India’s Science and Technology Sector

Why in news?

The year 2022 marks the 25 years since we started celebrating the National Technology Day (May 11).

What is so special about May 11?

- On May 11, 1998 3 special technologies were launched which includes
  - ***Operation Shakti*** (Pokhran-II nuclear tests)
  - Successful test firing of ***Trishul missile***
  - First test flight of the indigenously developed aircraft ***Hansa***
- The achievements of May 11, 1998 contributes significantly to the economy.

TRISHUL *- Short range low-level surface-to-air missile*

HANSA-New Generation (HANSA-NG) *- India’s first indigenous Flying Trainer. It is the revamped version of the original HANSA developed in 1993.*

What is the journey of India’s nuclear program?

- **Homi Bhabha** - India’s nuclear programme can be traced to the work of physicist Homi J Bhaba.
- In 1945, Tata Institute of Fundamental Research, India’s first research institution dedicated to the study of nuclear physics was opened in Bombay.
- **DAE -** In 1954, the Department of Atomic Energy (DAE) was founed, with Bhabha as director.
- **NPT** - In 1968, the Non-Proliferation Treaty (NPT) came into existence.
- The treaty defines nuclear-weapon states as those that have built and tested a nuclear explosive device before January 1, 1967 (The US, USSR, the UK, France and China) and effectively disallows any other state from acquiring nuclear weapons.
- India is one of the few *non-signatories of NPT*.
- **Vikram Sarabhai -** Bhaba’s successor at the DAE, Vikram Sarabhai, had worked to significantly broaden India’s nuclear technology
- **Pokhran-I** - On May 18, 1974, India carried out its first nuclear test at the Pokhran test site.
- Pokhran-I, codenamed ***Operation Smiling Buddha***, would be billed as a “peaceful nuclear explosion”, with “few military implications”.
- **Missile development** - In 1983, the Defence Research and Development Organisation’s (DRDO) funding was increased and Dr APJ Abdul Kalam was put in charge of India’s missile programme.

- **CTBT -** India also *did not sign the Comprehensive Test Ban Treaty (CTBT)* that was finalised in 1996.
- **Pokhran-II** - In 1998, India responded to Pakistan's launch of Ghauri missile with ***Operation Shakti*** (Pokhran-II).
- Indian Government declared itself as a state possessing nuclear weapons following Pokhran-II.

What are the other major initiatives in S&T sector?

- **Atal Innovation Mission (AIM)** - Established by NITI Aayog, it fosters a robust entrepreneurial landscape in India.
- Various programs of AIM are
    - Atal Tinkering Labs (ATLs) for schools, Atal Incubation Centers (AICs) for start-ups and entrepreneurs,
    - Atal Community Innovation Centers (ACICs) for grassroots innovation,
    - Atal New India Challenges (ANICs) for national-impact innovations and
- **Council of Scientific & Industrial Research (CSIR)** - Plays a crucial role in supporting not only industrial R&D for established industries but also startups and MSMEs.
- **The National Institute of Ocean Technology (NIOT)** - An *autonomous body under the Ministry of Earth Sciences.*
- Design, develop, and demonstrates technologies for the sustainable utilization of ocean resources ***(Example - Matsya 6000)***.
- **The Department of Atomic Energy (DAE)** - Committed to deploying atomic power for improving life quality and fostering national development.
- Has developed indigenous production methods for rare earth permanent magnets.
- Laid the foundation for a TIFRI campus in Hyderabad and the Laser Interferometer Gravitational Wave Observatory-India (LIGO-India) project.
- **The Indian Space Research Organization (ISRO)** - Space science data from missions like Chandrayaan and Mangalyaan is used for hackathons and workshops.
- The virtual space park, ***SPARK***, offers students exposure to space programmes, while ISRO's STEM portal, ***Jigyasa,*** encourages online education and innovation.
- The ***Space on Wheels programme*** consists of mobile space museums aimed at promoting awareness and education for rural students.

What are the notable achievements of India?

- India as a pharmaceutical hub of the world
- Indian IT industry gearing up to drive the world's IT enabled services
- Democratisation of financial transactions by digital payment gateways
- Making of indigenous BioJet fuels
- Mapping of subsurface water channels for sustainable use of water
- Making of indigenous light combat aircraft
- Digitisation of many aspects of trade
- Moving firmly towards a hydrogen economy

What are the challenges?

- Lack of urban infrastructure and planning
- Low diversification of agricultural produce
- Lack of promotion of artificial intelligence technologies in all industrial segments
- Inadequate investments in research and development

What is the way ahead?

- Scientists, innovators, and entrepreneurs should be encouraged to pursue their endeavors to create a brighter future for India.
- There is a need to unleash the immense potential India holds in various fields, from atomic energy to space exploration and biotechnology.

References

1. The Indian Express | India Nuclear Program
2. The Indian Express | India Initiatives
3. The Indian Express | Challenges