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# Information Technology and Communication

## 1 Public Domain Name Systems (DNS)

**Context:**

- **Ministry of Electronics & IT is planning to launch public domain name system (DNS) server for India to provide faster and more secure browsing experience to internet users in the country.**
- **This will ensure that the citizens' data is stored locally and also protect them from malware or phishing attacks.**

**More on News:**

- India's Public DNS, as an inherent feature, would ensure fast access, enhanced availability, secure access, maintain data privacy and data localization within India and will be one of the key components to ensure Internet Resilience.a
- The new DNS will be placed across the country to minimise outage and would be available round the clock. Users can simply use it by typing the IP number into the Internet browser.
- The Centre has also launched a new email platform for all government employees including those in states and Union Territories.
- The rollout of the public DNS is expected to be completed in the next four to six months. The NIC is currently using the public DNS within the government network.

**Domain Name Systems (DNS)**

- **It is the phonebook of the Internet.** Humans access information online through domain names.
- Web browsers interact through Internet Protocol addresses. **DNS translates domain names to IP addresses so browsers can load Internet resources.**
- Each device connected to the Internet has a unique IP address which other machines use to find the device. DNS servers eliminate the need for humans to memorize IP addresses.
- The process of DNS resolution involves converting a hostname into a computer-friendly IP address

## 2 Param-Shivaay

**Context:** Recently, Param-Shivaay, a supercomputer, was inaugurated at Indian Institute of Technology- Banaras Hindu University (IIT-BHU) under the National Supercomputing Mission.

### More on News:

- Supercomputer 'ParamShivay' with a capacity of **833 teraflop has been developed by the Center for Development of Advanced Computing (C-DAC).**
- It will include **1 peta byte secondary storage** and appropriate open source system and application software suite using 223 processor nodes, 384 GB per node DDR4 RAM, parallel file system, including CPU and GPU.

### Facts:

- India's first supercomputer called PARAM 8000 was launched in 1991.
- Pratyush (4.0 Petaflops) and Mihir (2.8 petaflops) are the other supercomputers established at Indian Institute of Tropical Meteorology (IITM), Pune and National Center for Medium Range Weather Forecast (NCMRWF), Noida respectively.

## 3 National Supercomputing Mission

**Context:** IIT-Kharagpur will receive a 1.3 petaflop high power computing facility and a data centre under the National Supercomputing Mission (NSM).

### National Supercomputing Mission:

- It envisages empowering national academic and R&D institutions spread over the country by installing a vast supercomputing grid comprising of more than 70 high-performance computing facilities.
- These supercomputers will also be **networked on the National Supercomputing grid over the National Knowledge Network (NKN).**
- The Mission also includes development of highly professional **High Performance Computing (HPC)** aware human resource for meeting challenges of development of these applications.
- The Mission is implemented and steered jointly by the **Department of Science and Technology (DST) and Department of Electronics and Information Technology (DeitY)** at an estimated cost of Rs.4500 crore over a period of seven years (2015-2022).
- The first Supercomputer ("PARAM Shivay") designed and built under Build approach of National Supercomputing Mission (NSM) by C-DAC at Indian Institute of Technology (BHU), Varanasi was dedicated to the scientific and research community of the nation in order to strengthen the research and development activities in the country.

### Centre for Development of Advanced Computing (C-DAC)

- It is the premier R&D organization of the Ministry of Electronics and Information Technology (MeitY) for carrying out R&D in IT, Electronics and associated areas.

### National Knowledge Network (NKN)

- It is a state-of-the-art Pan-India network and is a revolutionary step towards creating a knowledge society without boundaries.

## 4 Adoption of latest technology-3G, 4G, 5G

**Context:** Banks have been given directions to upgrade their Point of Sale (PoS) devices to run on 3G and 4G in the backdrop of the impending phase-out of 2G technology to which they are mated now.

### What are the latest technologies-3G,4G,5G?

- **3G:**
  - The introduction of 3G networks in 1998 ushered in faster data-transmission speeds.

- It helped us in using our cell phone in more data-demanding ways such as for video calling and mobile internet access.
- The maximum speed of 3G is estimated to be around 2 Mbps.

- **4G:**
  - The fourth generation of networking was released in 2008.
  - It supports mobile web access like 3G does and also gaming services, HD mobile TV, video conferencing, 3D TV, and other features that demand high speeds.
  - The max speed of a 4G network is 1 Gbps.
- **5G:**
  - **5G promises significantly faster data rates, higher connection density, much lower latency, and energy savings, among other improvements.**
  - The anticipated theoretical speed of 5G connections is up to 20 Gbps.
  - 5G Use Cases Lab for the Banking and Financial Sector were inaugurated at the Institute for Development and Research in Banking Technology (IDRBT).
  - The objectives of 5G Lab are- developing and demonstrating 5G use cases for banking and financial services, setting up a 5G R&D experience platform, and provide state-of-the-art experimental test bed solutions for mobile, wireless technologies, IoT and security services for BFSI.

## 5 Ramanujan Machine

**Context:** Scientists from Technion — Israel Institute of Technology has developed a concept and named it Ramanujan Machine, after the Indian mathematician.

### More on News:

- The Ramanujan 'machine' is, in reality, an algorithm. It attempts to automatically generate conjectures. Conjectures are mathematical statements which are proposed as true statements. In other words, they are mathematical statements that are, as yet, unproven.
- Typically, people provide the input and the algorithm finds the solution. For example, the user enters the 'Destination' in Google Maps and then the algorithm provides the user with the Navigation assistance.
- But, the Ramanujan Machine reverses the process. If a constant such as π is fed into the machine, it will generate a series whose value would lead towards π. Then, it is for the humans to prove that this proposed equation is correct.
- The researchers have also set up a website, **ramanujanmachine.com.** Users can suggest proofs for algorithms or propose new algorithms, which will be named after them.
- To date, the Ramanujan Machine focused on two algorithms, variants of **Meet-In-The-Middle (MITM**) algorithm and a **Gradient Descent (GD**).

### Famous works of Ramanujan

- He made substantial contributions to the analytical theory of numbers and worked on elliptic functions, continued fractions, and infinite series.
- Ramanujan was shown how to solve cubic equations in 1902 and he went on to find his own method to solve the quartic.

- He investigated the series ∑(1/n) and calculated Euler's constant to 15 decimal places.
- He began to study the Bernoulli numbers, although this was entirely his own independent discovery.
- He worked on Hyper-geometric series and investigated relations between integrals and series.
- After publication of a brilliant research paper on Bernoulli numbers in 1911 in the Journal of the Indian Mathematical Society he gained recognition for his work.
- Ramanujan worked out the Riemann series, the elliptic integrals, hypergeometric series and functional equations of the zeta function.
- Ramanujan left a number of unpublished notebooks filled with theorems that mathematicians have continued to study.

## 6 5G Debate

**Context:** The Union Communications Minister announced that the government will be holding auction for spectrum, which includes airwaves that will be used to offer 5G or fifth-generation services.

### 5th Generation:

- 5G is the next generation cellular technology that will provide faster and more reliable communication with ultra low latency.
- A government panel report points out that with 5G, the peak network data speeds are expected to be in the range of **2-20 Gigabit per second (Gbps**).
- This is in contrast to 4G link speeds in averaging **6-7 Megabit per second (Mbps**) in India as compared to 25 Mbps in advanced countries.
- South Korea and the U.S. became the first countries to commercially launch 5G services.

### Cellular Operators Association of India (COAI)

- COAI was constituted in 1995 as a registered, **non-governmental society**.
- COAI's core membership includes private cellular operators, namely - Aircel Ltd., BhartiAirtel Ltd., Idea Cellular Ltd., Reliance JioInfocomm Limited, Telenor (India) Communications Private Limited, Videocon Telecom and Vodafone India Ltd. operating across the whole country.

### Steps Taken:

- The government launched a three-year programme that started in March 2018 to advance innovation and research in 5G with a budget of ₹224 crore.
- Ericsson has also installed a 5G test bed at IIT Delhi for developing applications in the broadband and low latency areas.

## 7 Cryptocurrency

**Context:** Recently, a government panel headed by senior bureaucrat Subhash Chandra Garg placed in the public domain a draft bill calling for a complete ban on private Cryptocurrency in India.

### More on News:

- The panel recommended a fine of up to Rs. 25 crore and a jail term of up to 10 years for anyone found to be owning or handling private Cryptocurrency.
- As an alternative to private crypto currencies, the panel recommended the introduction of a single crypto currency for the whole country that is backed by the Reserve Bank of India.
- Volatility doesn't sound like a good rationale to ban crypto currencies because if crypto currencies are volatile, so are many other asset classes.
- Also, banning the consumption of a good or service doesn't really mean that people will stop consuming it.

### Cryptocurrency

- It is a digital asset designed to work as a medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets.
- Many crypto currencies are decentralized systems based on block chain technology, a distributed ledger enforced by a disparate network of computers.
- The first block chain-based crypto currency was Bitcoin, which still remains the most popular and most valuable.

## 8 Quantum Computing

**Context :** Google claims a Quantum breakthrough that could change computing.

### More on News:

- Google claims to have achieved a long-sought breakthrough called "**quantum supremacy**", which could allow new kinds of computers to do calculations at speeds that are inconceivable with today's technology.
- A quantum machine is based on a branch of physics called **quantum mechanics**, the science that governs **how matter behaves on the atomic scale.**
- Google's quantum computer took under 3 minutes for a calculation that would take a supercomputer 10,000 years.
- Google's quantum computer, named **Sycamore, used a 53-qubit processor** to generate a sequence of millions of numbers.
- In 2018, the Department of Science & Technology unveiled a programme called **Quantum-Enabled Science & Technology (QuEST)** and committed to investing ₹80 crore over the next three years to accelerate research.

### Quantum Computers vs. Traditional Computers

- **Traditional computers follow the principles of a Turing machine** and perform calculations by processing "**bits**" of information, with each bit holding **either a 1 or a 0.**
- **Quantum computing** relies on the way some objects act at the **subatomic level or when exposed to extreme cold,** like the metal chilled to nearly 460 degrees below zero.
- By harnessing this odd behavior, scientists can build a quantum bit, or "qubit". A**qubit is not always 0 or 1, but can be both** at the same time (a state called **quantum superposition**). Only at the end of the computation would you know which, but during the computation process, its exact state is **indeterminate**.
- Two qubits can hold four values at once. And as the number of qubits grows, a quantum computer becomes exponentially more powerful.

## 9 Wifi Access Network Interface (WANI)

**Context:** The Indian telecom regulator, TRAI, recently proposed setting up a Wifi Access Network Interface (WANI) architecture with the ability to delink telecom infrastructure from access services.

### More on News:

- A **single interoperable platform** that will enable the **delivery of data and WiFi services** to all Indians is the heart of India's new Digital Communications Policy (2018–2022).
- TRAI is inviting participation from companies/ entities in the country to help set up a nation-wide interoperable WiFi network in form of **Public Data Offices (PDOs)** across the country.
- The new pilot project named **Wi-Fi Access Network Interface (WANI)** will run on a **partnership model.**
- **Small entrepreneurs and shop owners can set up WiFi hotspots (or PDOs)** by acquiring bandwidth from multiple Internet Service Providers (ISPs) and **re-selling bandwidth as data to end customers at a cheaper rate**.
- The pilot project of WANI will accept any **company, proprietorship, societies, NGOs, etc.** to help set up paid public WiFi access points across the country using a shared model.

**Key words:**

- **'Public Data Offices (PDOs)'** basically have features of Public Call Offices (PCOs) but it aggregates mobile data instead of providing cheap voice calls. Small shops, bakeries, eateries, café outlets, cinema halls, museums, residential builders, are examples of Public Data Offices or PDOs.
- **'Public Data Office Aggregators (PDOAs)'** are PDOs who aggregate WiFi hotspots, bandwidth.
- **'App Providers'** are any mobile app company that can provide and manage eKYC (via mobile no. or Aadhaar) as well as digital payment providers.
- **'Hotspot providers'** are any domestic or foreign company manufacturing or providing WiFi/hotspot hardware, software services.

- These companies will be able to **purchase bandwidth from Public Data Office Aggregators (PDOAs)—a bandwidth aggregator** which aggregates spectrum from multiple ISPs and provide them to PDO owners at cheaper rates.
- In this manner, the cost of setting up WiFi infrastructure will be shared **without PDOs requiring to register for a telecom license.**
- Wifire, PayTM, Linq and C-DOT have created WANI enabled mobile apps for consumers.

## 10 Centralised Access Control System (CACS) & Training Module of e-BCAS

**Context:** In the latest development, the government has launched the Biometric enabled Centralised Access Control System (CACS) and 'e-BCAS Project Training Module', with the objective to enhance security and ease of doing business at airports.

### Centralised Access Control System (CACS) Project:

- It is aimed to digitize the employee movement process at the airports.
- It covers 43 Airports of AAI (Airports Authority of India) and 5 Joint Venture (JV) airports.

- This multi-layered security system encompasses the uniqueness of the Airport Entry Permit (AEP) users, biometric authentication in addition to PIN-based identity verification through contactless smart card technology.
- It will manage access of personnel along with RFID based automated vehicle access control system according to the region, terminal, zone, and gate access privileges.
- The cost of the card is Rs. 225, which shall be valid for three years.
- Biometric ID (Biometric enabled Centralised Access Control System having chip-embedded smart AEPs) thus issued, is non-duplicable.

### e-BCAS Project Training Module:

- It is aimed at helping more than 1.5 lac employees of various stakeholders by migrating from manual process of training to a digital platform.
- All 29 Aviation Security Training Institutes (ASTIs) have been registered as user entities and now they can make nominations for various courses online.
- Moreover, the system will also allow its users to check the approvals by BCAS, declaration of results and QR coded online certificate generation will also be done through this project only.
- This would result in making the entire training ecosystem of BCAS transparent as well as efficient.

## 11 Centre of Excellence in Blockchain Technology

**Context:** The National Informatics Centre (NIC) has set up the Centre of Excellence (CoE) in Blockchain Technology in Bengaluru, Karnataka, aiming to provide Blockchain as a service and allowing all stakeholders to benefit from shared learning, experiences and resources.

### Centre of Excellence:

- It aims to facilitate the Government Departments in building proof of concepts for use of Blockchain technology in different dimensions of governance leading to large scale deployment of some such applications.
- The CoE has developed Blockchain-based **Proof of Concepts (PoCs)** for select government use cases to understand the potential benefits provided by this emerging technology.
- It will provide world-class blockchain services to the government by identifying and sharing suitable data for the use of government departments.
- With National Informatics Centre (NIC) providing a robust and agile infrastructure, the CoE shall also provide Blockchain as a Service (BaaS) for efficient hosting of Blockchain network.
- Apart from CoE in Bengaluru, the govt is also planning to launch another CoE for blockchain technology in **Gurugram**, Haryana also.

#### National Informatics Centre (NIC)

- Established in 1976 NIC has emerged as a promoter of digital opportunities for sustainable development.
- It functions under the **Ministry of Electronics & Information Technology**.
- NIC spearheaded "Informatics-Led-Development" by implementing ICT applications in social and public administration and facilitates electronic delivery of services to the government (G2G), business (G2B), citizen (G2C) and government employee (G2E).

## 12 National Mission on Quantum Technologies & Application (NM-QTA)

**Context:** The government in its budget 2020 has announced a National Mission on Quantum Technologies & Applications (NM-QTA) with a total budget outlay of Rs 8000 Crore for a period of five years to be implemented by the Department of Science & Technology (DST).

**More on News:**

- The new mission will oversee the development of quantum technologies for communications, computing, materials development and cryptography.
- It will coordinate the work of scientists, industry leaders and government departments
- **Implementing authority:** The move will be implemented by the Department of Science & Technology (DST).
- **Focus area:** The areas of focus for the Mission will be in fundamental science, translation, technology development, human and infrastructural resource generation, innovation and start-ups to address issues concerning national priorities.

### Quantum Technology

- It is a class of technology that works by using the principles of quantum including quantum entanglement and quantum superposition.
  - **Quantum entanglement** is when two atoms are connected, or entangled, despite being separated.
  - **Quantum superposition** is the theory that sub-atomic particles exist in multiple states simultaneously.

## 13 NIC TechConclave 2020

**Context:** The second edition of the TechConclave was inaugurated in New Delhi by Union Minister of Electronics and Information Technology.

**More on News:**

- **Organised by** - National Informatics Centre (NIC)
- **Theme -** 'Technologies for NextGen Governance'
- **Aim –** To contribute immensely to the capacity building of Government officers across the country and help in delivering high-quality citizen-centric services.

### National Informatics Centre (NIC)

- It was established in 1976. It has been deeply associated with the Government for effective Governance.
- Since its inception, the NIC has been providing e-Governance & Information and Communications Technology (ICT) support to the Government

## 14 Wifi Calling

**Context:** Telecom Company BhartiAirtel has launched its voice over Wi-Fi service – 'Airtel Wi-Fi Calling', a first for India.

**More on News:**

- Wi-Fi Calling is aimed especially for areas where cellular networks are not strong.
- It uses high speed Internet connection, available via broadband, to make and receive high definition (HD) voice calls. Users don't have to pay extra for these calls as it is using a Wi-Fi network.

- This is not much different from a voice call using WhatsApp or any other over-the-top messaging platform, but here the call is from one number to another, and not using an app.
- Since these calls use stable Wi-Fi connections, call drops are not expected to be a problem. Keeping VoLTE switched on will help in seamless voice calling, but this is not essential.
- At the moment the service is limited to Delhi-NCR users with compatible devices but will be rolled out across the country in coming days.

## 15 Central Equipment Identity Register

**Context:** To allow users to protect their data, the Telecom Ministry has launched a web portal that allows users to blacklist their mobile phones once stolen or lost. The services that were launched in Maharashtra back in September 2019 will now also be operational in Delhi soon.

### More on News:

- The project is backed by the **Central Equipment Identity Register (CEIR) system**, which was undertaken by the telecom department for addressing safety and security of phones, given the country's technological strides and digital prowess.
- The launch of the portal will facilitate requests for blocking of stolen or lost mobile phones by customers, allowing services to other existing customers having mobile phones with the same International Mobile Equipment Identity (IMEI) number, sharing of traceability data with police authorities, as well as unblocking of recovered phones.
- Moreover, because of the centralised nature of the register or database, all the operators can block the particular stolen or lost device across the country even though the phone is being serviced by one particular operator.
- Users whose phone is stolen or lost can simply log in to the portal and register a complaint, along with a copy of the police report and their ID proof. Once submitted, the lost mobile phone will be blocked. In addition, the mobile can also be traced and recovered through tower signals
- However, tracing the phone depends on whether the phone is being used after it has been stolen. If someone does not use it, it cannot be traced, but it can certainly be blocked and they won't be able to sell it.
- The IMEI is the unique identity of a mobile phone device. Since the IMEI number is programmable, miscreants and criminals reprogramme the 15-digit unique number, which results in cloning of IMEI. The result is multiple phone devices, at times even hundreds of numbers, with same IMEI number.
- If such IMEI is blocked, a large number of mobile phones stand the risk of being blocked causing inconvenience to genuine customers. The software that has been developed now allows an individual phone to be blocked even if it is on a cloned IMEI number.

### Equipment Identity Register

- The **Ministry of Telecom** has been compiling a list of International Mobile Equipment Identity (IMEI), 15-digit unique serial number for mobile phones, under Equipment Identity Register (EIR) since 2017.
- It is a database where all the numbers are collected and categorised in three lists — white, grey and blacklist.
  - The white list comprises mobile phones which are permitted for use, whereas

- The grey list is composed of devices that do not conform to the standards but can be permitted to connect under supervision.
- The blacklist compiles all the IMEI numbers/mobile numbers that have been denied permission due to various reasons. These numbers are denied from having access to any mobile network, making the device redundant.

## 16 Kerala to Achieve 100% Internet Penetration

**Context:** The Kerala Fibre Optic Network project (Rs. 1,548 croreproject) aims to provide Internet to every household in the State.

### More on News:

- The project is slated for completion by December 2020, under which 20 lakh BPL household will get internet for free.
- As per the report titled **'India Internet 2019' released by the Internet And Mobile Association of India (IAMAI),** the State's Internet penetration rate is the second highest in the country i.e. 54%, next only to Delhi NCR with 69% penetration.
- **The Internet penetration rate** is defined as **number of individuals aged above 12 per 100 population who accessed the Internet in the last month.**
- However, the internet penetration rate is the lowest in Odisha (25%), Jharkhand (26%) and Bihar (28%).
- **Kerala, Tamil Nadu and Delhi have the highest proportion of female Internet users.**

## 17 Freedom on Net 2019 Report

**Context:** The report was released by an international internet watchdog, the Freedom House, the title of the report was 'The Crisis of Social Media'.

### More on News:

- Overall, 65 countries were assessed to prepare this year's report. This year's edition is the ninth report in the series.
- It provides the overall scores to countries using a 21-question in three categories. These are:
  - **Obstacles to Access** - Details infrastructural and economic barriers to access, legal and ownership control over internet service providers , and independence of regulatory bodies
  - **Limits on Content -**Analyzes legal regulations on content, technical filtering and blocking of websites, self-censorship, the vibrancy/diversity of online news media, and the use of digital tools for civic mobilization
  - **Violations of User Rights -** Tackles surveillance, privacy, and repercussions for online speech and activities, such as imprisonment, extra-legal harassment, or cyber-attacks.

### Key Highlights:

- 33 out of 65 countries showed an overall decline in internet freedom since June 2018.
- Only 16 countries showed improvements in their internet freedom status.
- **Pakistan was given a score of 26** and was declared **'not free'** in internet freedom status for the 9th consecutive year.

- **China (overall score 10)** was ranked as **the world's worst abuser of internet freedom** for the fourth consecutive year.
- **India was given an overall score of 55** in the report and the internet freedom status in the country was reported to be **'partly free'.**
- **USA had an overall score of 77.** Although its online environment was reported to be vibrant and free from state censorship, the report saw a decline in the overall internet freedom in the US for the third straight year.
- **Ethiopia recorded the biggest improvement in its internet freedom score in 2019.**
- **Iceland tops the list with an overall score of 95.** It has been given a status of world's best protector of internet freedom. The country had no civil or criminal cases registered against the users for online expression.

## 18 ICEDASH AND ATITHI

**Context:** Recently, the government unveiled two new IT initiatives, ICT ICEDASH and ATITHI.

### More on News:

- ICEDASH is **Ease of Doing Business monitoring dashboard** of the Indian Customs helping public see the daily Customs clearance times of import cargo.
- This dashboard has been developed by the **Central Board of Indirect Taxes and Customs (CBIC) in collaboration with National Informatics Centre**.
- ATITHI is **Easy to use mobile app, developed by CBIC for international travellers** to file the Customs declaration in advance.
- This will facilitate hassle-free and faster clearance by Customs at the airports and enhance the experience of international tourists and other visitors at the airports with.

