3. Frontier Technologies: The Tech Frontier for Developing Nations

Prelims Level: **Robotics & Artificial Intelligence**

Mains Level: **GS-III Awareness in the fields of IT, Space, Computers, Robotics, Nano-Technology, Bio-Technology and Issues Relating to Intellectual Property Rights.**

Context:

- Industrial Revolution 4.0 or Frontier Technology, the latest wave of disruptive technological change is fundamentally altering how goods, services and ideas are exchanged.
- However, the disruptive nature of technology is nothing new, and it offers promising new opportunities, while at the same time posing a challenge to Policymaking.

About Frontier Technologies:

- It is defined as potentially disruptive technologies that can address large-scale challenges or opportunities.
- It is the next phase in the evolution of modern technology. It is the intersection where radical forward-thinking and real-world implementation meet.
- It has unlocked new routes to prosperity through agriculture, manufacturing, trade in services, the linking of informal and formal sectors, and domestic interconnectivity.
- The rapid technological transformations that started from the Industrial Revolution to the digital revolution, have boosted economic performance, improved efficiency, accelerated the pace of globalization, and transformed human society in the process.
- The Frontier technologies include robotics, automation, renewable energy technologies, Artificial Intelligence and bio technologies. Some of the top frontier technologies are Big Data Analysis, Sustainable polymers, Internet of Things, Artificial Intelligence, 3D printing, Nanotechnology, renewable energy technologies, drones and customized satellites.
- They are technologies that offer potential for cheaper, faster, scalable and easy to use solutions for everyday problems. It includes waste management as well.

Applications of Frontier Technologies:

- It is used to improve Government Administration and the delivery of Public Services.
- It can help anticipate and respond to the effects of climate hazards and air pollution through the adoption of state-of-the-art technologies to address environmental impacts.

- It is used to reduce traffic pollution, save energy and water, and create a cleaner environment in Republic of Korea, which is built around the Internet of Things.
- It is used to achieve the ambitions of the 2030 Agenda for Sustainable Development.

Challenges in Frontier Technologies:

- The backbone of many frontier technologies are Information and Communication Technology, there is a risk of its triggering a new frontier technology divide, compounding an already existing digital divide.
- It is estimated that, three billion people could still lack internet access by 2023, and many more will have little or no opportunity to reap the benefits of Digital Technologies.

Way Forward:

- There is a need to promote lifelong learning, reskilling and entrepreneurship development to develop a cadre of job creators. The government should start planning for digital readiness in areas such as infrastructure, human capital, policy and regulation, and finance.
- There should be a policy framework to strengthen public-private partnerships, so as to capture the benefits of the Fourth Industrial Revolution. Here the Policymakers must also account for local contexts and conditions so that they can create social, political and economic ecosystems in which technology creates jobs and drives inclusive growth.
- The policy framework for the next generation of technology and innovation should focus on creating an enabling environment for frontier technologies to positively impact the Economy, Society, and Environment; and to Reduce Inequalities.