security:** Advanced computing capabilities have applications in defence, cybersecurity, intelligence and critical infrastructure.

Challenges

Advanced chip manufacturing involves high capital investment, specialised materials, intellectual property and complex global supply chains. Rapid technological changes, energy requirements and concentration of computing infrastructure further complicate access.

Way Forward

India should strengthen semiconductor manufacturing, support indigenous AI accelerator design, promote public–private research partnerships and develop skilled human resources. Initiatives such as the India Semiconductor Mission and IndiaAI Mission can support this ecosystem. International collaboration should complement domestic technological capacity.

Conclusion

AI leadership will increasingly depend on the integration of hardware, software, talent and infrastructure. Building indigenous capabilities while maintaining global partnerships is essential for India's technological sovereignty and economic competitiveness.

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