## 19 EDGE COMPUTING

**Context:** According to a research, by 2025 companies will generate and process more than 75% of their data outside of traditional centralised data centres — that is, at the "edge" of the cloud.

### Edge Computing

- It enables data to be analysed, processed, and transferred at the edge of a network. Meaning, the data is analysed locally, closer to where it is stored, in real-time without latency.

### How it differs from cloud computing?

- The basic difference between edge computing and cloud computing lies in where the data processing takes place.
- In simple terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive.
- Currently, the existing Internet of Things (IoT) systems perform all of their computations in the cloud using data centres.
- Edge computing, on the other hand, manages the massive amounts of data generated by IoT devices by storing and processing data locally.

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# 2

# SPACE TECHNOLOGY & EVENTS

## 1 TESS discovers its third new planet, with longest orbit yet

NASA's **Transiting Exoplanet Survey Satellite, TESS**, has discovered a third small planet outside our solar system. The new planet, named **HD 21749b,** orbits a bright, nearby dwarf star about 53 light years away, in the **constellation Reticulum,** and appears to have **the longest orbital period of the three planets** so far identified by TESS. HD 21749b journeys around its star in a relatively leisurely 36 days, compared to the two other planets -- **Pi Mensae b**, a **"super-Earth"** with a 6.3-day orbit, and **LHS 3844b**, a rocky world that speeds around its star in just 11 hours. All three planets were discovered in the first three months of TESS observations.

## 2 Juno Mission Captures Images of Volcanic Plumes on Jupiter's Moon IO

The **Juno spacecraft** captured new images of a volcanic plume on **Jupiter's moon Io** during Juno mission's 17th flyby of the gas giant.On Dec. 21, during winter solstice, four of Juno's cameras captured images of the Jovian moon Io, the most volcanic body in our solar system. Juno Cam, the Stellar Reference Unit (SRU), the Jovian Infrared Auroral Mapper (JIRAM), and the Ultraviolet Imaging Spectrograph (UVS) observed Io for over an hour, providing a glimpse of the **moon's Polar Regions** as well as **evidence of an active eruption**.

## 3 Milky Way to collide with another Galaxy

In two billion years, the Milky Way will collide with a neighboring galaxy and this may fling our solar system into space. Researchers led by astrophysicists from **Durham University** found that the **Large Magellanic Cloud (LMC)** may hit our galaxy and this collision will be followed by one more. Another neighbour, **Andromeda**, will hit the Milky Way galaxy in eight billion years. The LMC, which has nearly twice as much dark matter than previously thought, is the Milky Way's brightest satellite galaxy. It only entered our neighbourhood about 1.5 billion years ago and is about 163,000 light years away from our galaxy. It has been predicted by the scientists that it will not impact earth.

## 4 Communication Satellite GSAT-31

**Context:** European launch services company Arianespace launched India's latest communication satellite GSAT-31 successfully from French Guiana.

**More on News:**

- GSAT-31is the country's 40th communication satellite which is configured on ISRO's enhanced 'I-2K Bus'.
- GSAT-31 separated from the launch vehicle in an elliptical Geosynchronous Transfer Orbit with a perigee – the nearest point to Earth – of 250 km and an apogee – the farthest point from Earth – of 35,850 km, inclined at an angle of 3 degrees to the equator.

**Salient Features of GSAT-31**

- Launch mass: 2535 kg
- Spacecraft power: 4.7 kW
- Payload: Ku-band transponders
- Coverage are:Indian mainland and island
- Mission life : Around 15 years

- The launch vehicle for GSAT- 31 was Ariane 5 VA-247.
- GSAT-31 derives its heritage from ISRO's earlier INSAT/GSAT satellite series.
- It is configured on ISRO's enhanced I-2K Bus, utilizing the maximum bus capabilities of this type.
- The satellite will provide continuity to operational services on some of the in-orbit satellites.
- GSAT-31 has a unique configuration of providing flexible frequency segments and flexible coverage.
- Two Ku-band beacon downlink signals are transmitted by the satellite for ground tracking purpose.
- Researchers will undertake phase-wise orbit-raising manoeuvres to place the satellite in geostationary orbit – 36,000 km above the equator – in the coming days using its on-board propulsion system.

## 5 Japan satellite off to deliver artificial meteors

A Japanese company plans to stage the world's first artificial meteor shower after a rocket carrying its technology was blasted into space. This micro satellite will be able to shoot tiny meteors like balls into the sky which contains secret chemical formula and will appear like glowing lights into the sky. This satellite is solely for entertainment purpose and contains 400 tiny glowing balls which can be unleashed to light up skies in as many as 30 space entertainment shows.

## 6 Hubble fortuitously discovers a new galaxy in the cosmic neighborhood

Astronomers using the NASA/ESA **Hubble Space Telescope** to study some of the oldest and faintest stars in the globular cluster NGC 6752 have made an unexpected finding. They discovered a dwarf galaxy in our cosmic backyard, only 30 million light-years away. The aim of their observations was to use these stars to measure the age of the globular cluster, but in the process they made an unexpected discovery. The Hubble Space Telescope is a project of international cooperation between ESA and NASA.

## 7 Atmospheric Waves Experiment

**Context:** The National Aeronautics and Space Administration has selected a new mission- Atmospheric Waves Experiment (AWE)- that will help scientists understand and ultimately, forecast the vast space weather system around the Earth.

### Atmospheric Waves Experiment

- Its objective is to study and focus on airglow, colorful bands of light in Earth's atmosphere to determine what combination of forces drive space weather in upper atmosphere.
- It will be the first such experiment to obtain global observations of important driver of space weather in dynamic region of Earth's upper atmosphere that can cause interference with radio and GPS communications.
- The mission will cost $42 million and is planned to launch in August 2022, attached to the exterior of the Earth-orbiting International Space Station (ISS).
- AWE is a Mission of Opportunity under NASA's Heliophysics Explorers Program, which conducts focused scientific research and develops instrumentation to fill the scientific gaps between the agency's larger missions.
- AWE was selected for development based on its potential science value and the feasibility of its development plans.

## 8 Wide Field Infrared Survey Telescope

**Context:** NASA has recently revealed its Wide Field Infrared Survey Telescope (WFIRST), a mission scheduled for launch in the mid-2020s.

### More on News:

- With 300-megapixel Wide Field Instrument, it will be able to map the Milky Way and other galaxies 100 times faster than the famous Hubble space telescope.
- The new telescope could find as many as 1,400 new planets outside our solar system, enabling humans to find the largest, deepest and clearest picture of the universe as well as the existence of extraterrestrial life.
- It will scan a small piece of the universe - about two square degrees - at a resolution higher than any similar mission in the past.
- The mission will build on the work of Kepler, a deep-space telescope that found more than 2,600 planets outside our solar system. The Kepler mission ended in October 2018.

**Hubble Telescope**

- It is the first major optical telescope to be placed in space.It was launched in 1990.
- Scientists have used Hubble to observe the most distant stars and galaxies as well as the planets in our solar system.
- NASA named the world's first space-based optical telescope after American astronomer Edwin P. Hubble. He confirmed an "expanding" universe, which provided the foundation for the big-bang theory.

- While the Kepler began the search by looking for planets that orbit their stars closer than the Earth is to our Sun the WFIRST will complete it by finding planets with larger orbits.
- WFIRST's has a unique combination of both a wide field of view and a high resolution therefore makes it so powerful for microlensing planet searches.
- Infrared light allows it to see through dust that lies in the plane of the Milky Way in between us and the galactic center, something optical telescopes on the ground cannot do. This gives WFIRST access to parts of the sky that are more densely packed with stars.
- To find new planets, it will use gravitational microlensing, a technique that relies on the gravity of stars and planets to bend and magnify the light coming from stars that pass behind them from the telescope's viewpoint.
- This micro-lensing effect allows a telescope to find planets orbiting stars thousands of light-years away from the Earth -- much farther than other planet-detecting techniques.

- It will spend long stretches of time continuously monitoring 100 million stars at the centre of the galaxy adding that about 100 of those not yet discovered planets could have the same or lower mass as Earth.

## 9 Auroras

**Context:** Geostorm offers Northern USA rare chance to see aurora borealis.

### More on News:

- A solar flare that erupted on March 20 and made the National Oceanic and Atmospheric Administration to issue a G2 watch, or moderate geostorm watch.
- The flare bends around the Earth's natural magnetic field, and slammed into the poles at either end of the planet, which supercharged the northern lights and pushed it deeper.

### What are Pulsating Auroras sometimes seen in news?

- Sometimes on a dark night near the poles, the sky pulses a diffuse glow of green, purple and red. Unlike the long, shimmering veils of typical auroral displays, these pulsating auroras are much dimmer and less common.
- According to NASA's THEMIS Mission and Japan's Arase satellite mission, it is the chirping waves that rhythmically pulse the particles that create the auroras.
- The magnetosphere is home to a type of plasma wave known as **whistler mode chorus.**
- These waves have characteristic rising tones reminiscent of the sounds of chirping birds and are able to efficiently disturb the electrons.
- When these waves make their appearance within the magnetosphere, some of the electrons scattered by the wave careen down into Earth's atmosphere, causing the pulsating auroras.

### Magnetosphere

- It is that area of space, around a planet, that is controlled by the planet's magnetic field.
- The shape of the Earth's magnetosphere is the direct result of being blasted by solar wind.
- A supersonic shock wave is created sunward of Earth called the **Bow Shock.**
- Most of the solar wind particles are heated and slowed at the bow shock and detour around the Earth in the **Magnetosheath.**
- The solar wind drags out the night-side magnetosphere to possibly 1000 times Earth's radius; its exact length is not known.
- This extension of the magnetosphere is known as the **Magnetotail**. The outer boundary of Earth's confined geomagnetic field is called the **Magnetopause**.
- The Earth's magnetosphere is a highly dynamic structure that responds dramatically to solar variations.

### THEMIS MISSION

- NASA's **Time History of Events and Macroscale Interactions during Substorms (THEMIS)** aims to resolve one of the oldest mysteries in space physics, namely to determine what physical process in near-Earth space initiates the violent eruptions of the aurora that occur during substorms in the Earth's magnetosphere.

- **Arase Mission/ERG**
  - ERG is a Japanese (JAXA/ISAS) STP (Solar Terrestrial Physics) minisatellite mission into geospace focused on the formation of the radiation belts associated with magnetic storms.
  - The aim is to elucidate acceleration and loss mechanisms of relativistic particles in the inner magnetosphere during space storms.

## 10 GRAPES 3 Muon Telescope

**Context:** For the first time in the world, researchers at the GRAPES-3 muon telescope facility in Ooty have measured the electrical potential, size and height of a thundercloud that passed overhead on December 1, 2014.

### More on News:

- At 1.3 gigavolts (GV), this cloud had 10 times higher potential than the previous record in a cloud.
- Clouds have negative charges along their lower side and positive charges on top and can be several kilometres thick.
- Using a computer simulation and the observed muon intensity variations, the group worked out the relationship with the electric potential of the cloud.
- Scientists calculated that the potential of the cloud they were studying was approximately 1.3 GV.
- Until now, no one has ever measured potential, size and height of a thundercloud simultaneously. That is the reason for all the excitement.

**Muons**

- **Muons and other particles are produced when cosmic rays bombard air particles surrounding the earth.**
- **The muons produced can have positive or negative charge. When a positively charged muon falls through a cloud, it loses energy.**
- **If its energy falls below 1 giga electron volt (GeV), which is the threshold of detection of the GRAPES-3 muon telescope, it goes undetected.**
- **On the contrary, a negatively charged muon gains energy when falling through the cloud and gets detected.**
- **Since there are more positive than negative muons produced in nature, the two effects don't cancel out, and a net change in intensity is detected.**

### GRAPES- 3 Experiment

- The GRAPES-3 experiment located at Ooty in India started as a collaboration of the Tata Institute of Fundamental Research, Mumbai, India and the Osaka City University, Osaka, Japan.
- GRAPES-3 (Gamma Ray Astronomy PeVEnergieS phase-3) is designed to study cosmic rays with an array of air shower detectors and a large area muon detector.
- It aims to probe acceleration of cosmic rays in the following four astrophysical settings. These include acceleration of particles to, (i) ~100 MeV in atmospheric electric fields through muons, (ii) ~10 GeV in Solar system through muons, (iii) ~1 PeV in our galaxy through nuclear composition of cosmic rays, (iv) ~100 EeV in nearby universe through measurement of diffuse $\gamma$-ray flux.
- The GRAPES-3 is located at N11.4°, E76.7°, and 2200m above mean sea level. The observations began with 217 plastic scintillators and a 560 $m^2$ area muon detector in 2000.
- The scintillators detect charged particles contained in extensive air showers produced by interaction of high energy cosmic rays in the atmosphere.

- At present the array is operating with ~400 scintillators that are spread over an area of 25,000 m². The energy threshold of muon detectors is 1 GeV.

## 11 Hayabusa 2 Mission of JAXA

### Context:

- **Japan's Hayabusa2 spacecraft will follow up last month's touchdown on a distant asteroid with another risky mission — dropping an explosive on the asteroid to make a crater and then collect underground samples for possible clues to the origin of the solar system.**
- **Hayabusa2 made history on 22 February when it successfully touched down on the boulder-strewn asteroid and collected some surface fragments.**

### More on News:

- Hayabusa2 is to drop a copper impactor the size of a baseball and weighing 2 kilograms (4.4 pounds) on the asteroid to collect samples from deeper underground where they had not been exposed to the sun or space rays.
- The new mission will require an immediate evacuation of the spacecraft to the other side of the asteroid so it won't get hit by flying shards from the blast.
- While moving away, Hayabusa2 will leave a camera to capture the outcome.
- The mission will allow JAXA scientists to analyze details of a crater to find out the history of the asteroid.
- Hayabusa2 will start descending toward the asteroid the day before to carry out the mission from its home position of 20 kilometers (12 miles) above.
- It will drop a cone-shaped piece of equipment containing explosives that will blast off a copper plate on the bottom.
- It will turn into a ball and slam into the asteroid at the speed of 2 kilometers (1.2 miles) per second.

### Hayabusa 2 Mission

- Hayabusa2 is an asteroid Hyugu sample-return mission operated by the Japanese space agency, JAXA.
- It follows on from Hayabusa mission which returned asteroid samples in 2010.
- It was launched in December 2014 and rendezvoused with near-Earth asteroid 162173Ryugu (It is a primitive carbonaceous near-Earth asteroid) in June 2018.
- It is in the process of surveying the asteroid for a year and a half, departing in December 2019, and returning to Earth in December 2020.
- Hayabusa2 carries multiple science payloads for remote sensing, sampling, and four small rovers that will investigate the asteroid surface to inform the environmental and geological context of the samples collected.

## 12 Study disproves Hawking, shows tiny black holes may not account for Dark Matter

### Context:

- **An international research team from Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, has ruled out the possibility of primordial black holes being a major constituent of Dark matter.**
- **This finding disproves a theoretical claim of Professor Stephen Hawking.**

### Dark matter

- Laws of gravity expect us to see stars closer to the centre of galaxies rotating faster than the stars on the edge. However, in most galaxies, the stars closer to the centre and the stars at the edge of the galaxies take almost same time to make one revolution.
- This implied that something invisible and enveloping the galaxies was giving an extra push to the outer stars, speeding them up. This entity, known as **`dark matter'.**
- The material is considered to be a 'matter' since it appears to have gravitational attraction, and it is 'dark' because it does not seem to interact with light (or with any part of the electromagnetic spectrum).
- Almost 85 per cent of the total mass of the Universe is composed of dark matter.
- Cosmologists have come up with various hypothesis and theories to explain the dark matter.
- Others have postulated they may be some new kind of elementary particles — **"weakly-interacting massive particles (WIMPs)", or "gravitationally-interacting massive particles (GIMPs)",** which are yet to be detected.

## 13 Nasa'sInSight Spacecraft

**Context:** NASA's Mars Lander InSight has recorded its first 'Marsquake.' It has recorded a quake of 2 or 2.5 magnitude which is hard to predict on Earth's surface.

### InSight — Studying the 'Inner Space' of Mars:

- InSight, short for **Interior Exploration using Seismic Investigations, Geodesy and Heat Transport**, is a Mars lander designed to give the Red Planet its first thorough checkup since it formed 4.5 billion years ago. **It is the first outer space robotic explorer to study in-depth the "inner space" of Mars: its crust, mantle, and core.**
- InSight also measures tectonic activity and meteorite impacts on Mars today.
- The lander uses cutting edge instruments, to delve deep beneath the surface and seek the fingerprints of the processes that formed the terrestrial planets. It does so by measuring the planet's "vital signs": its "pulse" (seismology), "temperature" (heat flow), and "reflexes" (precision tracking).
- The InSight Mars lander has two science objectives that support the Mission's science goals:
  - **Formation & Evolution:** Understand the formation and evolution of terrestrial planets through investigation of the interior structure and processes of Mars.
  - **Tectonic Activity:** Determine the present level of tectonic activity and meteorite impact rate on Mars.

## 14 Rare radioactive decay captured by dark matter detector

**Context:** Scientists have found the first direct evidence of a rare radioactive decay reaction, known as the two neutrino double electron capture.

### More on News:

- There are four fundamental forces in the Universe: gravitational force, electromagnetic force, strong forces and weak forces.
- Among these, **the weak forces act at the shortest distance** and aid in the disintegration of atomic nuclei. This happens through a process known as **beta decay.**

- One of the processes of beta decay is an **electron capture** — in which the nucleus captures an electron, in turn converting a proton in the nucleus into a neutron and emitting a neutrino.
- The disintegration of some atomic nuclei happens through a double electron capture (two electrons are captured by the nucleus instead of one) which is very slow, and hence the longer half life.

### Observations:

- The observation was made in the decay of xenon 124 nuclei, which were part of the XENON1T dark matter detector experiment, to tellurium 124.
- This detection is an important step towards knowing the constituents of dark matter.
- Researchers have theorised that dark matter could be made up of yet unfound particles known as Weakly Interacting Massive Particles (WIMP).
- Such particles will display rare radioactive reactions such as neutrino-less double beta decay, one example of which is a neutrino-less double electron capture.
- The current observation of a neutrino double electron capture is the first step towards the neutrino-less version of the reaction.

## 15 Artemis- NASA's next Moon Mission

**Context:** NASA has announced new plan to establish a permanent lunar presence and put an American on the Moon. The project is named Artemis.

### Project Artemis:

- It is $1.6 billion project of NASA to send the next man and first woman to the moon by **2024.**
- It's timing is in synchronous with the **Apollo lunar project of 1969**, the 50$^{th}$ anniversary of the culmination of which is this year.
- The astronauts going for the Artemis program will wear newly designed spacesuits, called **Exploration Extravehicular Mobility Unit, or xEMU.**
- For the Artemis program, NASA's new rocket called the Space Launch System (SLS) will send astronauts aboard the Orion spacecraft a quarter of a million miles away from Earth to the lunar orbit.
- Once astronauts dock Orion at the Gateway — which is a small spaceship in orbit around the moon — the astronauts will be able to live and work around the Moon, and from the spaceship, astronauts will take expeditions to the surface of the Moon.
- The mission is named Artemis after the twin sister of Greek god Apollo, whose name was used by NASA for the series of spacecraft that first landed Americans on the moon in 1969.

## 16 Chandrayaan-2 will carry 14 Indian payloads

**Context:** ISRO plans to launch Chandrayaan-2, the lunar lander mission which will carry 14 Indian payloads or study devices.

### Chandrayaan-2

- It will be India's second mission to the moon and is totally an indigenous mission. ISRO will send the mission on its heavy lift booster, the MkIII, from Sriharikota.
- The 3,800-kg spacecraft includes an orbiter which will circle the moon at 100 km; a five-legged lander called **Vikram(named after Vikram Sarabhai, who is widely regarded as the father of the Indian Space Programme)**; and a robotic rover, **Pragyan**, that will probe the lunar terrain around it and will be used mostly for in-situ experiments, mainly for science.

- While the orbiter will carry 8 payloads, the Vikram will have four and the Pragyan will have two payloads.
- The Orbiter and Lander modules will be interfaced mechanically and stacked together as an integrated module and accommodated inside the GSLV MK-III launch vehicle. The Rover is housed inside the Lander.
- It will launch aboard a **Geosynchronous Satellite Launch Vehicle Mark III, (GSLV -MK III) rocket**. The GSLV-Mk III is a three-stage heavy lift launch vehicle that has been designed to carry four-tonne class satellites into **Geosynchronous Transfer Orbit (GTO).**

## 17 Launch of RISAT-2B

**Context:** The RISAT-2B satellite, launched by the Indian Space Research Organisation (ISRO), adds to India's capability to observe the earth in all weathers and all conditions. It is a newest microwave Earth observation satellite.

### More on News:

- The RISAT is equipped with a sensor known as **'synthetic aperture radar'**, which takes what are known as 'radar images'.
- It is equipped with an active sensor, the synthetic aperture radar (SAR), which can sense or 'observe' Earth in a special way from space day and night, rain or cloud. This all-weather seeing feature is what makes it special for security forces and disaster relief agencies.

- **Facts:**
- **Two satellites in RISAT series have earlier been launched by ISRO. RISAT-2 was the first one to be launched, in 2009, while RISAT-1, which had got delayed, was launched only in 2012. RISAT-1 is no longer operational.**

- The SAR send out hundreds of radio signals every second towards the subject (in this case, the earth) and capture the reflected signals to create a radio image, which can then be used by computers to build a real image.
- RISAT-2B was recently launched from Sriharikota and this marked the resumption of a vital ring of Indian all-seeing radar imaging satellites after seven years.

## 18 NASA's mission to launch Dragonfly

**Context:** NASA will launch a robotic mission to Titan, the largest moon of Saturn, in 2026.

### What will the Dragonfly mission do?

- During its 2.7-year baseline mission, Dragonfly will explore diverse environments from organic dunes to the floor of an impact crater where liquid water and complex organic materials key to life once existed together for possibly tens of thousands of years.
- Its instruments will study how far prebiotic chemistry may have progressed. They also will investigate the moon's atmospheric and surface properties and its subsurface ocean and liquid reservoirs.
- Additionally, instruments will search for chemical evidence of past or extant life.
- It will first land at the equatorial "Shangri-La" dune fields, which are terrestrially similar to the linear dunes in Namibia in southern Africa and offer a diverse sampling location.

- Dragonfly will explore this region in short flights, building up to a series of longer "leapfrog" flights of up to 5 miles (8 kilometers), stopping along the way to take samples from compelling areas with diverse geography.
- It will finally reach the Selk impact crater, where there is evidence of past liquid water, organics – the complex molecules that contain carbon, combined with hydrogen, oxygen, and nitrogen – and energy, which together make up the recipe for life.
- The lander will eventually fly more than 108 miles (175 kilometers) – nearly double the distance traveled to date by all the Mars rovers combined.

