

QUANTUM COMPUTERS AND INDIA

Context

- Last week, India decided to join the global efforts of research on **Quantum Computers** by setting up a **6000 crore National Mission on Quantum Technologies and Applications**.
- **Developing homegrown quantum computers** is one of the major objectives of the mission.

Background to the Genesis of the Idea of Quantum Computers

- Richard Feynman, a Nobel Prize-winning physicist, at a lecture (in 1982) at the MIT Computer Science and Artificial Intelligence Laboratory **proposed the development of different, more powerful computers by utilising the quantum mechanical properties of matter**.
- This lecture is often considered the **original idea behind quantum computers**.

How quantum computers are different from conventional computers?

- Conventional computers store and process information in **bits (0 and 1)**.
 - A two-bit system in a conventional computer can have four states; (0,0), (0,1), (1,0), and (1,1), but only one at a time.
 - To go through each of these four states, the computer has to take four steps.
- Whereas Quantum computers use quantum bits or **qubits**. The concept of superposition allows a supercomputer to **process the ones and zeroes simultaneously**.
 - Therefore, a quantum computer can process a lot more information than conventional computers.
 - **With just a few qubits quantum computers can outpace traditional computers**.
- Quantum computers are **fundamentally different in the way they handle and process information**.
 - They are meant to be **useful in some very specific situations where the traditional ways of computing are inadequate**.
- As more qubits are added, the processing capability of the quantum computer increases exponentially.
- Tasks that conventional computers would take millions of years to finish can become a matter of seconds with a quantum computer

- Such tasks are found in a variety of domains: Internet and data security, Health research, Artificial intelligence and Machine Learning, etc.

Challenges in Building a Quantum Computer

- **Requirements of very cold temperatures and extreme isolation** without which there's a significant risk of errors.
- **Error correction**, and the ability to guide the computer to produce the correct result as the most favoured option, is one of the ongoing areas of active research.
- **The parallel processing happening in superposition states** all lead to different results, only one of which is correct or desirable.
- The final outcome is randomly selected from the range of possibilities which would make quantum computer totally useless.

Conclusion

- The excitement in the scientific community about the Quantum Mission is because it allows India to join a global technology development race when it is still in the nascent stages.
- To achieve the objective, **India should partner and incentivise private sectors**; many of them, are already working on developing Quantum computers.
- By implementing **right policies, investing heavily on R&D**, India has the potential to achieve the objective of building a 1000 qubit computer.

TIMES HIGHER EDUCATION (THE) WORLD UNIVERSITY RANKINGS

Why in News?

- Three years after the IITs boycotted the THE World University Rankings over issues of “transparency”, the ranking agency made specific changes in the performance parameters this year to address their concerns.
- The Times Higher Education World University Rankings/THE Rankings are **annually** published by the UK-based Times Higher Education magazine.

Why did IITs Boycott THE Rankings?

- **The seven old IITs** (Delhi, Bombay, Madras, Kanpur, Roorkee, Kharagpur and Guwahati) had boycotted THE Rankings first in **2020**, citing concerns over
- **None of them found a place** among the world’s best 300 universities in 2019, when a relatively newer IIT (Indore) surprisingly beat its older and established counterparts by scoring high on the **citation metric**.
- **The citation metric** measures the average number of times a university’s published work is cited by scholars globally, carrying a weightage of 30% earlier.
 - One of the reasons the IITs had raised concerns over the citation metric was the **issue of collaborative research projects**.
 - The IITs had alleged that **participating institutions use collaborative research projects to bump up their score** on the citation metric.
 - An institution that is part of such a project ends up having a **disproportionate advantage over others** because such projects get **high citations due to multiple authors**.

Rank	Name Country/Region	No. of FTE Students	No. of publications per staff	International Students	Employable Ratio
1	University of Oxford United Kingdom	20,965	10.6	42%	48
2	Harvard University United States	21,887	9.6	25%	50
=3	University of Cambridge United Kingdom	20,185	11.3	39%	47
=3	Stanford University United States	16,164	7.1	24%	46

THE World University Rankings 2023:

- It includes 1,799 universities across 104 countries and regions, making them the **largest and most diverse university rankings to date**.
- It is based on 13 carefully calibrated performance indicators that measure an institution’s performance across **four areas: teaching, research, knowledge transfer and international outlook**.

MANAMADURAI POTTERY

Recently, the Manamadurai pottery from the state of Tamil Nadu earned a Geographical Indication (GI) tag.



About Manamadurai Pottery:

- Manamadurai in the Sivagangai district of **Tamil Nadu** is known

for pottery making.

How are these pots made?

