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3D-printing

Published On: 20-08-2023

Why is in news? India's first 3D-printed post office was virtually inaugurated by Union Minister Ashwini Vaishnaw in Bengaluru's Cambridge Layout on August 18. Its construction was completed in just 43 days — two days ahead of the deadline.

Background:

Invented in the 1980s, 3D printing burst into the mainstream around the 2010s, when many thought it would take over the world.

The technology, however, at the time was expensive, slow and prone to making errors.

In recent years, some of these flaws have been done away with, making 3D printing more prevalent than ever before.

For instance, it's being used in **automotive and aerospace sectors** to make parts of cars and rockets respectively.

3D printing:

3D printing, also known as **additive manufacturing**, is a process that **uses computer-created design** to make three-dimensional objects layer by layer.

It is an additive process, in which **layers of a material like plastic, composites or bio-materials** are built up to construct objects that range in shape, size, rigidity and colour.

The most common **3D printing raw materials** are the commodity thermoplastic polymers: **Acrylonitrile butadiene styrene (ABS), Polylactic acid (PLA), Polyethylene terephthalate glycol-modified (PETG).**

How is 3D printing done?

To carry out 3D printing, one needs a personal computer connected to a 3D printer. All they need to do is design a 3D model of the required object on computer-aid design (CAD) software and press 'print'. The 3D printer does the rest of the job.

3D printers construct the desired object by using a layering method, which is the complete opposite of the subtractive manufacturing processes.

3D printers, on the other hand, build from the bottom up by piling on layer after layer until the object looks exactly like it was envisioned.

The (3D) printer acts generally the same as a traditional inkjet printer in the direct 3D printing process, where a nozzle moves back and forth while dispensing a wax or plastic-like polymer layer-by-layer, waiting for that layer to

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dry, then adding the next level.

It essentially adds hundreds or thousands of 2D prints on top of one another to make a three-dimensional object.

Notably, **these machines are capable of printing anything from ordinary objects** like a ball or a spoon **to complex moving parts** like hinges and wheels.

“You could print a whole bike – handlebars, saddle, frame, wheels, brakes, pedals and chain – ready assembled, without using any tools. It’s just a question of leaving gaps in the right places,” The Independent said in a report.

Notable examples of 3D printing:

3D printing is being used in a host of different industries like healthcare, automobile and aerospace.

In May this year, aerospace manufacturing company Relativity Space launched a **test rocket** made entirely from 3D-printed parts, measuring 100 feet tall and 7.5 feet wide. Shortly after its take off, however, it suffered a failure.

At the peak of the **Covid-19 pandemic** in 2020, the **healthcare industry used 3D printers** to make much-needed medical equipment, like swabs, face shields, and masks, as well as the parts to fix their ventilators.

Advantages of 3D Printing:

3D printing is **cheaper than traditional methods** of manufacturing.

Less Time: Printing of the 3D object can be done directly, differing from the traditional manufacturing where different components had to be joined to form the final product.

Efficiency: Generating prototypes with 3D printers is much easier and faster with 3D printing technology.

Flexibility: Different materials can be used in the 3D models. This makes it **very easy to create construction models** or prototypes for a wide variety of projects within many industries.

AM process **produces less waste** in comparison with other traditional manufacturing techniques

Issues with 3D Printing:

The **size of objects** created with 3D printers is **currently limited**

Limited Raw Materials: With 3D printing being an additive method (layer after layer), the materials available suited for it are limited- ceramics, resin, plastics, etc.

Jobs in manufacturing will be rendered obsolete which will have a **negative impact on developing economies**.

Lack of Standards: Since 3D printing is a very niche and new domain, there are **no global qualifications and certification norms**.

Hesitation in Adoption: Another challenge is to convince the industry and ministries to push for its adoption in their respective sectors as any new technology, which is not understood easily, faces a tough time.

Way Ahead:

3D Printing has **immense potential to revolutionise India’s manufacturing and industrial production** landscape through digital processes, communication, imaging, architecture, and engineering.

Therefore, it has been suggested that to get ahead in the additive manufacturing or 3D printing space, India must adopt it in all sectors, including in defence and public sectors.

An **apex body** that has subject matter experts and leaders from local and global industries **could be established** to lead the mission