## 19 Laser Interferometer Gravitational-Wave Observatory (LIGO)

**Context:** A gravitational wave observatory has been set up in India in collaboration with LIGO. This project is expected to join the international network in a first science run in 2025.

### What is LIGO?

- It is the world's largest gravitational wave observatory and a wonder of precision engineering.
- It comprises of two enormous laser interferometers located thousands of kilometres apart, each having two arms which are 4 km long.
- It exploits the physical properties of light and of space itself to detect and understand the origins of **Gravitational Waves (GW)**.

### Sources of Gravitational Waves (GW):

- Gravitational Waves are 'ripples' in space-time caused by some of the most violent and energetic processes in the Universe.
- Mergers of black holes or neutron stars, rapidly rotating neutron stars, supernova explosions and the remnants of the disturbance caused by the formation of the universe, the Big Bang itself, are the strongest sources.

### LIGO Project at a global level

- Two LIGO detectors are already operational in the U.S., at Livingston and Hanford.
- The Japanese detector, KAGRA, or Kamioka Gravitational-wave Detector, is expected to join the international network soon.

### LIGO India

- LIGO India will come up in Maharashtra, which will also have two arms of 4 km length.
- The project aims to move one Advanced LIGO detector from Hanford to India.
- This project is collaboration between the LIGO Laboratory and three lead institutions in the IndIGO consortium: Institute of Plasma Research (IPR) Gandhinagar, Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune and Raja Ramanna Centre for Advanced Technology (RRCAT), Indore.
- It is an ultra-high precision large-scale apparatus, which is expected to show a unique "temperament" determined by the local site characteristics.

## 20 Space Debris

**Context:** A majority of the debris created by India's anti-satellite testseem to have disintegrated according to the latest assessment of space debris by NASA.

### More on News:

- India **had shot down its 740-kg Microsat-R satellite on March 27** in a demonstration of its capability to destroy the space-based infrastructure of an enemy country.
- That anti-satellite test made India only the fourth country in the world to have demonstrated this capability.
- The destroyed satellite had disintegrated into several small and big pieces, and added to a large amount of debris in space, which is considered a threat to functional satellites and other space assets.
- At that time, India had said that since the test was carried out in the lower atmosphere, it did not expect to add any significant amount of space debris.

### RemoveDEBRIS Mission

- It is led by the Surrey Space Centre (SSC) at the University of Surrey, UK, and is co-funded by **the European Commission and other partners**, including prominent European space companies and institutions.
- Rather than engaging in active debris removal (ADR) of real space debris, the RemoveDEBRIS mission plan is to **test the efficacy of several ADR technologies** on mock targets in low Earth orbit.
- It showcases four methods of capturing artificial debris targets.
- The targets are two CubeSats (miniaturized satellites provided by the SSC) that are carried inside the main platform.
  - The first demonstration involves a net **that is deployed (net capture)** at the target CubeSat.
  - The second experiment sees the use of a **harpoon, which is launched at a target plate made of "representative satellite panel materials".** This is a first-of-its-kind harpoon capture in orbit.
  - The third experiment using the other CubeSat **involves vision-based navigation**. Using cameras and LiDARthe platform sends data about the debris back to the ground for processing.
  - The fourth experiment sees the RemoveDEBRIS spacecraft deploy **a large dragsail** to speed up its de-orbiting process. As it enters Earth's atmosphere, the spacecraft will burn up, leaving no debris behind.

## 21 ClearSpace-1 Mission

**Context:** The European Space Agency (ESA) is planning to launch a four-armed robot, Chaser, to clean up Earth's orbit in 2025.

### More on News:

- Chaser is to be developed by a Swiss start-up ClearSpace under ClearSpace-1 mission.
- Once launched into space, it will grab the chosen piece of space trash, one at a time, using its robotic arms and fall back towards Earth in a controlled descent.
- The target is a piece of junk called Vespa, around 800km above the Earth.
- Earth's orbit is home to more than 3,500 defunct satellites and an estimated 750,000 smaller fragments.
- All of these pieces are flying at a velocity of around 20,000km/h

- More debris could lead to more collisions - a cascade effect known as the **Kessler syndrome** which may render space eventually inoperable for important services like navigation, communications, weather forecasting etc.

## 22 Gravitational Lensing

- A gravitational lens is a distribution of matter (such as a cluster of galaxies) between a distant light source and an observer that is capable of bending the light from the source as the light travels towards the observer. This effect is known as gravitational lensing.
- The phenomenon occurs when a huge amount of matter, such as a massive galaxy or cluster of galaxies, creates a gravitational field that distorts and magnifies the light from objects behind it, but in the same line of sight.
- These large celestial objects will magnify the light from distant galaxies that are at or near the peak of star formation.

## 23 NASA Lunar Reconnaissance Orbiter (LRO)

**Context:** NASA's Lunar Reconnaissance Orbiter (LRO) helped to search India's lost moon landerVikram.

### More on News:

- Lunar Reconnaissance Orbiter (LRO)is a robotic mission that set out to map the moon's surface and, after a year of exploration, was extended with a unique set of science objectives.
- LRO entered lunar orbit on June 23, 2009 and after spacecraft commissioning, the Exploration Mission began on September 15, 2009.
- The Exploration Mission completed on September 15, 2010 when responsibility for LRO was transferred to NASA's Science Mission Directorate for a two-year Science Mission with a new set of science goals. The LRO mission has been extended to continue lunar science and exploration.

## 24 Project Miniature Sun

### Context:

- **Scientists in France are trying to create a 'miniature Sun' on Earth and India is a partner in this mega project.**
- **Dubbed as The ITER Project or The Path, costing over Euro 20 billion, it has 'Made in India' written all over it.**

### Project Miniature Sun:

- Nick named as '**miniature sun'**, **International Thermonuclear Experimental Reactor (ITER)** is the largest plasma based fusion reactor ever built.
- It is the costliest technological project of the 21st century with an estimated construction cost of $25 Billion.
- The project site is located in **Cadarache, Southern France**.

### International Thermonuclear Experimental Reactor (ITER)

- **Tokamak reactor** is a term used for the location where the nuclear fusion takes place.
- It is a **magnetic fusion** device to harness fusion energy by **mimicking the sun** and other stars.

- The term '**Thermonuclear'** indicates the **nuclear fusion reaction**.
- ITER will be two times the size of the largest fusion reactor present and the chamber volume will be 10 times the present one.
- It is worth mentioning here that the mega project is undertaken by USA, Russia, South Korea, China, Japan, European Union and India.

### India's Contribution:

- India has also provided a **Cryostat**, the **world's largest refrigerator**, weighing around 3800 tons and made with stainless steel. It is built by Larsen & Toubro
- It will cover the entire structure and keep the magnetic components at a very low temperature (less than -200°C) for maintaining the superconductivity of magnets.

- In the sun, the massive gravitational force creates the conditions for fusion.
- On earth, it is much harder to achieve:
  - Fuel must be heated to around **15 million$^{o}$C**.
  - Fuel need to be dense enough and maintained at higher temperature and pressure for fusion to take place.
  - Initially, the Tokamak cylinder is made **completely vacuum**.

## 25 K2-18b — a potentially 'habitable' planet

**Context:** Water vapour discovered on potentially 'habitable' planet. Using Hubble Space Telescope, scientists also detected the presence of hydrogen and helium in K2-18b's atmosphere.

### More on News:

- K2-18b an exoplanet that orbits around a small red dwarf star K2-18nearly 110 light-years away in the **constellation Leo.**
- K2-18b was first discovered in 2015 by NASA's now retired Kepler space telescope.
- Having a **mass that is eight times greater than Earth's,** K2-18b is also known as **Super-Earth exoplanets** with masses between those of Earth and Neptune.
- Water vapour has been detected on K2-18b a potentially 'habitable' planet by NASA and the European space agency's Hubble Space Telescope.
- K2-18b could be the only exoplanet known to have both water and temperatures in its atmosphere to sustain liquid water on a rocky surface
- K2-18b is not 'Earth 2.0' as it is significantly heavier and has a different atmospheric composition.

### What is an Exoplanet?

- Planets that orbit around other stars are called exoplanets.
- There are many methods of detecting exoplanets. Transit photometry and Doppler spectroscopy have found the most, but these methods suffer from a clear observational bias favoring the detection of planets near the star; thus, 85% of the exoplanets detected are inside the tidal locking zone.
- One way to search for exoplanets is to look for "wobbly" stars. A star that has planets doesn't orbit perfectly around its center. From far away, this off-center orbit makes the star look like its wobbling.
- The most massive planet listed on the NASA Exoplanet Archive is HR 2562 b, about 30 times the mass of Jupiter.

## 26 First all-woman space walk

- **NASA astronauts Jessica Meir and Christina Koch** made history when they ventured outside International Space Station (ISS) for first ever all women spacewalk. It was the first time in more than half a century of space exploration that two women astronauts walked in space together.

- Christina Koch had already carried out four spacewalks but it was the first such mission for Jessica Meir, who became the 15th woman to walk in space.
- They spent seven hours outside ISS replacing a failed power control unit and made their way to a location called Port 6 truss structure to replace battery charge-discharge unit (BCDU).

***Facts:***

- First woman to spacewalk-Russian Svetlana Savitskaya on 25 July 1984. She went outside USSR's Salyut 7 space station for 3 hours, 35 minutes.
- First person (in history) to spacewalk: Soviet cosmonaut Alexei Leonov.

## 27 Aditya –ISRO's Solar Mission

**Context:** Prime Minister Narendra Modi recently highlighted in Mann Ki Baat program that ISRO is planning to launch its first Sun Mission Aditya L1. It is an ambitious plan of Indian Space Research Organisation (ISRO).

### More on News:

- Aditya - L1 is the first Indian mission to study the **outermost region of the sun, called corona**.
- **Aditya-1 to Aditya L-1 Mission:** The concept of the Aditya-1 mission was to carry 400 kg of the payload called Visible Emission Line Coronagraph (VELC). Earlier, this mission was planned to launch in an 800 km low earth orbit. But, it was found that a satellite placed in a halo orbit around the Lagrangian Point 1 (L1) can give a big advantage of viewing Sun. Thus, this mission was renamed **Aditya L-1 Mission.**

### Features of Aditya L1:

- There will be six scientific payloads on this **400 kg satellite.**
- It will be placed in the **halo orbit** near the **L1 point of the Sun-Earth system**.
- The Aditya-L1 will provide observations of the Sun's photosphere (soft and solid X-rays), chromosphere (UV) and the corona (visual and NIR) along with additional experiments.
- The 20 cm coronagraph, having a field of view of corona from 1.05 R to 3.0 R, will use an off axis parabolic mirror. The payload will have three CCD detectors system with a capability of simultaneous imaging in 6374 Å, 5303 Å and in 5800 Å for continuum/broadband.

### 6 Payloads of Aditya L-1 Mission:

- **Visible Emission Line Coronagraph (VELC):** It will help to study the origin of Coronal Mass Ejection, diagnostic parameters of solar corona and its dynamics.
- **Solar Ultraviolet Imaging Telescope (SUIT):** This payload will help to find out the image of spatially resolved Solar Photosphere as well as to measure solar irradiance variations.
- **Plasma Analyser Package for Aditya (PAPA):** It has been designed to understand the energy distribution and composition of solar winds.
- **Solar Low Energy X-ray Spectrometer (SoLEXS):** It will monitor X-ray flares of Solar system to study the heating system of solar corona.
- **High Energy L1 Orbiting X-ray Spectrometer (HEL1OS):** It will help to observe the various dynamic actions happen in solar corona to provide an estimate of solar energy.
- **Magnetometer:** This payload will monitor and measure the magnitude of the nature of Interplanetary Magnetic Field in the solar system.

## 28 CARTOSAT 3

**Context:** India's PSLV C-47 launches CARTOSAT 3, 13 foreign satellites.

### More on News:

- Cartosat-3 is the third generation Earth observation satellite built by ISRO. It is one of the most advanced imaging satellites built by the organization so far. It has the capability to produce high resolution aerial images in the world.
- The features of the satellite include:
  - **Panchromatic** - captures all visible colors of light
  - **Hyperspectral** - captures light from electromagnetic spectrum
  - **Multispectral**- captures light within specific ranges of the electromagnetic spectrum.
  - **Resolution:** It has the **'sharpest eye' of civil remote sensing satellites in the world**.
  - One of Cartosat-3's cameras offers a **ground resolution of 25 cm** - it can pick up an object of a minimum of 25 cm size from a height of around 500 km.
  - Currently, a satellite owned by US private company- WorldView-3, has the best ground resolution of 31 cm.
  - **Weight:** At 1,625 kg, Cartosat-3 is unusually heavy and more than double the mass of the previous eight in its class.
  - **Inclination:** It has been placed at 97.5 degrees to the equator of the earth.
  - It has many new technologies such as a highly agile or flexible camera; high-speed data transmission, advanced computer system, etc.
- **Launch Vehicle:Polar Satellite Launch Vehicle, PSLV C-47**has launched Cartosat-3 into Sun Synchronous orbit from SatishDhawan Space Centre (SDSC) SHAR, Sriharikota.
- **PSLV-C47 is the 21st flight of PSLV in 'XL' configuration.**
- **PSLV-C47 will also carry 13 commercial nano-satellites from United States of America** as part of commercial arrangement with NewSpace India Limited (NSIL), Department of Space.

**Earth-observation satellites also include:**

- The **Resourcesat** and **RISAT** series of satellites, for example, provide images and data that are needed for land and water resources applications.
- The**Oceansat** series and the **SARAL** satellite, meanwhile, produce data on the oceans.
- The satellites like **INSAT 3D, INSAT-VRR or MeghaTropiques** study the atmosphere.

## 29 Gaganyaan Misson

**Context:** ISRO recently reported about four astronauts that have been identified for India's upcoming Gaganyaan mission. Gaganyaan is a crewed orbital spacecraft intended to send astronauts to space for a minimum of seven days by 2022, as part of the Indian Human Spaceflight Programme.

### More on News:

- The programme will make India the fourth nation in the world to launch a Human Spaceflight Mission. So far, **only the USA, Russia and China have launched human spaceflight missions.**

- ISRO has developed some critical technologies like re-entry mission capability, crew escape system, crew module configuration, thermal protection system, deceleration and floatation system, sub-systems of life support system etc. required for this programme.
- GSLV Mk-III launch vehicle, which has the necessary payload capability for this mission, will be used to launch Gaganyaan.
- The mission will aim to send a three-member crew to space for a period of five to seven days.
- The spacecraft will be placed in a low earth orbit of 300-400km.
- With the ability to hold one oxygen cylinder, the suit will allow the astronaut to breathe in space for 60 minutes.

**GSLV Mk- III**

- It is a three-stage heavy-lift launch vehicle.
- It is designed to carry 4 ton class of satellites into Geosynchronous Transfer Orbit (GTO) or about 10 tons to Low Earth Orbit (LEO).
- The powerful cryogenic stage of GSLV Mk III enables it to place heavy payloads into LEO's of 600 km altitude.
- The launcher uses two S200 solid rocket boosters to provide the huge amount of thrust required for lift off.

- The capsule will rotate around the Earth every 90 minutes, and astronauts will be able to witness sunrise and sunset.
- The three astronauts will be able to see India from space every 24 hours, while they conduct experiments on micro-gravity.
- For its return, the capsule will take 36 hours, and will land in the Arabian Sea, just off the coast of Gujarat.
- ISRO will receive assistance from the French space agency CNES, in terms of expertise various fields including space medicine, astronaut health monitoring, radiation protection and life support.

## 30 Hera Mission

**Context:** European ministers in charge of the ESA space agency have approved Hera, a mission that will test whether deflection could save humanity from a rogue asteroid.

### More on News:

- Scientists are studying asteroids and trying to find ways to deflect them from a collision course with Earth.
- One such project is the **Asteroid Impact and Deflection Assessment (AIDA),** which includes **NASA's Double Asteroid Redirection Test (DART) mission** and the **European Space Agency's (ESA) Hera.**
- The ***Double Asteroid Redirection Test, or DART,*** is a spacecraft designed to determine whether an asteroid can be redirected with a high-speed collision. ***DART would be NASA's first mission to demonstrate what's known as the kinetic impactor technique –*** striking the asteroid to shift its orbit – to defend against a potential future asteroid impact.
- **ESA and partner NASA** will send a pair of spacecraft to a **double-asteroid system called Didymos.**
- NASA will first crash its **DART probe into the smaller asteroid (Didymoon).** Hera will arrive later to map the impact crater and measure the asteroid's mass.
- The moon orbiting Didymos, called 'Didymoon' — almost the size of the Giza Pyramid in Egypt, measuring just 160 metres in diametre — will be the smallest asteroid ever explored.
- Hera will carry two CubeSats that can fly extremely close to the asteroid's surface before touching down.

- Those briefcase-sized spacecraft will act like drones, capturing vital data about the impact crater and giving scientists data including the mass of the asteroid that will help them deduce its composition.

## 31 Accretion Burst Event

### Context:

- **In a latest development, astronomers have found that the funneling of matter into a forming star happens at different rates over time. Sometimes the forming star swallows up a huge amount of matter, resulting in a burst of activities in the massive star. This is called an accretion burst event.**
- **The first detection of an accretion burst was in 2016.**

### Key-highlights of the findings:

- The international group of scientists, for the first time in history has been able to trace by masers and examine the subluminal propagation of a thermal radiation 'heatwave' emanating from an accreting high-mass protostar of the high-mass protostar **G358-MM1**.
- The object is eight times the mass of the sun; located at a distance of about 22,000 light years from Earth.

**Maser Monitoring Organisation**

- Established in 2017, it is an international collaboration of scientists dedicated to detecting masers to learn more about the birth of massive stars, among other cosmic phenomena.

- High-mass stars radically rebuild their surroundings and thus redetermine the structure and evolution of galaxies. One of the modern hypotheses is that high-mass protostars grow due to episodic accretion (an increase in mass due to the influx of matter from the surrounding objects).
- Large fragments of the surrounding matter fall on the star, dying in bright flashes.

### What is Maser?

- A maser (microwave amplification by stimulated emission of radiation) is the microwave (radio frequency) equivalent of laser.
- Masers are observed using radio telescopes and most of them are observed at centimetre wavelength. They are very compact.
- A maser flare can be a sign of an extraordinary event such as the formation of a star.
- Since 2017 radio telescopes in Japan, Poland, Italy, China, Russia, Australia, New Zealand and South Africa (HartRAO, in the country's Gauteng province) have been working together to detect a flare stimulated by a burst in the funnelling of materials into a massive star.

## 32 NASA's Artemis mission, and the Indian American in its new astronaut cohort

**Context:** Indian American Raja Chari is among 11 new astronauts who joined NASA's ranks, taking the strength of the active astronaut's corps in the United States space agency to 48.

### More on News:

- This cohort of new astronauts may be assigned to space missions to the International Space Station (ISS), the Moon and ultimately, Mars.

- The agency has targeted the human exploration of Mars by the 2030s.
- Raja Chari was selected by NASA to join the 2017 Astronaut Candidate Class.

## 33 Goldilocks Zone

**Context:** NASA has reported the discovery of an Earth-size planet, named TOI 700 d, orbiting its star in the "goldilocks zone".

### More on News:

- TOI 700 d measures **20% larger than Earth.** It orbits its star once every 37 days and receives an amount of energy that is equivalent to 86% of the energy that the Sun provides to Earth.
- The star, TOI 700, is an "M dwarf" located just over 100 light-years away in the southern constellation Dorado, is roughly 40% of our Sun's mass and size, and has about half its surface temperature.
- TOI 700 d is the outermost planet, and the only one in the star's habitable zone.
- The newest such planet was found by NASA's Transiting Exoplanet Survey Satellite (TESS) mission, which it launched in 2018.
- The find was confirmed by the Spitzer Space Telescope, which sharpened the measurements that TESS had made, such as orbital period and size.

- **Goldilocks Zone**
- **It is a habitable zone around a star where it is not too hot and not too cold for liquid water to exist on the surface of surrounding planets.**

**Transiting Exoplanet Survey Satellite (TESS) Mission**

- It is a space telescope for NASA's Explorers program, designed to search for exoplanets using the transit method in an area 400 times larger than that covered by the Kepler mission.
- TESS launched on April 18, 2018, on a SpaceX Falcon 9 rocket.

## 34 NASA's Spitzer Space Telescope

**Context:** NASA is ending its Spitzer Space Telescope mission, which observed the universe in infrared for 16 years.

### More on News:

- The **Spitzer Space Telescope (SST),** formerly known as'Space Infrared Telescope Facility' (SIRTF), is an **infrared space telescope.**
  - It was launched in 2003.
  - It retired on 30 January 2020.
- **Mission plan:**The planned mission period was to be 2.5 years, with an extendable period depending upon exhaustion of **on-board liquid helium supply.**
- Spitzer was launched from **Cape Canaveral SLC-17B aboard a Delta II 7920H rocket**.
- NASA is shutting down SIRTF; which was its long-lasting space observatories.

**NASA observatories**

- Spitzer is one of four space telescopes operated by NASA known as the Great Observatories.
  - Compton Gamma Ray Observatory
  - Chandra X-ray Observatory
  - Hubble Space Telescope.
  - Spitzer Space Telescope

- The telescope had been wandering through space for nearly two decades.
- NASA has run out of money to fund the spacecraft.
- In 2018 it had cost roughly $12 million to operate the telescope.
- In 2017, NASA made an unsuccessful attempt to search for private organizations to take over Spitzer.

- **James Webb Space Telescope:**
  - Designed to study the Universe in infrared, the James Webb will be the most powerful space telescope ever made.
  - It will be able see back in time to the beginning of the Universe.

- **Infrared Science Archive (IRSA):**All Spitzer data, from both the primary and warm phases, are archived at the Infrared Science Archive (IRSA).

## 35 VOYAGER 2

**Context:** In an incredible feat of remote engineering, NASA has fixed one of the most intrepid explorers in human history. Voyager 2, currently some 11.5 billion miles from Earth, is back online and resuming its mission to collect scientific data on the solar system and the interstellar space beyond.