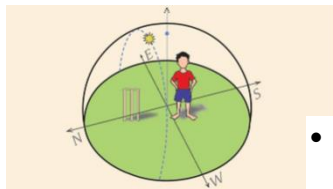
- The **Vaigai River enriches** the clay used for the Manamadurai pottery.
- Pot making requires expertise as the bottom has to be perfectly round.
- The circumference of the pot and the neck should be proportionate so that the pot sits flat on the ground.
- The right proportion of mud, clay and heating makes this product very strong.
- The main raw materials for making these pots are soil and water.
- The **sand, collected from different places** in the district, is used for making pottery and dried for two days. The particles of the mud get separated by sieving.

What is a Geographical Indication Tag?

- It is a sign used on products that have a **specific geographical origin and possess** qualities or a reputation that are due to that origin.
- This is typically used for agricultural products, foodstuffs, wine and spirit drinks, handicrafts and industrial products.
- The **Geographical Indications of Goods (Registration and Protection) Act, 1999** seeks to provide for the registration and better protection of geographical indications relating to goods in India.
- This GI tag is **valid for 10 years** following which it can be renewed.

WHAT IS ZERO SHADOW DAY?

Recently, Bengaluru experienced a ‘Zero Shadow Day’, when vertical objects appear to cast no shadow.



About Zero Shadow Day:

- **What it is?** It is a **sub-solar point** where the sun is directly overhead at a particular latitude.
- When the **sun is at the zenith** (the highest point in the sky) its rays will be hitting a particular point **exactly perpendicular to the surface**.

- This will make the shadow of a person exactly under him, making it look like there are no shadows.

When does it occur?

- There are **two zero shadow days** every year in May and July/August, observed in places that lie between the tropic of Cancer and the tropic of Capricorn.
- One falls during the **Uttarayan** (when the Sun moves northwards), and the other is during **Dakshinayan** (when the Sun moves southwards).
- It lasts for a small part of a second, but the effect can be seen for a minute to a minute-and-a-half.

TAAM JA BLUE HOLE

Recently, scientists have discovered a massive blue hole off the coast of the Yucatan Peninsula in Mexico.



About Blue Hole:

- **What it is?** It is a type of **underwater sinkhole or vertical cave** that is typically found in low-lying **coastal karst platform regions**.
- These are formed when **limestone or other carbonate rock** is dissolved by slightly acidic groundwater over a long period.
- **Features of Taam Ja Blue hole**
- It is around 900 feet deep and scientists have dubbed it the **second-deepest blue hole** found on the planet.
- It has a nearly circular shape at its surface with steep sides that form a large conic structure covered by biofilms, sediments, limestone, and gypsum ledges.
- It was found in the **central portion of Chetumal Bay**, where submerged coastal karstic sinkholes locally named ‘pozaz’ have been reported.
- A series of discontinuous terraces were detected at water depths, near the eastern and north-western walls of the blue hole before developing steep and almost vertical slopes.
- There is **variation in salinity and temperature** inside the blue hole.

Key facts about Yucatan Peninsula

- It is a **Northeastern projection** of Central America which is **lying between the Gulf of Mexico** to the west and north and the **Caribbean Sea** to the east.
- The peninsula is almost wholly composed of beds of coralline and porous limestone rocks.

What is Sinkhole?

- It can be formed due to **natural processes or human activity**.
- It is formed in the areas of **“karst” terrains**, where the rock below the surface of the Earth can be easily dissolved by groundwater.
- Karst terrain is created from the **dissolution of soluble rocks**, mostly limestone and dolomite and is characterised by distinctive landforms such as caves, sinkholes and springs.
- These can also be formed due to **human activity** due to broken land drains, water mains and sewerage pipes, increased rainfall etc.

EXERCISE AJEYA WARRIOR 2023

Indian Army contingent will participate in the 7th edition of the bilateral training exercise 'Ajeya Warrior 2023'.



About Exercise Ajeya Warrior 2023:

- It is a **bilateral training exercise** between the **armies of India and the UK**.
- This is the **7th edition of the exercise**.
- It **aims to improve interoperability** between the two forces while carrying out operations in accordance with UN mandates.
- The exercise will witness the **participation of an infantry company from India and a unit of equal strength from the British Army**.
- The **soldiers of both countries will practice using each other's weapons, war tactics, equipment, war strategies, and procedures for conducting combined military operations in difficult situations**.

- In addition, there will also be a number of expert academic discussions on a range of topics of common interest, such as the combined arms concept, operation logistics, sharing of joint force experience, etc.

What is an infantry company?

- It is a unit of the armed forces that consists of 100 to 250 soldiers and is led by a captain or a major.

PRADHAN MANTRI SCHOOLS FOR RISING INDIA (PM-SHRI) SCHEME

A total of 6,448 schools from 28 states and Union territories have been selected for upgradation under the Pradhan Mantri Schools for Rising India (PM-SHRI) scheme.