### What is Voyager 2?

- NASA's Voyager 2 is the second spacecraft to enter interstellar space. It is sister craft to Voyager 1.
- Both were launched a few weeks apart in 1977 to perform an unprecedented "grand tour" of the outer solar system.
- Both spacecraft conducted flybys of Jupiter and Saturn, revealing a great deal about the solar system's two biggest planets.
  - Closest approach to Jupiter occurred on March 5, 1979, for Voyager 1; July 9, 1979
  - Closest approach to Saturn occurred on November 12, 1980, for Voyager 1; August 25, 1981
- **Voyager 2 then zoomed past Uranus in 1986 and Neptune in 1989; the probe remains the only craft to have gotten up-close looks at either of these "ice giants."**
- **Voyager 1 and Voyager 2 are currently about 13.8 billion miles (22.2 billion kilometres) and 11.5 billion miles (13.5 billion km) from Earth, respectively.**
- **Voyager 2 is the furthest away object made by humans: 11.5 billion miles from Earth. Not even light can travel such a distance instantaneously as it does on our planet.**
- **It takes more than 17 hours for light to travel from Earth to Voyager 2.**

## 36 Betelgeuse Supernova

**Context:** Betelgeuse, the red supergiant star that marks the armpit of Orion the Hunter, has been dramatically and mysteriously dimming for the last six months.

### More on News:

- Betelgeuse is a red supergiant star, located an estimated 642 light-years away.
- **Location:** It's usually the **11$^{th}$ brightest star** in the sky, taking its position as the right shoulder of Orion. But in the last few months, it's dimmed down to 38% of its usual brightness, now the **24$^{th}$ brightest star** in the sky.

- **Variable star:** Variations are normal for Betelgeuse, and it's known to get dimmer and brighter. It's literally growing and shrinking as the internal temperatures rise and fall pushing the star in and out like a beating heart.
- **Convective cells:** It has **enormous convective cells** on its surface that boil creating brighter and dimmer regions, and it's constantly blowing out dust that can obscure our view for a time.

### What is the Very Large Telescope array (VLT)?

- The **Very Large Telescope array (VLT)** is the flagship facility for **European groundbased astronomy** at the beginning of the third Millennium.
- It is the **world's most advanced optical instrument**, consisting of four Unit Telescopes with main mirrors of 8.2m diameter and four movable 1.8m diameter Auxiliary Telescopes.
- The telescopes can work together, to form a giant 'interferometer', the ESO Very Large Telescope Interferometer, allowing astronomers to see details up to 25 times finer than with the individual telescopes.
- The light beams are combined in the VLTI using a complex system of mirrors in underground tunnels where the light paths must be kept equal to distances less than 1/1000 mm over a hundred metres.
- With this kind of precision, the VLTI can reconstruct images with an angular resolution of milli arc seconds, equivalent to distinguishing the two headlights of a car at the distance of the Moon.
- The 8.2m diameter Unit Telescopes can also be used individually.

## 37 GISAT-1 MISSION

**Context:** An ISRO GSLV-II rocket will launch the GISAT-1 mission.

### More on News:

- GISAT-1 is an Indian earth observation satellite to be launched in geostationary orbit. Itis tasked with continuous observation of Indian sub-continent and quick monitoring ofnatural hazards and disaster.
- GISAT carries an imaging payload consisting of multi-spectral, multi-resolution from 50m to 1.5 km.
- It will operate in geostationary orbit above the Southern India region after beinglaunched from Sriharikota, India.

**Specification:**

- **Height:** 49.13 m/161.2 ft
- **Diameter:** 2.8 m/9.2 ft
- **Rocket:** GSLV Mk II
- **Manufacturer:** ISRO
- **Destination orbit:** Geostationary Transfer Orbit
- **Launching from:** SatishD hawan Space Center, Sriharikota

- The rocket consists of three stages and four liquid engine strap-on rocket motors thatuse UDMH and $N_2O_4$.
- **First Stage:** The solid propellant first stage uses Hydroxyl-terminated polybutadiene(HTBP) and has a burn time of around 100 seconds.
- **Second Stage:** Also used by the second stage, Unsymmetrical dimethylhydrazine(UDMH) is the fuel of choice which has been used since the 1950s by many rocketcompanies, and Nitrogen tetroxide ($N_2O_4$) is the oxidizer of choice.
- **Third Stage:** Finally, the third stage uses more familiar and frequently usedpropellants, Liquid Oxygen (LOX) as the oxidizer and Liquid Hydrogen ($LH_2$) as thefuel.
- Using all the energy from these stages combined, ISRO can launch up to 2500 kg toGeostationary Transfer Orbit (GTO).

## 38 ISRO to launch an unprecedented 10 Earth Imaging Satellites

**Context:** The country will send up an unusually large number of 10 earth observation (EO) satellites during 2020-21, according to the latest annual report of the Indian Space Research Organisation for 2019-20**.**

### 10 Earth Observation (EO) Satellites:

- **GISAT-1**: It is a Geo Imaging Satellite in Geostationary orbit with a high temporal resolution. It is primarily meant for near real-time imaging of natural resources and disaster management.
- **RISAT-2BR2**: It is a high agility X-Band Synthetic Aperture Radar-based satellite. It will provide all-weather, day/night imaging services from space.
- **OCEANSAT-3**: It will provide continuity of ocean colour data with improvements to continue and enhance operational services like potential fishery zone and primary productivity.
- **RISAT-1A and 2A:** They will provide continuity of service for RISAT-1 and RISAT-2 respectively.
- **HRSAT**: It will have a constellation of three satellites. Applications include large scale and cadastral level mapping, urban and rural planning, infrastructure development & monitoring, précising agriculture, disaster management, etc.
- **RESOURCESAT-3/3A**: The mission is envisaged to provide continuity of data service on an operational basis in the area of Land and Water resources management.
- **RESOURCESAT-3S/3SA**: These are planned to provide data services for earth resource monitoring with improved resolution and a wide swath.
- **INSAT-3DS**: It is designed for enhanced meteorological observations, monitoring of land and ocean surfaces, generating a vertical profi le of the atmosphere for weather forecasting and disaster warning.
- **Microsat-2A**: It will meet demands for cartographic applications at cadastral level, urban and rural management, coastal land use and regulation, utility mapping, development and various other GIS applications.
- **NISAR**: It is being jointly developed by NASA & ISRO. The primary mission goals are: Global coverage of the earth's biomass, cryosphere, for surface dynamics and coastal studies over a period of 3-5 years, Systematic coverage of global environment with 12 days repeat the cycle.

## 39 Mini-moon

**Context:** Astronomers at the NASA-funded Catalina Sky Survey in Arizona have observed a small object orbiting Earth, which they have dubbed as 2020 CD3 or "mini-moon" or the planet's "second moon".

### More on News:

- It's most likely a small asteroid, about the size of a car. Its diameter is about 1.9-3.5 m.
- When an **asteroid's orbit crosses Earth's orbit, it can sometimes be captured into the latter orbit**. This is what happened with 2020 CD3. It is now orbiting at a distance farther from Earth. Such an asteroid is called a **Temporarily Captured Object (TCO).**
- Unlike Earth's permanent Moon, the mini-moon is temporary and will eventually break free of Earth's orbit and go off on its own way. The orbit of such objects is unstable as they have to contend with the gravitational influence of Earth's permanent Moon as well as that of the Sun. Once caught in Earth's orbit, such objects usually remain for a few years before they break free and go into independent orbit around the Sun.

- According to the researchers, 2020 CD3 was captured into Earth's orbit over three years ago. For CSS, it is only the second such discovery. It previously discovered 2006 RH120, which orbited Earth for some time that year, before it escaped in 2007.

## 40 Indian Data Relay Satellite System (IDRSS)

**Context:** India plans for its own space-to-space tracking and communication of its space assets this year by putting up a new satellite series called Indian Data Relay Satellite System (IDRSS).

### Indian Data Relay Satellite System (IDRSS)

- A set of 2 IDRSS satellites will be placed in geostationary orbit, enabling satellite to satellite communication and transfer of data.
- It will track, send and receive real-time information from other Indian satellites, in particular those in **low-earth orbits (LEO)** which have limited coverage of earth.
- It will also be useful in monitoring launches and benefitting crew members of the Gaganyaan mission ensuring mission control throughout their travel.
- It is also significant for space docking, space station, as well as distant expeditions to moon, Mars and Venus.
- It will also reduce the dependence on the ground stations in tracking satellites.
- First satellite will be launched by 2020 end and second one by 2021.
- India will join US, China, Japan and Europe who already have such DRS systems.

## 41 Human Space Flight Centre (HSFC)

**Context:** It was inaugurated in January 2019 under Indian Space Research Organisation (ISRO) to coordinate Indian Human Spaceflight Programme (HSP) and will be responsible for the implementation of Gaganyaan project.

### More on News:

- It will be involved in all the end-to-end mission planning, development of engineering systems for crew survival in space, crew selection and training and also pursue activities for sustained human space flight missions.
- It will take support of the existing ISRO Centres to implement the first development flight of Gaganyaan under HSP.
- Currently, HSP work is split across various centres such as the Vikram Sarabhai Space Centre in Thiruvananthapuram and the U.R. Rao Satellite Centre in Bengaluru.
- Recently, ISRO has proposed a consolidated HSFC, which will be established at Challakere, Karnataka. It will help India in the long run as currently India has to pay large sums of money for training and using such facilities in foreign countries.

## 42 Ethiopia Launched its First Satellite

**Context:** Ethiopia has launched its first satellite from a space station in China.

**More on News:**

- A **Chinese Long March 4B rocket** hoisted the first **Ethiopian Remote Sensing Satellite (ETRSS-1)** aloft from the Taiyuan space base in northern China.
- The satellite was developed by the Chinese Academy of Space Technology with the help of 21 Ethiopian scientists.
- The launch makes Ethiopia the eleventh African country to have a satellite into space. **Egypt was the first in 1998.**

## 43 China-Brazil Earth Resource Satellite-4A (CBERS-4A)

**Context:** An Earth observation satellite jointly developed by China and Brazil was launched into space.

**More on News:**

- The **China-Brazil Earth Resource Satellite 4A** was launched on a Long March 4B rocket in the northern Chinese province of Shanxi.
- The satellite was the sixth developed under the China-Brazil Earth Resources Satellite (CBERS) programme that began in 1988**. The satellites are designed for Earth observation from orbit for nonmilitary use.**
- CBERS-4A is equipped with 3 optical payloads i.e. a wide-range panchromatic multispectral camera developed by China, and a wide-field imager and a multispectral camera developed by Brazil.
- It will obtain **global optical remote-sensing data** and will also support Brazilian government's to **monitor Amazon rainforest and changes in country's environment**.
- It will also be used in fields such as earth resource monitoring, agriculture, environmental protection, meteorology, surveying and mapping, and serve Brazil and more developing countries. It can also provide services for African, Latin American and Asian countries.
- The satellite was jointly developed by China Academy of Space Technology (CAST) and National Institute for Space Research (NISR) of Brazil, while the carrier rocket was developed by Shanghai Academy of Spaceflight Technology.

## 44 A second mysterious object from interstellar space may be about to fly through our solar system

**Context:** COMET 2I/BORISOV has become the second interstellar object to be identified till date to have passed through our solar system. (First was 1I/Oumuamua spotted in 2017)

**More on News:**

- Objects born in our solar system travel in elliptical orbits around the sun **while interstellar bodies follow the hyperbolic path.**

- It was confirmed that 2I/Borisov has a more hyperbolic path than any other comet which has been studied to date.
- It's between 2 and 16 kilometres in diameter. Its chemical composition is similar to the Solar System's long-period comets that originate in the distant OortCloud, rather than the short-period comets that come from closer in.
- Interstellar objects can provide unique data about the star systems of their origin, particularly about their building blocks.

## 45 NASA selects site on Asteroid Bennu for Sample Collection Mission

**Context:** NASA has selected a site on asteroid Bennu for the sample collection mission known as OSIRIS-REx. The site is designated as Nightingale.

### More on News:

- This site is located near North Pole of Asteroid Bennu. So, temperatures in the region are lower than elsewhere on the asteroid and the surface material is well-preserved.
- Its regolith or rocky surface material is dark and crater is relatively smooth and is thought to be relatively young, and the regolith is freshly exposed.
- OSIRIS-Rex mission also selected 'Osprey' as a backup sample collection site, if any significant disturbance to Nightingale's surface would make it difficult to collect a sample.

**OSIRIS-Rex**

- It stands for Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer.
- It is the third mission in NASA's New Frontiers program, which previously sent the New Horizons spacecraft zooming by Pluto and the Juno spacecraft into orbit around Jupiter.

## 46 NAVIC AS ALLIED SYSTEM OF US

**Context:** Recently, the US congress has agreed to designate India's NavIC as its allied navigational satellite system along with Galileo of European Union and QZSS of Japan. This tag is designated as part of the conference report of the National Defense Authorization Act (NDAA) 2020.

### More on News:

- Also, US designated Russia's GLONASS and Chinese Beidou as a **"non-allied system".** It means that US satellite navigation system will not co-operate or exchange data with these satellite navigation systems.
- The designation of India's NAVIC as **an "allied system"** is part of the American effort to develop a prototype program for **Multi-Global**

**Navigation Satellite System (GNSS) receiver** development.

- A Multi-GNSS receiver is the system able to calculate position, velocity and time by receiving the satellite signals broadcasted from multiple navigation satellite systems.
- It helps to achieve high position accuracy with increased number of satellites compared to GPSonly positioning.

## 47 Ultima-Thule renamed as Arrokoth

**Context:** The International Astronomical Union and Minor Planets Center, the global body for naming Kuiper Belt objects, has officially named the New Horizons Kuiper Belt Flyby Object as 'Arrokoth'.

### More on News:

- Arrokoth is one of the thousands of known small icy worlds in the Kuiper Belt, the vast "third zone" of the solar system beyond the inner terrestrial planets and the outer gas giant planets.
- Data from the newly named Arrokoth, has given clues about the formation of planets and our cosmic origins.
- It was discovered in 2014 by a New Horizons team using the powerful Hubble Space Telescope.
- NASA launched the New Horizons mission in January 2006. After crossing by Pluto in 2015, in January 2019 it flew by Arrokoth which was then provisionally named as Ultima Thule. This remains the farthest flyby ever conducted.
- Arrokoth is a Native American term meaning "sky" in the Powhatan/Algonquian language.

## 48 Dwarf Planets in Solar System

**Context:** Recently, the astronomers have suggested that Hygiea may possible be considered as a dwarf planet.

### More on News:

- Currently, there are officially five dwarf planets in our Solar System, namely, **Pluto, Eris, Makemake, Haumea and Ceres.**
- The International Astronomical Union sets four criteria for a dwarf planet, which are, it orbits around the Sun; it is not a moon; it has not cleared the neighbourhood around its orbit and lastly it has enough mass that its own gravity pulls it into a roughly spherical shape.
- Hygiea, which was considered as an asteroid till now, lies in the asteroid belt between Mars and Jupiter. Earlier it was thought that Hygiea qualifies only first three criteria.
- But now, new observations made through the European Space Organisation's SPHERE instrument at the Very Large Telescope (VLT), show that Hygiea satisfies the fourth criteria too and thus qualifies to be classified as a dwarf planet.

## 49 Geotail

**Context:** Recently Chandrayaan-2 had detected charged particles in Moon's soil during the orbiter's passage through the "geotail".

### More on News:

- **CLASS, is an instrument on Chandrayaan-**2, designed to detect signatures of elements in the Moon's soil.
- The Moon's soil can be best observed when a solar flare provides a rich source of X-rays to illuminate the surface. This happens when Moon traverses through geotail.
- Once every 29 days, the Moon traverses the geotail for about six days.

### What is geotail and how is it formed?

- The Sun emits the solar wind, which is a continuous stream of charged particles. These particles are present in the upper atmosphere of the Sun, called the Corona. Since the Earth has a magnetic field, it obstructs this solar wind plasma.
- This interaction results in the formation of a magnetic envelope around Earth called magnetosphere.
- On the Earth side facing the Sun, this magnetosphere is compressed into a region that is approximately three to four times the Earth radius.
- On the opposite side, the envelope is stretched into a long tail, which extends beyond the orbit of the Moon. It is this that is called the geotail.

## 50 GEMINI

**Context:** Recently, the Government of India has launched the Gagan Enabled Mariner's Instrument for Navigation and Information (GEMINI) device, a satellite-based advisory service for deep-sea fishermen.

### More on News:

- In an effort to achieve Blue Revolution, to enhance the country's marine resources management and utilisation, the **Meena Kumari Committee** had recommended optimum utilization of the Exclusive Economic Zone (EEZ)— sea between 22 and 370 km from the coast.
- The committee's recommendations on allowing large trawlers in this zone invited protests from several fishermen bodies, as it would negatively impact large number of small fishermen.
- However, there have been two issues in deep-sea fishing for fishermen- location of potential fishing zones and disaster forecasts.
- To overcome this difficulty, Government has developed the GEMINI device to disseminate

**GAGAN**

- It stands for **GPS Aided GEO Augmented Navigation.**
- **Developed by-** Airports Authority of India (AAI) and Indian Space Research Organization (ISRO).
- It is a system to improve the accuracy of a global navigation satellite system (GNSS) receiver by providing reference signals.
- It is the first in the world, which has been certified for approach with vertical guidance operating in the equatorial ionospheric region.

seamless and effective emergency information and communication on disaster warnings**, Potential Fishing Zones (PFZ) and Ocean States Forecasts (OSF) to fishermen**.

- It has been developed by the **Indian National Centre for Ocean Information Services (INCOIS),** an autonomous body under **the Ministry of Earth Sciences (MoES) and Airports Authority of India (AAI).**
- This device receives and transfers the data received from GAGAN satellites to a mobile through bluetooth communication.

- It consists of three geosynchronous satellites (GSAT-8, GSAT-10 and GSAT-15), and covers the entire Indian Ocean round the clock. It covers entire area from Australia to Africa.

## 51 Ionospheric Connection Explorer

**Context:** NASA has finally launched Ionospheric Connection Explorer (ICON) satellite into the orbit after a delay of nearly two years onboard Northrop Grumman Pegasus XL rocket.

### More on News:

- ICON will be placed in the thick of the Earth's ionosphere, which is a massive layer of Earth's atmosphere that overlaps with the boundary of space and will study the ionosphere.
- The satellite is equipped with various instruments which are designed for measuring winds and particles. It will also measure how dense the atmosphere is and also analyse its chemical composition.
- NASA had also launched the Gold satellite last year for studying the upper atmosphere, but the Gold mission is analysing it from a much higher region.

**Ionosphere**

- The ionosphere is a charged part of the upper atmosphere which extends several hundred miles up.
- It plays an important part in atmospheric electricity and forms the inner edge of the magnetosphere.
- It has practical importance because, among other functions, it influences radio propagation to distant places on the Earth.
- The layer faces constant change due to space weather bombarding it from the above and the weather of Earth from below.

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3

# DEFENCE TECHNOLOGY

## 1 IAF Inducts Its First Squadron Of Sukhoi-30 MKI Aircraft

**Context:** The IAF has commissioned 'Tiger Sharks' squadron. It will be based in Thanjavur, Tamil Nadu.

**More on News::**

- The squadron will consist of Sukhoi Su-30 MKI fighter jets, equipped with the supersonic BrahMos cruise missiles that have a range of over 300 km.
- This is the first time the Fourth Generation air dominance fighters have been based out of the Southern Air Command.
- The IAF has made this move with an eye on the increasing Chinese presence in the Indian Ocean Region
- The Su-30s have a range of about 1,500 km without mid-air refuelling capacity, and now come equipped with the 2.5- tonne air-launched BrahMos.

## 2 Nuclear-Capable K-4 Ballistic Missile

**Context:** India has successfully test-fired the 3,500 km strike range nuclear-capable K-4 submarine-launched ballistic missile off the coast of Andhra Pradesh.

**More on News::**

- Missile was developed by the Defence Research and Development Organisation (DRDO)
- It was deployed on the fleet of the Arihant Class nuclear submarines
- K-4 is one of the two underwater missiles that are being developed by India for its submarine force. The other one is K-15 with a range of 750 km.

## 3 Defence Innovation Hubs

**Context:** The Defence Innovation Organisation set up under iDEX has announced setting up of two Defence Innovation Hubs (DIHs) in Tamil Nadu (Coimbatore) and Maharashtra (Nashik).

### More on News::

- The Innovations for Defence Excellence (iDEX) framework of the Government envisages setting up and managing independent DIHs.
- These DIHs will serve as platforms where innovators can get information about needs and feedback from the Services directly and create solutions for India's major defence platforms.
- This structure is also geared towards attracting more innovators to work for the defence sector in India.

### What are the criteria for establishing Defence Innovation Hubs?

- The Framework to Fund Defence Innovation Hubs under iDEX prescribes the following minimum criterion for setting up Defence Innovation Hubs:
- Any Central Government recognized Incubator including but not limited to:Department of Science and Technology (DST) recognized Incubators.
- Atal Innovation Mission, NITIAayog created Atal Incubation Centers (AICs) and Established Incubation Centers (EICs).
- Ministry of MSME recognized incubators.
- Any other incubator recognized or funded through any Central government scheme.
- The incubator located in districts mentioned in the list of SME clusters hosted by the Ministry of MSME in collaboration with UNIDO.
- Incubator / Hub promoted by local industry associations.

### Innovations for Defence Excellence (iDEX):

- It was launched by the Governmentin April 2018, primarily aims at creation of an ecosystem to foster innovation and technology development in Defence and Aerospace
- It aims at engaging Industries including MSMEs, start-ups, individual innovators, R&D institutes & academia for defence technology to be made and fostered in India.
- It will provide them grants/funding and other support to carry out R&D which has good potential for future adoption for Indian defence and aerospace needs.

**Defence India Start Up Challenge:**

- Taking the iDEX initiative further, "Defence India Startup Challenge "has been launched by Ministry in partnership with Atal Innovation Mission.
- It aims at supporting Startups/MSMEs/ Innovators to create prototypes and/or commercialize products/solutions in the area of National Defence and Security.

- iDEX is funded and managed by **a 'Defence Innovation Organization (DIO)'** which has been formed as a 'not for profit' company as per Section 8 of the Companies Act 2013 for this purpose
- DIO has been created by the two founder members i.e. Defence Public Sector Undertakings (DPSUs) - HAL & BEL.
- iDEX functions as the executive arm of DIO, carrying out all the required activities while DIO will provide high level policy guidance to iDEX.

## 4 Solid Fuel Ducted Ramjet Missile System

**Context:** Defence Research and Development Organisation (DRDO) successfully flight tested the second indigenously developed 'Solid Fuel Ducted Ramjet (SFDR)' propulsion based missile system from ITR, Chandipur, Odisha.

### What is Solid Fuel Ducted Ramjet (SFDR) system?

- The SFDR propulsion is designed in such a way that it allows for an up and down throttling. This further lets the missile to amplify its speed until it reaches the terminal phase of the flight.
- The speed increases until the point when sharp turns are required to search for highly manoeuvring targets.
- The development and demonstration of SFDR propulsion system is a **joint venture of DRDO and Russia.**
- Its successful use in missiles will mark India's entry into a select club of nations that use next-generation missile technology against manoeuvring targets, compromising the effectiveness of conventional missiles.
- SFDR project was started in May 2013 with the objective of developing state-of-the-art SFDR propulsion technology, which can operate at varying altitudes and speeds.

### How is Solid Fuel Ducted Ramjet better than conventional missile systems?

- SFDR technology will exceptionally enhance endgame manoeuvrability at the terminal stage when the seeker is locked onto a target.
- Ramjets require a rocket booster, or gun launch, to achieve a flight condition where thrust is greater than drag, which for missiles is approximately Mach 2, at which point the ramjet is capable of accelerating to higher speed.
- Since the ramjet propulsion system depends only on its forward motion at supersonic speed to compress intake air, the engine flow-path components have no moving parts.
- Consequently, it has inherent simplicity, reliability, light weight, and high-speed flight capability not possible with other air-breathing engines.
- These attributes make the ramjet a good choice for propelling medium-calibre cannon ammunition at supersonic speed.
- Unlike traditional rocket motor, SFDR can throttle its engine during different phases of flight especially while approaching its target it can throttle up and able to manoeuvre and attack even rapidly manoeuvring targets.

## 5 Artillery Gun Dhanush

**Context:** Recently, Indian Army received its first batch of indigenous built Dhanush artillery Guns. It was inducted during a ceremony held at Ordnance Factory in Jabalpur, Madhya Pradesh.It is the first long-range artillery gun to be produced in India and has been billed as a success of the government's Make in India initiative.

### More on News::

- Dhanush is the first indigenous artillery gun with a **calibre of 155mm x 45mm**.
- It is the first long range artillery gun to be produced in India, having a **range of 38 km,** which is equipped with a navigation- based sighting system, on board ballistic computation and an advanced day and night direct firing system.

- It is an upgrade of the existing 155m, 39 calibre Bofors FH 77 gun.
- It is compatible with all North Atlantic Treaty Organisation (NATO) 155 mm ammunition system.
- The guns can travel in all terrains viz desert and high altitude. The self-propulsion unit allows the gun to negotiate and deploy itself in mountainous terrains with ease.

**Ordnance Factory Board**

- It works under the aegis of Ministry of Defence.
- The primary objective of the ordnance factories is achieving self-reliance in equipping the armed forces with state of the art battlefield equipment.

- It has been developed by Ordnance Factory Board (OFB), Kolkata based on requirements of Indian Army and manufactured by Jabalpur-based Gun Carriage Factory (GCF) and 81 % of its components are indigenously sourced.
- It is also referred to as **Desi Bofors** because Bofors had played a crucial role in targeting Pakistani military positions during the 1999 Kargil War, and similarly has a 155 mm calibre.

## 6 Sub-sonic cruise missile 'Nirbhay'

**Context:** Recently, the Indian Ministry of Defense (MoD) and Defense Research and Development Organization (DRDO) conducted the sixth flight test of the nuclear-capable Nirbhay (the fearless) cruise missile, from the Integrated Test Range on Abdul Kalam Island off the coast of Odisha.

### More on News::

- Nirbhay is the **India's first indigenously** designed and developed **long-range state-of-the-art cruise missile**, which can be deployed from multiple platforms.
- After the initial blast-off with a solid-propellant booster rocket engine to gain speed and altitude, Nirbhay is designed to deploy its smallish wings and tail fins in the second-stage and fly like an unmanned aircraft.

### Features:

- The missile is highly maneuverable with "loitering capabilities" to first identify and then hit the intended target with precision at 0.7 Mach at altitude as low as 100 metre and covers the designated target range in just 42 minutes and 23 seconds.
- The Nirbhay can be armed with a 200-300-kilogram warhead.

## 7 ABHYAS Drone

**Context:** Recently, DRDO successfully conducted the flight test of ABHYAS - High-speed Expendable Aerial Target (HEAT) from a test range in Odisha**.**

### More on News::

- The trial was carried out by the Defence Research and Development Organisation (DRDO) from the Integrated Test Range (ITR) at Chandipur in Balasore.

- It was tracked by various radars and electro-optic systems and proved its performance in fully autonomous waypoint navigation mode.

### ABHYAS Drone

- It is built by the **Aeronautical Development Establishment (ADE) of the Defence Research and Development Organisation (DRDO**) for the Indian Armed Forces.
- Abhyasis an evolution of an older Indian target drone, the Lakshya.
- The first experimental launch (without the main engine) of the Abhyas was held at the Chitradurga Aeronautical Test Range in June 2012.
- The configuration of ABHYAS is designed on an **in-line small gas turbine engine** and it uses **indigenously developed micro-electromechanical systems-based (MEMS) navigation system.**
- The performance of the system was as per simulations carried out and it demonstrated the capability of 'Abhyas' to meet the mission requirement for a cost-effective HEAT.
- 'Abhyas' is designed for autonomous flying with the help of an autopilot.
- A Luneburg lens in the nose cone improves the radar cross-section of the target for weapons practice. It also has an acoustic miss distance indicator (AMDI) to indicate the missed distance.

## 8 INS Vela

### Context:

- **Recently, the Indian Navy's fourth Scorpene-class submarine Vela, constructed by the Mazagon Dock Shipbuilders Ltd (MDL), was launched at the KanhojiAngre Wet Basin of MDL.**
- **The submarine was towed to the Mumbai Port Trust for separation from the pontoon after which she will undergo rigorous trials and tests, both at the harbour and at sea before delivery to the Navy.**

### Scorpene Class Submarine:

- These are diesel-electric attack submarinesjointly developed by the French company - Naval Group (formerly Direction des Constructions Navales (DCNS)) and the Spanish company - Navantia.
- These submarines can undertake multifarious tasks typically undertaken by any modern submarine which include anti-surface as well as anti-submarine warfare.
- They feature diesel propulsion and additionalAir-Independent Propulsion (AIP).
- AIP is a marine propulsion technology that allows a non-nuclear submarine to operate without access to atmospheric oxygen (by surfacing or using a snorkel).
- The system of AIP fitted in this class of submarines is a modified version of nuclear propulsion system with heat being generated by ethanol and oxygen. The combustion of the ethanol and stored oxygen, at a pressure of 60 atm, generates steam which powers a conventional turbine power plant.

### INS Vela:

- It is the fourth Scorpene class submarine being built under the project 75I by Mazagon

- The complete list of the submarines of this class are:
  - INS Kalvari - Active
  - INS Khanderi – Sea trials
  - INS Karanj – Sea trials
  - INS Vela – Sea trials
  - INS Vagir – Under construction
  - INS Vagsheer – Under construction

Dock Shipbuilders Ltd throughtransfer of technology.

- This involves appropriate technical support by the Naval Group to Mazagon Dock Shipbuilders Ltd in the field of construction, integration and tests of the submarines in India which is achieved through transfer of technical data package to MDL through information system as well as on job training to MDL's personnel on critical technologies.
- The AIP fitted in these submarines enables them to operate for more than 21 days under water, depending on variables such as speed.

## 9 Recent Achievements of DRDO

### Context:

- **Recently, Defence Research and Development Organisation (DRDO) test fired guided bomb from Sukhoi combat jet and AKASH-MK-1S missile.**
- **Parallelly, Indian Army along with Indian Navy andIndian Air Force(IAF) also test fired the aerial version of the supersonic BrahMos cruise missile from a Sukhoi jet at the Andaman and Nicobar Islands.**

### Guided bomb from Sukhoi combat jet

- **Guided bombs** are meant to precisely hit a designated target to minimize collateral damage.
- DRDO test fired an indigenously-developed **500 kg class Inertial Guided Bomb from Su-30 MKI Aircraft** from the **Pokhran test range in Rajasthan**.
- It achieved the desired range and hit the target with high precision.
- It is capable of carrying different warheads.
- The weapon being developed is similar to the **SPICE** (Smart, Precise Impact, Cost-Effective), an Israel made bomb which was used by the Indian Air Force to hit terror camps in Pakistan's Balakot on February 26, 2019.

### Supersonic BrahMos cruise missile

- A BrahMos Supersonic Cruise Missile was successfully test-fired by a Unit of Eastern Command, Indian Army from Car Nicobar Islands as part of joint training by Indian Army, Indian Navy and Indian Air Force, demonstrating high standards of Inter Service Synergy.
- The 2.5 tonne **air-to-surface missile has a range of around 300 km**.
- The BrahMos cruise **missile travels at a speed of Mach 2.8,** nearly three times that of sound.
- This missile has by now established itself as a major **'Force Multiplier'** in modern day battlefield with impeccable multi role and multi-platform launch capabilities furthering the confidence amongst Indian troops.
- The missile is a derivative of the Russian anti-ship cruise missile and it is thought to be one of the world's fastest cruise missiles currently in operational use. The missile was inducted into the Army in 2007.

### AKASH-MK-1S Missile

- DRDO has successfully test fired AKASH-MK-1S missile with a **strike range of 25 km** and capability to carry warhead of 60 kg from Odisha.
- The supersonic missile has **a range up to the altitude of 18,000 metres.**
- The missile uses **high-energy solid propellant for the booster** and **ramjet-rocket propulsion for the sustainer phase.** The missile system is said to be highly mobile.
- The medium range multi-target engagement capable missile was developed as part of the

Integrated Guided-Missile Development Programme (IGMDP) other than Nag, Agni, Trishul, and Prithvi missiles.

- AKASH MK-1S is an upgrade of existing AKASH missile with **indigenous Seeker.**
- It is **a surface to air missile** which can neutralize advanced aerial targets.
- The missile is guided by a phased array **fire control radar called 'Rajendra'** which is termed as **Battery Level Radar (BLR)** with a tracking range of about 60 km.

## 10 Hypersonic Technology DemonstratorVehicle

**Context:** Recently, India conducted a successful first test flight of the indigenously developed Hypersonic Technology Demonstrator Vehicle (HSTDV). The only other countries that possess this technology are the USA, Russia and China.

### More on News::

- The vehicle was test launched using the Agni 1 missile platform.
- In the test, a missile with the technology demonstrator vehicle mounted on it is launched.
- This test marked a landmark achievement in airborne ballistics and reusable rockets.
- A successful test could boost the development of a hypersonic cruise missile, the Brahmos II, which is currently under development with Scramjet technology.

### Features of HSTDV

- India's HSTDV was test-fired by the Defence Research and Development Organisation (DRDO) from the Integrated Test Range (ITR).
- HSTDV is an **unmanned scramjet demonstration vehicle** that can cruise up to a **speed of Mach 6** and **rise up to an altitude of 32 km in 20 seconds**
- The HSTDV cruise vehicle is mounted on a solid rocket motor, which will take it to a required altitude, and once it attains certain Mach numbers for speed, the cruise vehicle will be ejected out of the launch vehicle.

**Scram-Jet technology**

- In scram-jet technology, fuel combustion takes place in a chamber in missile at supersonic speeds while in a ram jet system, the system collects air it needs from atmosphere during flight at subsonic speeds and propellants burn in combustion chamber.

- The scramjet engine gets ignited automatically later. Besides its utility for long-range cruise missiles of the future, the dual-use technology will have multiple civilian applications too.

## 11 Maritime Information Sharing Workshop

**Context:** The Indian Navy has hosted a Maritime Information Sharing Workshop (MISW) under the aegis of the Information Fusion Centre — Indian Ocean Region (IFC-IOR) at Gurugram.

### More on News::

- Over 41 delegates from 29 countries of the IOR and beyond participated in the two-day event.
- The aim was to acquaint participants about IFC-IOR and its information sharing mechanisms and promote sharing of best practices in this field.

- The workshop was meant to enhance coordination and to improve response to the myriad security and safety challenges that IOR faces.
- Themes such as **maritime terrorism, piracy, human and drug trafficking, humanitarian assistance and disaster relief; and the legal perspective of combating** were at the core of the workshop.

### Information Fusion Centre –Indian Ocean Region

- It is an initiative of Indian Navy supported by the Government of India.
- It was launched in December 2018 for enhancing maritime safety and security in the Indian Ocean Region.
- It is collocated with **Information Management and Analysis Centre** which is jointly administered by the Indian Navy and Indian Coast Guard.
- It has so far established linkages with more than 16 countries and 13 international maritime security agencies.
- The information exchange at the IFC-IOR would be initially undertaken by virtual means, using telephone calls, faxes, emails and video conferencing over internet.
- Subsequently, to enable better interaction, quicker analysis of information and provide timely inputs, the IFC-IOR would host Liaison Officers from partner countries.
- IFC-IOR would also undertake conduct of exercises and training capsules in maritime information collation and sharing.

## 12 Duchifat 3

- Three youngsters from an Israeli school will travel to India to launch a satellite -- **Duchifat 3 -- designed and built by them aboard PSLV C-48 from ISRO's Sriharikota launch site**.
- Duchifat 3 is the third in the series of **Israeli student-made satellites**. Jointly built by Herzliya Science Center and Sha'arHanegev High School students, **the satellite is designed to serve children from across the country to "observe the Earth".**
- It is a photo satellite used for **ecological research** of Earth from space. **The size of the satellite is 10x10x30 cm (3U) and weighs 2.3 kg.** The students worked for almost two and a half years to build it. The satellite will be of **good help to agriculturists.**

## 13 Avangard Hypersonic Missile System

**Context:** Recently, Russia's first regiment of Avangard hypersonic missiles has been put into service sending shock waves around the world.

### More on News::

- **Avangard is a hypersonic glide vehicle developed by Russia**. It's designed to be carried as a**multiple independently targetable re-entry vehicle (MIRV)** payload by the UR-100UTTKh, RS-26 Rubezh and RS-28 Sarmat super-heavy ICBM.
- **Avangard can presumably reach speeds up to Mach 20** and can be used to deliver nuclear and conventional payloads.
- It's designed to sit atop an intercontinental ballistic missile(ICBM) and, once launched, it uses aerodynamic forces to sail on top of the atmosphere.
- During the annual state-of-the-nation **in March 2018**, the President of Russia, Vladimir Putin unveiled the Avangard and described the Hypersonic Missile as one of the six next-generation weapons that are under development.

- The initial research on hypersonic warheads started back in the mid-1980s at the time of the USSR or the Soviet Union which was ceased at the time of the dissolution of the Soviet Union in 1991. Later around the mid-1990s, Russia started working back on the project under the name **'Project 4202'.** Since then, Russia has made around 14 reported tests of the Avangard Hypersonic Missile**.**
- **A Hypersonic Missile means that can travel at speed of above Mach 5 (Mach 5 speed is 5 times more than the speed of sound).**

## 14 Quick Reaction Surface-to-Air Missiles (QRSAM)

**Context:** DRDO successfully test-fired its Quick Reaction Surface to Air Missile (QRSAM) system, likely to be inducted into the armed forces by 2021, from a base off Odisha coast.

### More on News::

- The missile, developed by the Defence Research and Development Organisation (DRDO) for the Indian Army, was flight-tested from the Integrated Test Range (ITR) at Chandipur
- It has been **developed to replace the 'Akash' missile defence system**, and **has 360-degree coverage.**
- The first test firing of the missile took place on 4 June 2017. This was followed by the second successful test on 3 July 2017.
- The test flights had successfully demonstrated their aerodynamics, propulsion, structural performance and high manoeuvring capabilities.

### Features

- It uses solid fuel propellant and has a **strike range of 25-30 km** with capability of hitting multiple targets.
- It is capable of hitting the low flying objects.
- The missile is an **all-weather, all-terrain surface-to-air missile** equipped with electronic counter measures against jamming by aircraft radars
- The missile can be mounted on a truck and is stored in a canister.
- The missile is equipped with a midcourse inertial navigation system with a two-way data link and a DRDO-developed terminal active seeker. The system has the capability to search and track targets while moving.
- QRSAM is a compact weapon system and is mobile. It has a fully automated Command and Control System. The missile system comprises of two four-walled radars both of which encompass **360-degree coverage**, namely, the **Active Array Battery Surveillance Radar and the Active Array Battery Multifunction Rada**r, apart from the launcher.

## 15 RISAT-2BR1

**Context:** India placed a spy satellite, RISAT-2BR1, and nine customer satellites in orbit on Polar Satellite Launch Vehicle's (PSLV) 50$^{th}$ mission.

### More on News::

- **IRISAT-2BR1** is a**synthetic-aperture radar (SAR) imaging satellite** for reconnaissance built by Indian Space Research Organisation **(ISRO).**

- It is **part of India's RISAT series of SAR imaging space crafts** and **4th satellite in the series.**
- RISAT-2BR1 was launched in December 2019 **aboard PSLV-C48** from First Launch Pad of SatishDhawan Space Centre.
- It was the **50th launch of** Polar Satellite Launch Vehicle(PSLV) and 75th launch from SatishDhawan Space Centre.
- **RISAT-2BR1 usage:** Apart from being used for **military purposes**, RISAT-2BR1 has applications in fields such as **agriculture and disaster management support.**

### Technical details

- The RISAT-2BR1 is follow on to **RISAT-2B** and has an **X-band SAR** with **unfurl-able radial rib reflector antenna** of 3.6 meter diameter.
- It can operate in different modes including **Very High Resolution imaging modes** of 1m x 0.5m resolution and 0.5m x 0.3m resolution with swath of 5 to 10 km.
- **Mass: 628 kg**
- **Orbit: 557 km** (circular) at **inclination of 37°**
- Mission life: **5 years**

### Secondary payloads

- Nine commercial **ridesharing satellites weighed 157.6 kg cumulatively.** These customer satellites included **six from United States, and one each from Japan, Italy and Israel:**
  - QPS SAR-1 "Izanagi"byiQPS.
  - Four Lemur-2 cubesats by Spire Global.
  - Duchifat-3 by Sha'arHanegev High School students built at Herzliya Science Center
  - 1HOPSAT by Hera systems for Seguritech of Mexico.
  - Tyvak-0129
  - Tyvak-0092
- The international satellites on board PSLV-C48 were for a **range of applications**:
  - The US satellites were for earth imaging, multi-mission remote sensing platform, and technology demonstration;
  - Japan's was for radar imaging earth observation;
  - Italy's for search and rescue;
  - Israel's for remote sensing.

## 16 Integrated Air Defence Weapon System (IADWS)

**Context:** The U.S. Department of State has approved the potential sale of a $1.867 billion Integrated Air Defence Weapon System (IADWS) to India.

### More on News::

- The potential sale, which is being processed via Foreign Military Sales (FMS) route, is now before U.S. Congress for consideration, with a 30-day window for Congress to raise any objections to the sale.
- India intends to use these defence articles and services to modernize its armed forces, and to expand its existing air defence architecture to counter threats posed by air attack. Further, it will also help in enhancing greater interoperability between India, the US, and other allies.

- The Integrated Air Defence Weapon System, also known as the **National Advanced Surface to Air Missile System (NASAMS)**, provides integrated air missile defence and is currently deployed around Washington, DC.
- The IADWS system includes radar, launchers, targeting, and guidance systems, advanced mediumrange air-to-air missile (AMRAAM) and Stinger missiles, and related equipment and support.
- Communications equipment, testing and training equipment and documentation and technical and logistics support are also part of the package.

## 17 India's First Integrated Air Defence Command

**Context:** Chief of Defence Staff (CDS) General Bipin Rawat announced that India's first integrated tri-services command will be set up by June.

### More on News::

- Integrated tri-services command will be headed by **a three-star Indian Air Force (IAF) officer**.
- It will have elements of Army and Air Force air defence assets under it.
- CDS is also working on the creation of **the joint Peninsula Command and a Logistics Command** apart from the theatre commands.
- A logistic support pool could be a single depot and base workshop that provides supplies and repair works to the services. This will lead to saving manpower and funds, and avoid wastage.
- CDS also emphasised upon the need of having a collegiate system of functioning.
- A collegiate system of functioning would require that all three services and the Coast Guard must be consulted and their views obtained in a time bound manner.

## 18 The Military Balance 2020

**Context:** The International Institute of Strategic Studies has released its report titled "Military Balance". The report highlights the Defence Spending all over the world. It provides an annual assessment of the military capabilities and defence economics of 171 countries worldwide.

### Key Highlights of the report

- According to the report, the **global spending rose by 4% in 2019** which is the largest growth in 10 years.
- The report highlights the **Military use of the electromagnetic spectrum.** It states that there is renewed focus on electronic warfare.
- It also highlights that the Defence race between China and US has increased alarmingly.
- Under the **Military Modernization Programme,China is developing new hard to detect Hypersonic missiles.** This has forced US to spend more towards its Defence Programmes (in 2018-19, US spent 53.4 billion USD).
- It concludes that defence spending in Europe reached levels not seen since before the financial crisis, increasing by 4.2% when compared with 2018.

## 19 World's Cheapest Gunshot locators has been named as "Parth"

**Context:** World's cheapest gunshot locators have been named as "Parth".

**More on News::**

- It has been developed by **the Army's College of Military Engineering jointly with a private firm.**
- The device costs around Rs 3 lakhs, and if inducted, would replace a similar imported item which costs around Rs 65 lakhs.
- The device can locate the exact location of a bullet from a distance of 400m and will help to locate and neutralize terrorist faster.
- The College of Military Engineering (CME) at Pune, a premier tactical & Technical training institution is the alma mater of the Corps of Engineers.
- CME is responsible for training of personnel of the Corps of Engineers besides imparting instructions in Combat Engineering, CBRN Protection, Works Services and GIS matters to the personnel of All Arms & Services.

## 20 VAJRA: Indian Coast Guard's Offshore Patrol Vessel

**Context:** VAJRA, the sixth coast guard Offshore Patrol Vessel (OPV-6) was launched in Chennai to enhance coastal security.

**More on News::**

- This OPV is to be utilized for patrolling, surveying, anti-smuggling and anti-terrorist operations.
- The vessel is expected to strengthen the Indian Coast Guard's efforts to secure the vast Indian coastline and the exclusive economic zone (EEZ).

## 21 Pranash Missile

**Context:** DRDO is developing the 200-km strike range Pranash ballistic missile which would be used for tactical missions.

**More on News::**

- It is a **surface-to-surface ballistic missile** and will be used by the Army and the Air Force for destroying enemy targets at short ranges.
- The missile would be an advanced version of **the 150-km strike range Prahar missile** developed by the DRDO .
- It will be a **non-nuclear missile** and will be propelled by a **single-stage solid propellant engine.**
- It will be one of the cheapest missiles in the world in its range category.

### Missile Technology Control Regime

- It was started in 1987 by the G-7 industrialised countries namely, USA, UK, Canada, France, Germany, Japan and Italy.
- It was started to check the proliferation of unmanned delivery systems for nuclear weapons (particularly systems that could carry a payload of 500 kg to a range of 300 km).

- The missile could be exported to friendly foreign countries as it is outside the purview of the Missile Technology Control Regime (MTCR), which places export restrictions on missiles with ranges of more than 300km.