About Pradhan Mantri Schools for Rising India (PM-SHRI) Scheme:

- It is a Centrally Sponsored scheme announced in 2022.
- Objective: Development of more than 14500 schools across the country by strengthening selected existing schools being managed by Central Government/ State/ UT Government/ local bodies.
- The duration of the scheme is from 2022-23 to 2026-27, after which it shall be the responsibility of the States/UTs to continue to maintain the benchmarks achieved by these schools.
- Features:
 - The selected schools will act as exemplar schools showcasing all components of the National Education Policy 2020 (NEP) and offering mentorship to other schools in their vicinity.
 - The PM SHRI Schools will be developed as Green Schools, incorporating environment-friendly aspects.
 - The pedagogy adopted in these schools will be more experiential, holistic, integrated, play/toy-based (particularly in the foundational years), inquiry-driven, discovery-oriented, learner-centric, discussion-based, flexible and enjoyable.
 - The focus will be on the learning outcomes of every child in every grade.

- **Assessment** at all levels will be based on conceptual understanding and application of **knowledge** to real-life situations and will be competency-based.
- **Linkage with Sector Skill Councils and local industry** for enhancing employability and providing better employment opportunities will be explored.
- A **School Quality Assessment Framework (SQAF)** is being developed, specifying the key performance indicators to measure outcomes. Quality evaluation of these schools at regular intervals will be undertaken to ensure the desired standards.

GENOME SEQUENCING AND THE GENOME INDIA PROJECT

Why in news?

- Recently, the Department of Biotechnology (DBT) said that the exercise to sequence 10,000 **Indian human genomes** is about two-thirds complete.
- About 7,000 Indian genomes have already been sequenced of which, 3,000 are available for public access by researchers.
- This exercise is being conducted to create a database under the Centre-backed Genome India Project.

What is genome sequencing?

- **Human genome**
 - The human genome is the entire set of deoxyribonucleic acid (DNA) residing in the nucleus of every cell of each human body.
 - It carries the complete genetic information responsible for the development and functioning of the organism.
 - The DNA consists of a **double-stranded** molecule built up by four bases – adenine (A), cytosine (C), guanine (G) and thymine (T).
 - Every base on one strand pairs with a complementary base on the other strand (A with T and C with G).
 - In all, the genome is made up of approximately 3.05 billion such base pairs.
- **Genome sequencing**

- While the sequence or order of base pairs is identical in all humans, compared to another species, there are differences in the genome of every human being that makes them unique.
- The process of deciphering the order of base pairs, to decode the genetic fingerprint of a human is called genome sequencing.
- In other words, Genome sequencing is the process of determining the complete DNA sequence of an organism's genome.
- There are several methods of genome sequencing, but the most common is called next-generation sequencing (NGS).
- NGS allows for rapid, accurate, and cost-effective sequencing of large amounts of DNA.

What are the applications of genome sequencing?

- **To evaluate rare disorder**

- Genome sequencing has been used to evaluate rare disorders, preconditions for disorders, even cancer from the viewpoint of genetics, rather than as diseases of certain organs.
- Nearly 10,000 diseases — including cystic fibrosis and thalassemia — are known to be the result of a single gene malfunctioning.

- **Tool for prenatal screening**

- It has also been used as a tool for prenatal screening, to investigate whether the foetus has genetic disorders or anomalies.
- **Technology Crispr**, which relies on sequencing, may potentially allow scientists to repair disease-causing mutations in human genomes.

- **In public health**

- Sequencing has been used to read the codes of viruses.
- One of its first practical usages was in 2014, when a group of scientists sequenced samples of Ebola from infected African patients to show how genomic data of viruses could reveal hidden pathways of transmission.
- In January 2020, at the start of the Covid-19 pandemic, Chinese scientist sequenced the genome of a novel pathogen.

- Later, genome sequencing of the virus led to the development of vaccine and the creation of diagnostic PCR machines.
- To enable an effective COVID-19 pandemic response, researchers kept track of emerging variants and conducting further studies about their transmissibility, immune escape and potential to cause severe disease.
- Genomic sequencing became one of the first steps in this important process.
- India also put in place a sequencing framework. The **Indian SARS-COV-2 Genomics Consortia (INSACOG)** was tasked with scanning coronavirus samples from patients.
- **Uses at the population level**
 - Advanced analytics and AI could be applied to essential datasets created by collecting genomic profiles across the population.
 - This would allow to develop greater understanding of causative factors and potential treatments of diseases.

What is Genome India project?

- The Genome India Project is a gene mapping project sanctioned by the Department of Biotechnology.
- It was launched with the goal of creating a comprehensive database of genetic variations among the Indian population.
- The project aims to sequence the genomes of over 10,000 Indians from different regions of the country and establish a reference genome for the Indian population.