- **It is not a legally binding treaty on the members.** It is only an informal political understanding.
- Currently, there are 35 members in the regime including India. China is not a member of the regime.

## 22 LIGHT COMBAT HELICOPTERS (LCH)

**Context:** LCH production centre was inaugurated in Bengaluru, under the Make in India initiative.

### Key Facts regarding Light Combat Helicopter (LCH)

- It is a 5.5-tonne class **multi-role combat helicopter** designed and developed by **Hindustan Aeronautical limited (HAL).**
- It is powered by two **Shakti engines** and inherits many technical features of the **Advanced Light Helicopter.**
- The features that are unique to LCH are sleek and narrow fuselage, tri-cycle crashworthy landing gear, crashworthy and self-sealing fuel tanks, armor protection and low visibility features which makes it agile and survivable.

**HAL Dhruv (Advance Light Helicopter)**

- It is a multi-role and multi-mission helicopter, intended for both military and civil operators.
- Current military operators of the HAL Dhruv are India, Bolivia, Burma, Israel, Maldives and Nepal.

- LCH has the distinction of being the first attack helicopter to land in Forward Bases at Siachen, 4,700 mts above sea level with 500kg load.

## 23 SIPRI Report on Sales of Arms Worldwide

**Context:** Stockholm International Peace Research Institute (SIPRI) has recently released a report about sales of arms worldwide.

### More on News::

- New data from SIPRI's Arms Industry Database form the basis of this report. The database, however, excludes Chinese companies due to the lack of data to make a reliable estimate.
- Sales of arms and military services by the sector's largest 100 companies (excluding those in China) totalled $420 billion in 2018, marking an increase of 4.6 per cent compared with the previous year.
- US companies dominate the Top 100 - For the first time since 2002, the top five spots in the ranking are held exclusively by arms companies based in the United States: Lockheed Martin, Boeing, Northrop Grumman, Raytheon and General Dynamics.
- Russia stands second in the ranking of the top arms producing countries, followed by the UK and France.

### India Specific Findings

- The combined sales of three public sector Indian defence companies that figure among the world's 100 top arms suppliers dropped by 6.9 per cent to stand at $5.9 billion in 2018.

- These three Indian companies are **Hindustan Aeronautics Ltd (HAL) ranked 38, the Indian Ordnance Factories ranked 56 and Bharat Electronics Ltd (BEL) ranked 62.**
- Together, they accounted **for 1.4 per cent of the arms sales of the top 100 companies**.
- The report highlighted that all three are state-owned and are almost entirely dependent on domestic demand.

## 24 Brahmos Missiles

**Context:** Recently, Defence Research & Development Organisation (DRDO), Indian Air Force (IAF) and BrahMos jointly successfully conducted two BrahMos supersonic cruise missiles tests one each from land and air platforms.

**More on News::**

- BrahMos is a joint venture India's DRDO and NPOM of Russia.
- It is a **medium-range ramjet supersonic cruise missile** capable of being launched from submarines, warships, fighter jets or land and has a strike range of nearly 300 kilometres.
- The missile is operational with the Indian Army, Navy and Air Force.
- It is often described as the **world's fastest supersonic cruise missile**. It is highly versatile thus can be fired from land, sea and air with a high rate of precision and accuracy.

## 25 Prithvi-II

**Context:** Nuclear capable surface-to-surface Prithvi-2 missile was successfully test-fired at night.

**More on News::**

- Prithvi-2 is capable of carrying 500-1,000 kg of warheads and is powered by **liquid propulsion twin engines**
- Already inducted into the armory of Indian defence forces in 2003, 'Prithvi' was the first missile to have been developed by DRDO under the Integrated Guided Missile Development Programme (IGMDP).

## 26 Spike LR missile

**Context:** Indian Army successfully test-fired two Spike LR (long-range) anti-tank missiles from an Infantry School at Mhow, in Madhya Pradesh.

**More on News::**

- Spike LR is a fourth-generation missile that has the capability of engaging with any target with **precision up to a range of 4 km.**
- It does not only have the capability to fire and forget but also **the ability to fire, observe and update**.
- It also has the ability **to switch to a different target mid-flight**, if the shooter decides to do so.
- Spike LR missiles is developed and designed by **Israel's Rafael Advanced Defense Systems**.

## 27 Night Trial of AGNI-II

**Context:** Recently, India successfully conducted the night trial of Agni-II missile for the first time.

### AGNI-II Missile

- It is **surface-to-surface medium-range nuclear capable ballistic missile**.
- It is developed by the Defence Research and Development Organisation (DRDO).
- It has already been inducted into the armed forces.
- It is **20-metre-long**, and has a **strike range of 2,000 km.**
- It has a **launch weight of 17 tonnes and can carry a payload of 1,000 kg**.
- It is a **two-stage missile equipped with advanced high accuracy navigation system**, was guided by a novel state-of-the-art command and control system and propelled by solid rocket propellant system.

## 28 LGM-30 Minuteman III

**Context:** USA has tested an unarmed Minuteman III intercontinental ballistic missile by lauching the missile from California base.

### More in news:

- The missile traveled 6,750 km across Pacific Ocean to the Kwajalein Atoll in Marshall Islands.
- This took place after North Korea tested a ballistic missile from the coast of Wonsan.
- **Minuteman III** program was started in 1966. The missile is armed with 170 kilo tons of TNT. Airborne Launch Control System is a part of the missile.
- The airborne launch system offers a survivable launch capability to the US air force.

## 29 Rafale Jet Delivered

**Context:** It aims at supporting Startups/MSMEs/Innovators to create prototypes and/or commercialize products/solutions in the area of National Defence and Security.the first batch of four jets will arrive in India only in May 2020.

### More on News::

- All 36 jets are expected to arrive in India by September 2022, for which the IAF has been reportedly undertaking preparations, including readying required infrastructure and training of pilots.
- The Dassault Rafale is a fourth generation multirole fighter aircraft that was developed through the 1990s and early 2000s by France's Dassault Aviation.

- Rafale name literally **means 'a gust of wind' and a 'burst of fire'** in a more military sense. It is a twin-engine, canard-delta wing, multi-role fighter aircraft, able to operate from both an aircraft carrier and a shore base.
- It is equipped with a wide range of weapons and is intended to perform air supremacy, interdiction, aerial reconnaissance, ground support, in-depth strike, anti-ship strike and nuclear deterrence missions.
- Rafale's trade-off between side and ventral air takes allows a beefed up fuselage and better load carrying capacity giving it a traditional edge over other contemporaries.
- It features a net-centric capability due to its open architecture and data fusion software which allows it to enter into the battle-space with a highly secure data link allowing it to exchange information with other aerial and ground assets through **"Remotely Operated Video Enhanced Receiver"** in real time, building up a coherent mode of compatibility among other assets deployed in the combat multiplying the effectiveness.
- Rafale's beefed up airframe and intakes, allow it to carry some 2.5 times its own empty weight, carrying a mix of different weapon system for both **Air-to-Air and Air-to-Ground Roles.**

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# 4

# HEALTH & BIOTECHNOLOGY

## 1 Lymphatic Filariasis

### Context :

- A pilot project to administer triple drug therapy with the long term aim of eradicating lymphatic filariasis was launched in Nagpur.
- Nagpur is one of the five districts in the country and only one in Maharashtra, where this triple drug therapy campaign is being launched.

### More on News:

- Over 40% of worldwide cases are found in India and to eradicate the disease a concerted effort is needed.
- Since 2004, two drug therapies for lymphatic filariasis have been in place but the addition of the third drug now will give boost to the overall campaign.
- The third drug used in this therapy will help control adult worms of lymphatic filariasis.

### Lymphatic filariasis

- Commonly known as elephantiasis, is a neglected tropical disease.
- Infection occurs when filarial parasites are transmitted to humans through mosquitoes.
- Infection is usually acquired in childhood causing hidden damage to the lymphatic system.

**30 January- World Neglected Tropical Diseases day**

This is the first time (**30 January2020)** World NTD Day that is being observed to increase awareness in addressing the tropical diseases.

- The painful and profoundly disfiguring visible manifestations of the disease, lymphoedema, elephantiasis and scrotal swelling occur later in life and can lead to permanent disability.
- These patients are not only physically disabled, but suffer mental, social and financial losses contributing to stigma and poverty.

## 2 Measles Rubella Vaccination

### Context:

- The New Delhi High Court stopped the implementation of the 'Measles and Rubella Vaccine Immunization Campaign' by the Delhi government. Around 70 schools in Mumbai city continue to refuse the measles vaccination.

- With a 30% increase in measles cases worldwide in 2018, the World Health Organization, in January 2019, included 'vaccine hesitancy' as one of the 10 threats to global health this year.

### More on News:

- Court's order said that 'measles vaccination cannot be administered "forcibly" and without the consent of parents,'it introduced a dimension to vaccination — **the question of consent** — that had not been adequately dealt with earlier.

### Measles-Rubella (MR) Vaccine

- It was introduced in Universal Immunization Programme in 2017, as **Measles-Rubella combination vaccine** to provide protection against congenital birth defects caused by Rubella infection for children aged between 9 months and 15 year

### Spread of Measles and Rubella in India

- According to latest Global Measles and Rubella Update, India had 56,399 confirmed measles cases and 1,066 confirmed rubella cases in 2018.
- As per WHO, measles is a leading cause of death in children, with one-third (around 56,000 in 2011) of all measles deaths worldwide happening in India.
- Rubella causes birth defects, such as irreversible deafness and blindness in nearly 40 thousand children in India every year.
- At least 220 million children from 30 states and union territories have already been vaccinated under the nationwide campaign that started in 2017.

- It is a part of global efforts to reduce illness and deaths due to measles and rubella/ Congenital Rubella Syndrome (CRS) in the country.
- **Measles is a serious and highly contagious disease** that can cause debilitating or fatal complications, including encephalitis, severe diarrhoea and dehydration, pneumonia, ear infections and permanent vision loss. The disease is preventable through two doses of vaccine.
- CRS is an important cause of severe birth defects. A woman infected with the rubella virus early in pregnancy has a 90% chance of passing the virus to her foetus. This can cause the death of the foetus, or CRS.

## 3 Zearalenone, a fungal toxin

**Context:** A Journal of Food Science study detected Zearalenonea fungal toxinin wheat, rice, corn and oats from markets in Uttar Pradesh.

### More on News:

- Zearalenone is a fungal toxin infesting cereals such as wheat, maize and barley. It attacks crops while they are growing, but can also develop when cereals are stored without being dried fully.
- **Health concern:**
  - In zearalenone's case, there is no strong evidence of toxicity in humans so far, though several research groups are investigating.
  - As a result, **the International Agency for Research on Cancer (IARC)** classifies it as a Group 3 carcinogen, which means evidence is not sufficient for an evaluation yet.
- **Regulation in India:** The Food Safety and Standards Authority of India (FSSAI) does not impose maximum limits for zearalenone, though the European Union (EU) does.
- **Recent Study:** This month, researchers from Lucknow's Indian Institute of Toxicology Research (IITR) published a study in the Journal of Food Science on presence of zearalenone in Uttar Pradesh markets.

- **Findings:**Zearalenone has been detected in wheat, rice, corn and oats from markets in Uttar Pradesh. The substance was found in 70 of the 117 samples tested. 24 of the U.P. samples exceeded the EU regulatory limits of 100-200 mcg/kg of cereals.
- **Recommendation:** India should set limits on zearalenone in cereals.
- **Significance:** While numerous studies document this toxin in cereals across the world, no data existed for India until now.

## 4 Formalin

### Context:

- Odisha's dried-fish industry is using formalin, a chemical which is considered carcinogenic and has other ill effects on humans.
- The state government has come up with new plans to take measures against the practice which will include punishing those who use formalin, awareness campaigns and introduction of new hygienic methods.

### What is Formalin and what are its uses?

- It is a **colourless flammable chemical** used in pressed wood products, fabrics, insulation materials.It is a dangerous and anti-decomposition agent.
- It is also used as fungicide, germicide, and disinfectant. In mortuaries, it is used as a preservative for bodies and organs.

### What are the effects on health?

- Short term damages for formaldehyde are watery eyes, coughing, wheezing, nausea and skin irritation.
- Formaldehyde increases risk of leukemia, blood cancer and other lymphomas.
- International Agency for Research on Cancer and US FDA both classify formaldehyde as a human carcinogen.
- Exposure to it causes irritation to mucous membrane like throat, respiratory tract causing sore throats, bronchitis and pneumonia.
- It can also cause allergic reaction.
- Formalin causes kidney and liver problems.

**Why is fish laced with formalin?**

- Fish is a highly perishable commodity. If it isn't maintained at the proper temperature of 5 degree Celsius, it gets spoilt. To avoid that and increase its shelf life, the sellers now use chemicals such as formalin and ammonia.
- If the point of sale is far from the place of catch, formalin is used as a preservative. Meanwhile, ammonia is mixed with the water that is frozen to keep fish fresh.

## 5 Oxytocin

**Context :** The central government moved Supreme Court against the Delhi high court order which quashed the ban on sale of Oxytocin by private manufacturers and retail chemists.

### More on News:

- Last year government has banned oxytocin's private manufacture and sale stating its indiscriminate use in milch cattle has affected the health of cattle and humans as well.

- The Delhi high court recently had quashed the Centre's December 14, 2018 notification, which had banned its sale by private manufacturers and retail chemists, saying the sale was allowed.
- Oxytocin has been moved to the **H1 category**, which means retailers must maintain record of sales.
- It also figures in **the National List of Essential Medicines.**

### What is Oxytocin and what are its uses?

- Oxytocin is **naturally secreted by the pituitary glands of mammals** during sex, childbirth, lactation or social bonding, and is sometimes called **"love hormone".**
- It is used as a drug during childbirth because it can contract the uterus and induce delivery, control bleeding, and promote the release of breast milk.
- Oxytocin can be administered to humans as an injection or a nasal solution.
- It is chemically synthesised and sold by pharmaceutical companies across the world.

**Key Facts:**

- **Scheduled Drugs:** Drugs and Cosmetics Act differentiates prescription drugs, narcotic and psychotropic substances, over the counter drugs and medical devices, with a view to promote safety in public health.
- **Schedule H Drugs:** Only the required amount of medications mentioned in the prescription can be dispensed. These drugs can be supplied only to the licensed parties. The drug label must exhibit the text "Rx" and Schedule H drug warning. To be sold by retails on the prescription of a registered medical practioneronly.
- **Schedule H1 Drugs:** These include 3rd& 4th generation antibiotics, anti-tuberculosis drugs and certain habit-forming drugs like psychotropic drugs.
- **Schedule X drugs:** That stipulates prescription in duplicate, separate license requirement and meticulous storage and dispensing records.

## 6 Global Influenza Strategy for 2019-2030

**Context:** The World Health Organization has launched a strategy to protect people worldwide over the next decade against the threat of influenza.

### Global Influenza Strategy for 2019-2030

- It aims at protecting people in all countries from the threat of influenza. The goal of the strategy is to prevent seasonal influenza, control the spread of influenza from animals to humans, and prepare for the next influenza pandemic.
- The new strategy outlines a path to protect populations every year and helps prepare for a pandemic through strengthening routine programmes.
- It has two overarching goals:
  - Build stronger country capacities for disease surveillance and response, prevention and control, and preparedness. To achieve this, it calls for every country to have a tailored influenza programme that contributes to national and global preparedness and health security.

**Influenza**

- Influenza, commonly known as the flu, is an infectious disease caused by an influenza virus. Symptoms can be mild to severe.
- Three of the four types of influenza viruses affect humans: Type A, Type B, and Type C.
- WHO recommends annual influenza vaccination as the most effective way to prevent influenza.
- Every year across the globe, there are an estimated 1 billion cases, of which 3 to 5 million are severe cases, resulting in 290 000 to 650 000 influenza-related respiratory deaths.

- Develop better tools to prevent, detect, control and treat influenza, such as more effective vaccines, antivirals and treatments, with the goal of making these accessible for all countries.

- The strategy meets one of WHO's mandates to improve core capacities for public health, and increase global preparedness and was developed through a consultative process with input from Member States, academia, civil society, industry, and internal and external experts.
- Through the implementation of the new WHO global influenza strategy, the world will be closer to reducing the impact of influenza every year and be more prepared for an influenza pandemic and other public health emergencies.

## 7 West Nile Fever

**Context:** A six year old child died in Malappuram, Kerala due to West Nile Fever, claimed to be the first victim of the virus in the recent past.

### More on News:

- Health experts claimed this could be the first confirmed death in the State due to the relatively unknown viral infection that leads to neurological diseases.
- Birds are the natural hosts of the virus and vaccine is not available for it.

### West Nile Fever:

- It is a zoonotic disease. Disease is caused by West Nile virus (WNV), which is a flavivirus related to the viruses that cause St. Louis encephalitis, Japanese encephalitis, and yellow fever.
- It is commonly found in Africa, Europe, the Middle East, North America and West Asia.
- Human infection is most often the result of bites from infected mosquitoes.
- Infection with WNV is either asymptomatic (no symptoms) in around 80% of infected people, or can lead to West Nile fever or severe West Nile disease.
- About 20% of people who become infected with WNV will develop West Nile fever. Symptoms include fever, headache, tiredness, and body aches, nausea, vomiting, occasionally with a skin rash (on the trunk of the body) and swollen lymph glands.
- The symptoms of severe disease (also called neuroinvasive disease, such as West Nile encephalitis or meningitis or West Nile poliomyelitis) include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis.
- The incubation period is usually 3 to 14 days.

#### West Nile Fever in India

- Febrile illness and encephalitis cases in epidemic form were observed in Rajasthan, and Maharashtra.
- Human sera collected from Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Odisha and Rajasthan showed presence of WNV neutralizing antibodies.
- Serologically confirmed cases of WNV infections were reported from Vellore and Kolar districts during 1977, 1978 and 1981.
- Presence of WNV was documented in north- eastern region of India during the year 2006 from four districts (Japanese encephalitis (JE) endemic areas) of Assam.
- During an outbreak of AES in Kerala, in May 2011, presence of WNV was confirmed in clinical specimens. Since then, WNV encephalitis cases have regularly been reported in Kerala.

## 8 Dry Eye Syndrome

### Context:

- **For the first time, a large-scale, hospital-based study in India involving over 14.5 lakh patients had found the incidence (number of new cases occurring each year) of dry eye disease to be 21,000 (1.46%).**
- **With a large ageing population, growing middle-class and chronic nature of the disease, India is on the verge of a dry eye disease epidemic.**

### Dry Eye Syndrome

- It is caused by a chronic lack of sufficient lubrication and moisture on the surface of the eye.
- Consequences of dry eyes range from subtle but constant eye irritation to significant inflammation and even scarring of the front surface of the eye.
- The disease tends to be progressive with age.
- The onset of dry eye disease is early in men than in women. In men, the age of disease onset is early 20s and 30s compared with 50s and 60s in women.
- Hormonal imbalance could be a likely reason for higher cases in women in their 50s and 60s
- Once corneal damage becomes irreversible it can lead to visual impairment and even blindness. Early diagnosis and treatment is therefore important.
- The disease is hugely underdiagnosed in India.

## 9 Zika virus: US relaxes travel warnings to India

### Context:

- **The US government's Centre for Disease Control and Prevention (CDC) has modified its advisory against travelling to India which it had issued after Zika cases were reported in Rajasthan and Madhya Pradesh.**
- **The Indian government had urged the US to "withdraw or modify" it's advisory in January by providing evidence of the contained outbreak in the country.**

### More on News:

- It said that the Zika virus strain isolated from Rajasthan matches with the Brazilian Zika strain associated with outbreaks and microcephaly or Congenital Zika Syndrome (CZS).
- The ICMR-NIV Pune has initiated mice/animal studies to understand the potential of this virus to cause microcephaly or CZS.
- The ICMR has also initiated a study to understand the outcomes of pregnancy among women infected with Zika and also the occurrence of CZS as well as other neurological malformations in their newborns. The study is being rolled out in Rajasthan in the first week of April and in Bhopal by the end of April.

### What is Zika Virus?

- Zika virus is similar to dengue fever, yellow fever and West Nile virus. **Carried by infected Aedes-aegypti mosquitos**, Zika is largely transmitted through bites, but can also occur through intrauterine infection.
- It was first identified in 1947 in Zika Forest, Uganda from where it derives its name. If a woman is bitten by an infected mosquito and becomes infected, Zika can cross into the placenta and affect the foetus.

- While anyone can contract Zika, pregnant women are the most at risk due to the potential for foetal microcephaly and other neurologic abnormalities.
- **Symptoms include** fever, headache, red eyes, skin rash, fatigue, muscle pain etc.
- **Treatment:** There is no specific treatment or vaccine currently available to treat Zika. The best form of prevention is protection against mosquito bites and clearing stagnant water where mosquitoes breed.

## 10 Candida Auris fungus

### Context:

- **US Centers for Disease Control and Prevention has reported that a drug-resistant superbug fungus- Candida Auris has sickened nearly 600 people across the United States, including more than 300 patients in New York State.**
- **Recently, a top American hospital had to rip out ceiling and floor tiles to get rid of the infestation from this fungus in the room of the effected patient after his death.**

### Candida Auris

- It is a fungus that causesserious bloodstream infections and even death, particularly in hospital and nursing home patients. It preys on people with weakened immune systems. More than 1 in 3 patients with invasive C. Auris infection die.
- The **most common symptoms** of the infection are fever and chills that don't improve after antibiotic treatment for a suspected bacterial infection. Only a laboratory test can diagnose the infection.
- **Treatment:** Isolation of the patient. Everyone who has come in contact with a patient should be screened for the fungus. Only when there are symptoms of an infection should the patient be given anti-fungals such as Caspofungin and Micafungin.

## 11 Non-Communicable Diseases

### Context:

- The Vice President of India addressing the Annual Meeting of the National Interventional Council (NIC) of the Cardiological Society of India described the rise in non-communicable diseases as a "deeply disturbing trend" and called upon the medical fraternity to educate the people on the dangers of leading sedentary lifestyles.
- Disease burden from non-communicable diseases increased from 30 per cent to 55 per cent between 1990 and 2016, while the communicable diseases dropped from 61 per cent to 33 per cent in the same period.

### Global efforts for its prevention:

- To strengthen national efforts to address the burden of NCDs, the 66th World Health Assembly endorsed the WHO **Global Action Plan** for the Prevention and Control of NCDs 2013-2020.

**India's efforts:**

- India has adopted National Action Plan and Monitoring Framework for Prevention and Control of NCDs in line with WHO's Global Action Plan for the Prevention and Control of NCDs.
- The global action plan lists 9 targets for countries to set. But India has taken the unprecedented step of setting a **tenth target to address household air pollution.**

- **Objectives of the plan:**
  - To raise the priority accorded to the prevention and control of NCDs in global, regional and national agendas and internationally agreed development goals, through strengthened international cooperation and advocacy.
  - To strengthen national capacity, leadership, governance, multi-sectoral action and partnerships to accelerate country response for the prevention and control of NCDs.
  - To reduce modifiable risk factors for NCDs and underlying social determinants through creation of health-promoting environments.
  - To strengthen and orient health systems to address the prevention and control of NCDs and the underlying social determinants through people-centred primary health care and universal health coverage.
  - To promote and support national capacity for high-quality research and development for the prevention and control of NCDs.
  - To monitor the trends and determinants of NCDs and evaluate progress in their prevention and control.

- India has implemented WHO's Framework Convention on Tobacco Control aimed at reducing the demand for tobacco products.
- National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke( NPCDCS)
- Accredited Social Health Activist (ASHA)- female health volunteer of the village.
- Mental Health Act,1987
- Tobacco Control Act ,2003

## 12 Side Effects of Common Antibiotics

### Context:

- **Central Drugs Standard Control Organisation (CDSCO)has asked the manufacturers to inform the general public about known side effects and symptoms after the intake of seven popular antibiotics.**
- **Manufacturers were also asked to mention the information about the adverse reactions of these medicines in leaflets inserted into drug packets or on promotional literature.**

### Followings are the aforementioned seven antibiotics:

| Antibiotics | Known side effects |
|---|---|
| Cefotaxime | Swelling under the skin due to the accumulation of fluids |
| Ofloxacin | Rashes and blisters on skin and mucous membranes |
| Cefixime | Pain, diarrhoea, nausea and headache |
| Tranexamic acid | Diarrhoea , Nausea and seizures |
| Quetiapine | Involuntary leakage of urine |
| Sulfasalazine | Decreased appetite, nausea and headache |
| Sodium Valproate | Drowsiness and unsteadiness |

**Central Drugs Standard Control Organisation**

- It is the **National Regulatory Authority (NRA)** for discharging functions assigned under the Central Government under the Drugs and Cosmetics Act.
- It works under Directorate General of Health Services,Ministry of Health & Family Welfare.
- Its headquarters is located New Delhi.

## 13 WHO guidelines on use of Digital Health Technology

**Context:** WHO released new recommendations on 10 ways that countries can use digital health technology, accessible via mobile phones, tablets and computers, to improve people's health and essential services.

**Facts to know:**

- One digital intervention already having positive effects in some areas is sending reminders to pregnant women to attend antenatal care appointments and having children return for vaccinations.
- Other digital approaches reviewed include decision-support tools to guide health workers as they provide care; and enabling individuals and health workers to communicate and consult on health issues from across different locations.
- The guidelines demonstrate that health systems need to respond to the increased visibility and availability of information. People also must be assured that their own data is safe and that they are not being put at risk because they have accessed information on sensitive health topics, such as sexual and reproductive health issues.
- The guidelines stress the importance of providing supportive environments for training, dealing with unstable infrastructure, as well as policies to protect privacy of individuals, and governance and coordination to ensure these tools are not fragmented across the health system.
- They encourage policy-makers and implementers to review and adapt to these conditions if they want digital tools to drive tangible changes and provide guidance on taking privacy considerations on access to patient data.
- The guidelines also make recommendations about telemedicine, which allows people living in remote locations to obtain health services by using mobile phones, web portals, or other digital tools. WHO points out that this is a valuable complement to face-to-face- interactions, but it cannot replace them entirely. It is also important that consultations are conducted by qualified health workers and that the privacy of individuals' health information is maintained.
- The guideline emphasizes the importance of reaching vulnerable populations, and ensuring that digital health does not endanger them in any way.

## 14 Chemists and Druggists are past; from now, all will be Pharmacies

**Context:**

- **First coined in 1945, the words 'chemist' and 'druggist' are headed for a change, with the Union Health Ministry replacing them with 'pharmacy'.**
- **Drugs and Technical Advisory Board (DTAB) has also given its approval to replace the words 'chemist' and 'druggist' with the term 'pharmacy'.**

### Who is a pharmacist?

- According to Drugs and Cosmetics rules, the terms pharmacy or pharmacist are currently used by only those license holders who satisfy two conditions:
  - Employ the services of a registered pharmacist
  - Run a pharmacy for compounding against prescription from a doctor.

### Who are Chemists and Druggists?

- 'Chemists and Druggists' was to be displayed by those licensees who employ the services of a registered pharmacist but who do not maintain a 'pharmacy' for compounding. The pharmacist mixes different ingredients together to create the individualised medication.
- Compounding: The process of preparing a drug specifically for a buyer, based on a prescription from his or her doctor.

## 15 Genome Sequencing

**Context:** In an indigenous genetic mapping effort, nearly 1,000 rural youth from the length and breadth of country will have their genomes sequenced by the Council of Scientific and Industrial Research (CSIR).

- The project aims at educating a generation of students on the "usefulness" of genomics.
- The project is an adjunct to a much larger government-led programme, still in the works, to sequence at least 10,000 Indian genomes.

### What is Genome Sequencing?

- **Genome**: It is an organism's complete set of DNA, including all of its genes.
- **Genome sequencing**: It is figuring out the order of DNA nucleotides, or bases, in a genome—the order of As, Cs, Gs, and Ts that make up an organism's DNA. The human genome is made up of over 3 billion of these genetic letters.

### What is the methodology?

- Genomes will be sequenced based on a blood sample.
- Every person whose genomes are sequenced will be given a report. The participants would be told if they carry gene variants that make them less responsive to certain classes of medicines. For instance, having a certain gene makes some people less responsive to clopidogrel, a key drug that prevents strokes and heart attack.
- The sequencing to be done at the CSIR-Institute of Genomics and Integrative Biology (IGIB) and the Centre for Cellular and Molecular Biology (CCMB).

## 16 Bt Brinjal

### Context:

- **India banned Bt Brinjal in 2010 but, nine years on, the genetically modified (GM) crop is still in circulation, said activists recently.**
- **They cited the example of a farmer from Haryana's Fatehabad who allegedly has been cultivating the crop for a couple of years now.**
- **Representatives of the activists- Coalition for a GM-Free India have demanded immediate action from the central and state governments.**

### What is Bt Brinjal?

- Bt Brinjal is a GM crop created by inserting Cry 1Ac gene from the soil bacterium Bacillus thuringiensis into Brinjal.
- The insertion of the gene givesBrinjal plant resistance against lepidopteron insects like the Brinjal Fruit and Shoot Borer (Leucinodesorbonalis) and Fruit Borer (Helicoverpaarmigera).
- Upon ingestion of the Bt toxin by the insect, there would be disruption of digestive processes, ultimately resulting in the death of the insect.

## 17 WHO for eliminating industrially produced trans-fat by 2023

**Context:** The World Health Organization (WHO) has partnered withInternational Food and Beverage Alliance (IFBA) to eliminateindustrial trans-fatnot exceed 2 gram per 100 g fat/oil globally by 2023.

### More on News:

- The WHO has welcomed its partnership with the International Food and Beverage Alliance (IFBA) to eliminate industrial trans fats, and reduce salt, sugar and saturated fats in processed foods and to ensure that the amount of industrial trans-fat in their **products does not exceed 2 gram per 100 g fat/oil globally by 2023.**
- The other aim is to bring regulatory action on labelling, marketing and urged industry for full adherence to the WHO code of marketing of breast milk substitutes.
- In line with the **REPLACE initiative**, WHO has called on all food producers and oil and fat manufacturers, not only IFBA members, to commit to elimination of industrial trans-fat from the global food supply.
- Trans-fat, also called trans-unsaturated fatty acids or trans fatty acids, is a type of unsaturated fat that occurs in small amounts in nature, but became widely produced industrially from vegetable fats starting in the 1950s for use in margarine, snack food, packaged baked goods, and for frying fast food.

## 18 Stress buster Serotonin may help treat neurological decline

**Context:** Recently, researchers at the Tata Institute of Fundamental Research (TIFR), Mumbai, have found a new function for Serotonin.

### What is Serotonin?

- It is a chemical that signals between neurons.
- It is believed to help regulate mood and social behaviour, appetite and digestion, sleep, memory, and sexual desire and function.
- There may be a link between serotonin and depression. If so, it is unclear whether low serotonin levels contribute to depression, or if depression causes a fall in serotonin levels.
- At the level of an organism, serotonin is known to be involved in coping with stress. However, the underlying mechanism of its neuro-protective role was unknown.

### Mechanism of Serotonin for coping with stress

- Serotonin is involved in the generation of new mitochondria (the powerhouse of the cell) in neurons, increased cellular respiration and fuel (ATP) in the cell.

- As it generates more mitochondria, thereby giving neurons the capacity to produce more energy and the ability to cope with stress better.
- It can impact the manner in which neurons grapple with stress and affect the trajectory of ageing.

## 19 Nipah Virus

**Context:** The National Centre for Disease Control (NCDC) is investigating a sample from a man in Kerala who is suspected to be carrying the Nipah virus.

### Nipah Virus

- The virus can be transmitted to humans from animals (such as bats or pigs). The disease spreads **through fruit bats or 'flying foxes,' of the genus Pteropus**, who are natural reservoir hosts of the **Nipah and Hendra viruses.**
- Nipah virus infection is an emerging zoonotic disease of public health importance in the WHO South East Asia region with a high case fatality rate estimated to range between 40 and 75 per cent.
- It was first recognised in 1998-99 during an outbreak among pig farmers in Malaysia and Singapore.
- Human-to-human transmission of this virus has also been reported among family and care givers of infected patients.
- The **incubation period of the virus is 7-14 days.**
- Initial symptoms include fever, vomiting, sore throat, headaches and muscle pain.
- Nipah-case patients who had breathing difficulty are more likely than those without respiratory illness to transmit the virus.

## 20 Sexually Transmitted Infection (STI)

**Context:** The World Health Organization's latest report reveals that more than a million new cases of Sexually Transmitted Infections (STIs) are detected every day.

### Highlights of the Report

- The study found more than 376 million new cases of the four infections in 2016. By infection, there were 127 million new cases of chlamydia, 87 million cases of gonorrhoea, 6.3 million of syphilis and 156 million of trichomoniasis.
- Every 25$^{th}$ person in the world has a sexually transmitted infection.
- More than one million new cases of curable sexually transmitted infections are diagnosed every day in the age group of 15-59.
- The research also showed that the prevalence of chlamydia, gonorrhoea and trichomoniasis increased more in women than men.
- Approximately 13.5 per cent (50.8 million) of these infections occurred in low-income countries, 31.4 per cent (118.1 million) in lower middle-income countries, 47.1 per cent (177.3million) in upper middle-income countries and 8 per cent (30.1 million) in high-income nations, according to the report.

- Chlamydia, syphilis and gonorrhoeaare bacterial infections spread through vaginal, anal or oral sex. And trichomoniasis is caused by a parasite called Trichomonasvaginalis.
- Like Chlamydia, syphilis and gonorrhoea, trichomoniasis also spreads through sexual contacts. Both males and females are susceptible to all these four infections.

## 21 Encephalitis surge in Bihar

**Context:** Bihar has recorded more than100 deaths of children, since January due to the spread of Acute Encephalities Syndrome.

### Acute Encephalitis Syndrome (AES)

- AES affects central nervous system, mostly in children and young adults.
- It starts with high fever, then hampers neurological functions causing mental disorientation, seizure, confusion, delirium, and coma.
- The disease outbreak is usually reported during monsoons (June-October). But the incidence is also reported during April-June in Bihar.
- It can be caused by virus, bacteria, fungi, and a range of agents.
- **Japanese encephalitis (JE) virus** is the most common cause of AES in India.
- The syndrome is also caused by scrub typhus, dengue, mumps, measles, Nipah and Zika virus.

**Status of AES in India**

- According to **National Vector Borne Diseases Control Programme (NVBDCP),** 10,485 AES cases were diagnosed in 2018 with 632 deaths across 17 states.
- **India records fatality rate at 6 per cent in AES, but the fatality rises to 25 per cent amongst children.**
- Bihar, Assam, Jharkhand, Uttar Pradesh, Manipur, Meghalaya, Tamil Nadu, Karnataka, and Tripura are worst affected.

- In several cases though the cause of AES remains clinically unidentified.
- The toxin, presented naturally in the litchi, responsible for the deaths is **Hypoglycin A**.
- AES Spreads through contaminated surfaces. Viruses enter through **contaminated water**. Once infected the patient can infect more individuals through their secretions and saliva.
- In Bihar, it has been reported that the victims might have ingested toxins from the affected **litchi fruit**.

## 22 Chandipura Virus

**Context:** Chandipura virus came to light when blood samples from two patients in Maharashtra's Chandipura village were tested and found positive.

**What is this virus?**

- The ChandipuraVesiculovirus (CHPV), first discovered by two virologists of the Pune-based National Institute of Virology (NIV) in 1965, predominantly infects children.
- The virus spreads mainly through the bite of sand flies, and sometimes through mosquitoes.
- Animal studies show that the **virus affects neurons and causes neuro-degeneration**.
- The likely **vector (or carrier) of thevirus is the female phlebotomines and fly.** The virus was detected in sandflies in Senegal, Nigeria as well as in India.

- The virus is known to cause inflammation of the brain.
- CHPV belongs to the **Rhabdoviridae family** in the order **Mononegavirales of the genus Vesiculovirus**.
- Interestingly, its continuing mutating trend has enhanced its lethality to cause human infections, unlike its genetic cousin, the vesicular stomatitis virus (VSV).
- The virus predominantly infects children between the ages of 2-16, spreading through the bite of a sandfly, and in some cases, even the mosquito during the monsoon and pre-monsoon season.
- It is distantly related to the virus that causes rabies and is known to have a case fatality between 55-75 %.
- There is no specific medicine for its treatment. However with timely detection, hospitalisation and symptomatic treatment is given to the patient, which could help save lives.

## 23 Human Atlas

**Context:** A new human atlas initiative known as Manav has been launched by the Department of Biotechnology and Persistent Systems, a biotechnology company to create a unified database of molecular network of all the tissues in the human body and to derive a holistic picture of working of the human body.

### More on News:

- This mega project will collate and integrate **molecular information** on human tissues and organs that currently lie hidden in research articles in an unstructured and disorganised form.
- It would utilise large biological community, both students and scientists, for extracting and adding the information from scientific literature at the level of cells and organs.
- The undergraduates and postgraduates from the various distinct fields of biology such as zoology, biotechnology, botany, biochemistry, pharmacology and medical sciences can register and contribute to this project
- The project aims to create a unified database, which would eventually help researchers in identifying gaps in current knowledge and help in future projects in diagnostics and disease biology.
- The project will be executed by **Indian Institute of Science Education and Research (IISER)** and **National Center for Cell Sciences (NCCS)** based in Pune.

#### Indian Institutes of Science Education and Research (IISERs)

- It is the Scientific Advisory Council to the Prime Minister. Five such Institutes have already been established at Kolkata, Pune, Mohali, Bhopal and Thiruvananthapuram.

#### National Centre for Cell Science (NCCS)

- It is an autonomous organisation aided by the Department of Biotechnology, Government of India, was established with a tripartite mandate of:
  - Serving as a national repository of animal cell cultures.
  - Undertaking research in cell biology.
  - Human resource development.

## 24 Prevention of Tuberculosis

**Context:** The Indian Council of Medical Research (ICMR) has started a vaccine trial to prevent tuberculosis (TB) among those living close to patients suffering from the disease.

### More on News:

- The ICMR launched the third-phase trials for anti-Tuberculosis (TB) vaccine that could be administered to anybody aged six years and above.
- The clinical trial is aimed at preventing and decreasing the burden of TB in the country.
- The Phase III trial is the first-ever government conducted vaccine trial, which is being conducted to come up with the first TB vaccine for adults as the BCG vaccine is only for new-borns that was undertaken decades ago, it is poorly protective against pulmonary disease in adolescents and adults, and therefore at reducing **Mycobacterium tuberculosis** (Mtb) transmission.

**ICMR**

- It is an apex body in India for the formulation, coordination and promotion of biomedical research.
- It is one of the oldest and largest medical research bodies in the world. The ICMR is funded by the Government of India through the **Department of Health Research, Ministry of Health and Family Welfare**.

- TB is a contagious infection that usually attacks the lungs. It can also spread to other parts of the body, like the brain and spine. A type of bacteria called **Mycobacterium tuberculosis** causes it.

### Steps taken by Government of India

- It launched **TB Free India Campaign**. Government is implementing a **National Strategic Plan (NSP)** to end TB by 2025 with funding of over Rs.12, 000 crore for the next three years to ensure every TB patient has access to quality diagnosis, treatment and support.
- **Public-private partnership models** and **Information Technology** (IT) tools have been used for monitoring the programme and treatment adherence.
- Community engagement is the hallmark and it is becoming a social movement to end TB in India.
- Under the **Revised National Tuberculosis Control Programme** (RNTCP), the government has also proposed an incentive of Rs.500 per patient per month for the nutritional support of TB-affected patients during the course of the treatment.The states have the option for providing these incentives in cash or kind.
- The programme is also facilitating the TB patients to avail various social support schemes of the state governments.
- **NIKSHAY is a web based solution for monitoring of TB patients developed by National Informatics Centre (NIC).** This is used by health functionaries at various levels across the country in association with Central TB Division (CTD), Ministry of Health & Family Welfare.

## 25 3D Printed Pill

**Context:** New ingestible, 3D printed pill can analyse gut microbiome.

### More on News:

- Researchers have developed an ingestible 3D printed pill, which can non-invasively assess gut bacteria throughout the gastrointestinal (GI) tract.

- This biocompatible pill is manufactured in a **3D printer** with **microfluidic channels**.
- It can easily sample different stages of the GI tract, which was till now impossible to track non-invasively.
- Current method is based on the use of DNA sequencing techniques to analyse bacteria found in the gut known as the **microbiome** (The gut microbiome is comprised of the collective genome of microbes inhabiting the gut including bacteria, archaea, viruses, and fungi).

## 26 Ebola Virus

**Context:** Ebola virus is no longer incurable; Congo trial reports over 90 percent success.

### More on News:

- Ebola virus disease (EVD), also known as Ebola hemorrhagic fever (EHF), is a **viral hemorrhagic fever** of humans and other primates caused by ebolaviruses.
- It is a rare and deadly disease in people and nonhuman primates.
- The viruses that cause EVD are located mainly in sub-Saharan Africa. People can get EVD through direct contact with an infected animal (bat or nonhuman primate) or a sick or dead person infected with Ebola virus.
- Signs and symptoms typically start between two days and three weeks after contracting the virus with a fever, sore throat, muscular pain, and headaches. Vomiting, diarrhea and rash usually follow, along with decreased function of the liver and kidneys.
- Two experimental drugs showed survival rates of as much as 90% in a clinical trial in Congo.
- Two experimental drugs – an antibody cocktail called REGN-EB3 developed by Regeneron and a monoclonal antibody called mAb114 – will now be offered to all patients infected with the viral disease in an ongoing outbreak in the Democratic Republic of Congo (DRC).
- The drugs showed "clearly better" results, according to U.S. National Institute of Allergy and Infectious Diseases (NIAID).

## 27 Antimicrobial Resistance (AMR)

### Context:

- **Madhya Pradesh has become the second state after Kerala to develop an action plan to manage antimicrobial resistance (AMR).**
- **The government will carry out state- level AMR surveillance across all sectors including human health, animal husbandry, fisheries, environment, and food.**
- **The move will encourage other states to develop their own plans, which in turn, will help in tackling AMR on the national level.**

### More on News:

- The World Health Organisation (WHO) defines AMR as "the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarial) from working against it. As a result, standard treatments become ineffective, infections persist and may spread to others."
- One of the sources of antibiotic resistance development is the presence of antibiotics in the environment, which generates foci of resistant bacteria through bacterial exposure to antibiotics.

### Causes of AMR:

- Misuse of antibiotics in humans, animals, aquaculture, hospital effluents and antibiotic use in livestock and poultry contributes to AMR.
- Poor management of waste from farms, factories, healthcare settings and households adds to this problem.

### Methods of controlling the spread of AMR:

- Tracking antibiotic use in humans, animals, fisheries, crops.
- Ensuring effective infection prevention and control in human and animal health, community and environment.

### Optimised use of antimicrobial agents in the health, animal and food sectors.

- Promoting investments for AMR activities, research and innovations for AMR containment.

## 28 Diabetes

**Context:** The South Asian population, including Indians, has been showing symptoms of diabetes for at least 11,000 years now. Besides, the stature of this population began to reduce and since 7,000 years, has fallen by 8.5 cm among males and by 7.7 cm among females, a new study has found.

### Study Findings

- Origins of the diabetes have been traced to the **Mesolithic period**.
- That is the time when **the lean mass** of the South Asian population began to dip, making their bodies more susceptible **to type-2 diabetes**.
- **Lower lean mass** is associated with **poorer control of blood glucose** and greater susceptibility to the diabetes.
- **South Asian population** began growing **shorter in height than the Europeans** due to major **dietary and environment changes** which began to occur around **7,000 years ago**.

### Types of Diabetes

- **Type 1 diabetes:** It is an **autoimmune disease**. The immune system attacks and destroys cells in the pancreas, where insulin is made. **About 10 percent of people with diabetes have this type.**
- **Type 2 diabetes:** It occurs when **body becomes resistant to insulin**, and **sugar builds up in your blood**. It stems from a combination of **genetics and lifestyle factors.**
- **Pre-diabetes**: It occurs **when blood sugar is highe**r than normal, but **it's not high enough** for a diagnosis of type 2 diabetes.
- **Gestational diabetes**: It is **high blood sugar during pregnancy**. **Insulin-blocking hormones** produced by the placenta cause this type of diabetes.

## 29 Oxytocin Ban

**Context:** The question of banning oxytocin has been referred to a three judge bench of the Supreme Court

### Oxytocin:

- It has also been dubbed the **hug hormone, cuddle chemical, moral molecule, and the bliss hormone** due to its effects on behavior, including its role in love and in female reproductive biological functions in reproduction.
- It is a hormone that is made in the brain, in the **hypothalamus**. It is transported to, and secreted by, the **pituitary gland**, which is located at the base of the brain.
- It acts both as a **hormone and as a brain neurotransmitter.**
- The release of oxytocin by the pituitary gland acts to regulate two female reproductive functions: Childbirth and Breast-feeding.
- It induces contractions of the uterine muscles and initiates labour for the child birth.
- It is misused by the dairy owners on milch animals to artificially extract milk.
- It is also used irrationally by farmers to enhance the size and appearance of the fruits and vegetables.

## 30 AIDS

**Context:** Chief of International AIDS Vaccine Initiative (IAVI) has said that India is pivotal to the global fight-back against AIDS.

### More on News:

- International AIDS Vaccine Initiative (IAVI) is **working on two trials** for a possible AIDS vaccine but neither has yet reached a stage when a date can be put to the availability of the vaccine.
- Its work on vaccine has improved understanding of the immune system and spawned many technologies that can help fight other diseases, including emerging threats such as Ebola and Zika.
- With neither a vaccine nor any cure in sight, **antiretroviral therapy (ART)** is the only option available for people living with HIV-AIDS.
- According to the World Health Organization, **standard ART** consists of a combination of at **least three antiretroviral drugs** to suppress the HIV virus and stop the progression of the disease.

### National AIDS Control Programme (NACP)

It was launched in 1992, and is being implemented as a comprehensive programme for prevention and control of HIV/ AIDS in India.

- The NACP I started in 1992 was implemented with an objective of slowing down the spread of HIV infections so as to reduce morbidity, mortality and impact of AIDS in the country.
- In November 1999, the second National AIDS Control Project (NACP II) was launched to reduce the spread of HIV infection in India, and (ii) to increase India's capacity to respond to HIV/AIDS on a long-term basis.
- NACP III was launched in July 2007 with the goal of Halting and Reversing the Epidemic over its five-year period.
- NACP IV, launched in 2012, aims to accelerate the process of reversal and further strengthen the epidemic response in India through a cautious and well defined integration process over the next five years.

### UNAIDS '90-90-90' targets

The targets propose that to end the HIV epidemic by 2030, 90% of persons living with HIV (PLWH) worldwide should know their diagnosis, 90% of diagnosed PLWH should be on antiretroviral therapy (ART) and 90% of PLWH on ART should be virally suppressed by 2020.

## 31 Rafale Jet Delivered

**Context:** Study says anaemia may contribute to the spread of dengue.

### What is Anaemia?

- Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status.

### What is the relation between anaemia and the spread of dengue?

- Mosquitoes are more likely to acquire the dengue virus when they feed on blood with low levels of iron.
- Cells in a mosquito's gut take up iron in the blood and use it to produce reactive oxygen. The reactive oxygen kills the dengue virus.
- Supplementing people's diets with iron in places where both iron deficiency anaemia and dengue fever are a problem could potentially limit transmission of the disease, but there are many risks.

### Global burden of Anaemia:

- Globally, anaemia affects 1.62 billion people, which corresponds to 24.8% of the population. The population group with the greatest number of individuals affected is pregnant women (41.8%). In women, anaemia may become the underlying cause of maternal mortality and perinatal mortality.
- Nine out of ten anaemia sufferers live in developing countries, about 2 billion people suffer from anaemia and an even larger number of people present iron deficiency.
- WHO has estimated that prevalence of anaemia in developed and developing countries in pregnant women is 14 per cent in developed and 51 per cent in developing countries and 65-75 percent in India alone.
- Prevalence of anaemia in South Asian countries is among the highest in the world. It is estimated that about half of the global maternal deaths due to anaemia occur in South Asian countries and India alone contributes to 50% of global maternal deaths and about 80 per cent of the maternal deaths due to anaemia in South Asia.
- According to National Family Health Survey (NFHS)–IV (2015-16), the prevalence of anaemia among women aged 15 to 49 years is 53% and among adolescent girls aged 15-19 years is 54%.

## 32 Alzheimer's disease

**Context:** China recently announced that a new drug, meant to potentially treat Alzheimer's disease, will be available to Chinese patients by the end of this year. Called GV-971 or "Oligomannate", it is a seaweed-based drug, administered orally.

### More on News:

- The drug has received approval from China's National Medical Products Administration (NMPA), making it the new drug for the treatment of 'mild to moderate Alzheimer's disease (AD) and improving cognitive function'.
- It has been claimed that oligomannate has a different mechanism of action from that of other drugs. It builds on the evidence that suggests an association between microbiomes in the gut and progression of Alzheimer's.

- The study suggests that it is possible for a microbiome imbalance in an individual's gut to influence the formation of plaque and inflammation of the nervous tissue.
- It suggests Alzheimer's is not driven by proteins alone, but its development may require the interaction between the gut, brain and other inflammatory factors.
- Even so, the study did not establish if the link between gut bacteria and neuro-inflammation in Alzheimer's is direct or indirect. The lead inventor of the drug, has said that oligomannate works by reconditioning the imbalance of the microbiomes in the gut, thereby reducing the deposition of plaque and improving cognitive function.

### Alzheimer's disease

- It **is a progressive brain disorder** that typically affects people older than 65. When it affects younger individuals, it is considered early onset.
- The disease destroys brain cells and nerves, and disrupts the message-carrying neurotransmitters. Eventually, a person with Alzheimer's loses the ability to perform day-to-day activities.
- Alzheimer's disease is also the **most common cause of dementia —** which is a syndrome and not a disease in itself, and whose symptoms include loss of memory, thinking skills, problems with language, and changes in mood and deterioration in behaviour.
- Scientists believe that for most people, Alzheimer's disease is caused by a combination of genetic, lifestyle and environmental factors that affect the brain over time.
- There is no cure for Alzheimer's, because its exact causes are not known. Most drugs being developed try to slow down or stop the progression of the disease.
- There is a degree of consensus in the scientific community that Alzheimer's involves two proteins, called **beta amyloids and tau.**
- When levels of either protein reach abnormal levels in the brain, it leads to the formation of plaque, which gets deposited between neurons, damaging and disrupting nerve cells. But it is not known why the levels of these proteins reach abnormal levels in the first place.
- Most existing drugs for Alzheimer's try to target these proteins to manage some of the symptoms of Alzheimer's.

## 33 African Swine fever (ASF)

**Context:** According to United Nations Food and Agriculture Organization (FAO) report ASF has caused the deaths of more than 3.7 million pigs across a vast swathe of Asia, primarily in its east and south-east, where pork is the primary meat staple.

### What is African Swine Fever (ASF)?

- **It is a highly contagious haemorrhagic viral disease** of domestic and wild pigs.
- It is **caused by a large DNA virus of the *Asfarviridae* family,** which also infects ticks of the genus Ornithodoros.
- Although signs of ASF and classical swine fever (CSF) may be similar, the **ASF virus is unrelated to the CSF virus.**
- **Transmission and spread:**
  - Direct contact with infected domestic or wild pigs
  - **Indirect contact,** through ingestion of contaminated material. Contaminated fomites, or biological vectors where present.

- **Acute forms** of ASF are characterised by high fever, depression, anorexia and loss of appetite, haemorrhages in the skin , abortion in pregnant sows, cyanosis, vomiting, diarrhoea and death within 6-13 days (or up to 20 days). Mortality rates may be as high as 100%.
- ASF is not a risk to human health as it is relatively harmless.
- **Currently there is no approved vaccine for ASF.**

## 34 Prescription for plant-based diet overlooks Vitamin B12 Deficiency

**Context:** While an EAT-Lancet study had found that the world must shift to plant-based diets to meet the SDGs, this vitamin is only found in animal meat and to a lesser extent in milk products. Thus, not seems to be a viable option.

### More on News:

- A water-soluble vitamin, B12 is the most critical element in the metabolism of every cell in the human body. Deficiency can cause anaemia, weakness of limbs and dementia.
- Pregnant women who lack this vitamin can give birth to brain-damaged babies, which can lead to autism.
- India doesn't have nation-wide data on B12 deficiency. But there is wide acceptance among the medical fraternity that a large number of people as many as those suffering from vitamin D deficiency have this problem.
- About 47 per cent people in northern India are vitamin B12 deficient. Thus, being an endemic problem
- This vitamin is only found in animal meat and to a lesser extent in milk products. Cobalamin or Vitamin B12 is essential for the formation of red blood cells, regular functioning of nerve system and in the production of cellular energy.

## 35 Double burden of malnutrition

**Context:** Study finds there is a relationship between under-nutrition, overweight and obesity.

### What is Double Burden of Malnutrition?

- The double burden of malnutrition is characterized by the coexistence of under-nutrition along with overweight, obesity or diet-related Non Communicable Diseases (NCDs), within individuals, households and populations, and across the life-course.

### What are the drivers and detriments of the double burden of malnutrition?

- **The nutrition transition**: It describes the shift in dietary patterns, consumption and energy expenditure associated with economic development over time, often in the context of globalization and urbanization. This change is associated with a shift from a predominance of under-nutrition in populations to higher rates of overweight, obesity and NCDs.
- **The epidemiological transition**: It describes the changes in overall population disease burden associated with the increase in economic prosperity – with a shift from a predominance of infection and diseases related to under-nutrition to rising rates of NCDs.
- **The demographic transition:** It describes the shift in population structure and lengthening lifespans. This sees a transformation from populations with high birth rates and death rates

(related to the above transitions), with relatively high proportions of younger people, to populations with increasing proportions of older people (with age also being a risk factor for many NCDs).

**Prevalence of indicators of non-communicable diseases alongside indicators of under-nutrition in India:**

- Nearly 10% of children in the age group of 5-9 years and adolescents in the age group of 10-19 years are pre-diabetic, 5% are overweight and another 5% suffer from blood pressure.

## 36 Golden Rice: To Combat Vitamin A Deficiency for Public Health

**Context:** Said to be answer to Vitamin A deficiency, yet to be planted on large scale. Bangladesh could be on the verge of becoming the first country to approve plantation of this variety.

**More on News:**

- In the late 1990s, German scientists developed a genetically modified variety of rice called Golden Rice.
- It was claimed to be able to fight Vitamin A deficiency, which is the leading cause of blindness among children and can also lead to death due to infectious diseases such as measles.
- **Bangladesh could be on the verge of becoming the first country to approve plantation of this variety.**
- In Bangladesh, over 21 per cent of the children have vitamin A deficiency.
- The Golden Rice that is being reviewed in Bangladesh is developed by the Philippines-based International Rice Research Institute.
- This rice variety will not be more expensive than the conventional variety.
- Rice is naturally low in the pigment beta-carotene, which the body uses to make Vitamin A. Golden rice contains this, which is the reason for its golden colour.

**Vitamin A**

- Vitamin A is a fat-soluble vitamin that is good for healthy vision, skin, bones and other tissues in the body. It often works as an antioxidant, fighting cell damage, but it also has many other uses.
- Good sources are fortified milk, eggs, meat, and cheese, liver, halibut fish oil, cream and kidneys.
- Symptoms of a severe deficiency are night blindness, dry eyes, diarrhea and skin problems.

## 37 National Health Profile

**Context:** India's life expectancy rises to 68.7 years according to National Health Profile 2019 recently released by Central Bureau of Health Intelligence.

**More on News:**

- **Life Expectancy**: According to the Survey life expectancy in India has increased from 49.7 years in 1970-75 to 68.7 years in 2012-16.
- For the same period, the life expectancy for females is 70.2 years and 67.4 years for males.
- **Population Density**: According to the survey, the highest population density of 11,320 people per square kilometre was reported by the NCT of Delhi whereas Arunachal Pradesh has reported the lowest population density of 17.

- **Non Communicable Diseases**:On the non-communicable diseases, the survey notes that out of 6.51 crore patients who attended NCD clinics, 4.75 per cent people are diagnosed with diabetes and 6.19 per cent are diagnosed with hypertension.
- **Demographics**:On demographics, the survey found the high incidence of the young and economically active population.
- The survey notes that 27 per cent of the total estimated population of 2016 were below the age of 14 years and majority (64.7 per cent) of the population were in the age group of 15-59 years.
- **Birth Rate and Death Rate**: There has been consistent decrease in the birth rate, death rate and natural growth rate in India since 1991 to 2017.
- As on 2017, India has registered birth rate of 20.2 per 1,000 population and death rate of 6.3 per 1,000 population while the natural growth rate was 13.9 per 1,000 population in India.
- The birth rate in rural areas was higher than in the urban. Similarly, the death rate and natural growth rate were also higher in rural areas as compared to the urban.
- The population continues to grow, as the decline in the birth rate is not as rapid as the decline in the death rate

## National Health Profile

- **The Central Bureau of Health Intelligence (CBHI**) has been releasing its annual publication "National Health Profile (NHP)" on a regular basis since 2005.
- It involves prolonged, systematic and genuine efforts to collect an enormous amount of national data from the Directorates of Health & Family Welfare of all the 36 States/UTs, Central Government Organizations, National Health Programmes and various other concerned national and international agencies in India.

## The Central Bureau of Health Intelligence

- It is the National Nodal agency for Health Intelligence in the Directorate General of Health Services, Ministry of Health & Family Welfare, and Government of India.
- It also functions as Collaborating Centre for World Health Organization, Family of International Classification (WHO FIC) in India & South East Asia Region (SEAR) countries.

- **Infant Mortality**: The infant mortality rate has declined considerably (33 per 1,000 live births in 2016), however differentials of rural (37) & urban (23) are still high.
- **Total Fertility Rate**:The Total Fertility Rate (TFR) for the country was 2.3 whereas in rural areas it has been 2.5 and it has been 1.8 in urban areas during 2016 as per the latest available information.
- **Health Status**: On the health status indicators, the survey find that on communicable diseases, in 2018, maximum number of cases and deaths due to malaria has been reported in Chhattisgarh (77,140 cases and 26 deaths).
- The overall prevalence of the disease has diminished in 2012 and 2013 but there was a slight increase in 2014 and 2015 before it again started decreasing from 2016.
- Dengue and Chikungunya, transmitted by Aedes mosquitoes, are a cause of great concern to public health in India.
- Dengue outbreaks have continued since the 1950s but severity of disease has increased in the last two decades.
- The reported cases of Chikungunya in the country has shown a slight decrease from 67,769 to 57,813 in 2018 as compared to 2017.
- There has been considerable decrease in the number of swine flu cases/deaths in the year 2014 as compared with 2012 and 2013.
- During the year 2015, 4.13 lakh people lost their life due to accidental injuries and 1.33 lakh people died because of suicide.

- Suicide rates are increasing significantly among young adults and the maximum number of suicide cases (44,593) is reported between the age group 30-45 years.

## 38 World Malaria Report, 2019

### Context:

- **Despite a dip in cases, India still one of the worst-hit countries**
- **While Africa and India saw the maximum dip in malaria cases between 2017 and 2018, they still accounted for 85 percent deaths.**

### Findings in the report

- Nineteen countries in sub-Saharan Africa and India accounted for 85 per cent of the global malaria burden in 2018. Globally 228 million malaria cases were reported in 2018, which is marginally lower than the number of cases in 2017 (231 million), as per the **World Malaria Report 2019 released by the World Health Organization.**
- India registered a fall of 2.6 million malarial cases in 2018 as compared to previous year. The country also has one of the lowest funding per person at risk of being inflicted with malaria at just US$0.2.
- Despite being the highest burden country in the South-East Asia region, India showed a reduction in reported cases of 51 percent compared to 2017 and of 60 per cent compared to 2016.
- Although cases continue to decrease in the public sector, estimates indicate that there are still gaps in reporting from the private sector and those seeking treatment in India, as in Myanmar and Indonesia. The estimated burden of malaria, the WHO report says is 6.7 million while only 4 million cases were reported in 2018.
- India, Indonesia and Myanmar accounted for 58 percent, 21 percent and 12 percent of the total reported deaths in the region, respectively.

## 39 H9N2

**Context:** Indian scientists have detected the country's first case of infection with a rare variant of the virus that causes avian influenza, or bird flu.

### What is H9N2?

- H9N2 is a subtype of the influenza A virus, which causes human influenza as well as bird flu.
- The H9N2 subtype was isolated for the first time in Wisconsin, the US in 1966 from turkey flocks. According to the US National Centre for Biotechnology Information (NCBI), H9N2 viruses are found worldwide in wild birds and are endemic in poultry in many areas.
- H9N2 viruses could potentially play a major role in the emergence of the next influenza pandemic.

**Note:**

- Influenza A viruses are the only influenza viruses known to cause flu pandemics, i.e., global epidemics of flu disease.
- A pandemic can occur when a new and very different influenza A virus emerges that both infects people and has the ability to spread efficiently between people.

- H9N2 virus infections in humans are rare, but likely under-reported due to typically mild symptoms of the infections.

- Cases of human infection have been observed in Hong Kong, China, Bangladesh, Pakistan, and Egypt. One case was detected in Oman recently.
- The first case globally was reported from Hong Kong in 1998.
- Surveillance for influenza viruses in poultry in Bangladesh during 2008-2011 found H9N2 virus to be the predominant subtype.
- The virus was also identified in poultry populations in surveillance studies in Myanmar during 2014-16 and Burkina Faso in 2017.
- In India, the virus was picked up in February 2019 during a community-based surveillance study in 93 villages of Korku tribes in Melghat district of Maharashtra.

## 40 Polio comeback in a number of countries: Should India be worried?

**Context:** In the last one year or so, polio has made a comeback in countries such as the Philippines, Malaysia, Ghana, Myanmar, China, Cameroon, Indonesia and Iran, mostly as vaccine-derived polio infection.

### Polio

- Polio, or poliomyelitis, is a disabling and life-threatening disease caused by the poliovirus.
- **Transmission:**The virus spreads from person to person and can infect a person's spinal cord; causing paralysis (can't move parts of the body). It can spread easily from person to person.
- **Symptoms:** Flu like symptoms: Sore throat, fever, tiredness, nausea, headache, stomach pain. Most people who get infected with poliovirus will not have any visible symptoms.
- There are two vaccines available to fight polio:
  - **Inactivated poliovirus (IPV):** The vaccine is made from inactive poliovirus. It is very safe and effective and cannot cause polio.
  - **Oral polio vaccine (OPV)** is created from a weakened form of poliovirus. It is low cost, easy to administer, and gives an excellent level of immunity.
- The World Health Organisation (WHO) aim is to eradicate polio completely and, if this happens, it will be only the third disease to have been beaten in this way, after smallpox and rinderpest.
- Nigeria, Pakistan, and Afghanistan are the only three countries in which polio has not successfully been stopped.
- In January 2014, India was declared polio-free after three years on zero cases, an achievement that is widely believed to have been spurred by the successful pulse polio campaign in which all children were administered polio drops.

## 41 The First 3-D Model of GluD1 Receptor

**Context:** Researchers at the Department of Biotechnology's Pune-based National Centre for Cell Science (NCCS) have captured 'three-dimensional views' of a protein called 'GluD1 receptor'.

### What has been founded?

- The researchers found that GluD1 receptors had an unprecedented domain organisation, distinct from that observed in other members of the glutamate receptor family.

- This shows that glutamate receptor ion channels are all not built the same way.
- Majority (60 percent) of excitatory brain signalling is carried out by glutamate receptor ion channels that are present on the synaptic junctions of neurons.
- Interestingly, while many other members of the family of glutamate receptor are activated by neurotransmitter glutamate binding, GluD1 receptors are not.
- This is a new discovery and could provide deeper insights into the molecular underpinnings of receptor functions.

### What are GluD1 receptors?

- GluD1 receptor is a subtype of a family of proteins called **glutamate receptors**.
- Simply put, GluD1 is a protein that in humans is encoded by the GRID1 gene.
- Several studies have shown a strong association between several variants of the GRID1 gene and increased risk of developing schizophrenia.
- It is a postsynaptic organizer of inhibitory synapses in cortical pyramidal neurons.
- GluD1 is selectively required for the formation of inhibitory synapses and regulates GABAergic synaptic transmission accordingly.

### Glutamate

- Glutamate is the most abundant neurotransmitter in our brain and central nervous system (CNS).
- It is involved in virtually every major excitatory brain function. Glutamate is also a metabolic precursor for another neurotransmitter called GABA (gamma-aminobutyric acid).
- ABA is the main inhibitory neurotransmitter in the central nervous system.
- **Glutamate receptors** play crucial roles in motor coordination and motor learning, high-frequency hearing and are also key to many other brain functions.
- Besides, they are linked to social and **cognitive deficits** and **neuronal disorders** like **Schizophrenia** and cocaine addiction.

## 2.5 Vaccine to control classical swine fever

**Context:** In order to check fall in pig population in India, the government unveiled a new indigenously developed vaccine for controlling classical swine fever, which is a highly contagious fatal pig disease.

### More on News:

- Classical swine fever (CSF), also known as hog cholera, is a contagious viral disease of domestic and wild swine.
- It is caused by a virus of the **genus Pest virus** of the family **Flaviviridae**, which is closely related to the viruses that cause **bovine viral diarrhoea** in cattle and **border disease** in sheep.
- **Clinical signs:** The virus that causes CSF varies in virulence. Some strains are highly virulent and cause acute (i.e. rapid) serious disease. Some strains are of low virulence and cause chronic (i.e. long-lasting) disease, others are intermediate causing sub-acute disease.
- There is only one serotype of CSF virus (CSFV).
- CSF is a disease listed by the OIE World Organisation for Animal Health (OIE) Terrestrial Animal Health Code and must be reported to the OIE (OIE Terrestrial Animal Health Code).

### The new vaccine:

- **Developer:** The new vaccine is developed by Uttar Pradesh-based ICAR-Indian Veterinary Research Institute (IVRI).

- **Cost:** It will be much cheaper than the existing one. It would cost only Rs 2 per dose compared to the current vaccine's rate of Rs 15-20 per dose and imported Korean vaccine rate of Rs 30 per dose.
- The new vaccine has been developed using Indian strain and lakhs of doses can be produced very easily using the **cell culture technology**.
- The new vaccine is safe and potent. It does not revert to virulence and provide protective immunity from day 14 of the vaccination till 24 months studied so far.

## 43 Coronavirus

**Context:** A new virus has been identified by Chinese researchers which is believed to be responsible for a new pneumonia-like illness that had swept Wuhan. The researchers described the infectious agent as a "coronavirus."

**More on News:**

- Coronaviruses are a specific family of viruses, with some of them causing less-severe damage, such as the common cold, and others causing respiratory and intestinal diseases.
- A coronavirus has many "regularly arranged" protrusions on its surface, because of which the entire virus particle looks like an emperor's crown, hence the name "coronavirus".
- Apart from human beings, coronaviruses can affect mammals including pigs, cattle, cats, dogs, martens, camels, hedgehogs and some birds.
- So far, there are four known disease-causing coronaviruses, among which the best known are the **SARS corona virus and the Middle East Respiratory Syndrome (MERS) coronavirus**, both of which can cause severe respiratory diseases.
- In the newly identified coronavirus, a direct link with the disease has not been established yet.

### India: State Disaster Response Fund (SDRF)

- The Centre said that it will treat the Novel Coronavirus outbreak as a notified disaster for the purpose of providing assistance under the State Disaster Response Fund (SDRF).
- In case of procurement of essential equipment, the expenditure will be incurred only from the SDRF and not the National Disaster Response Fund, NDRF. The total expenditure on equipment should not exceed 10 per cent of the annual allocation of the SDRF.
- World Health Organization, **WHO has declared Coronavirus as a pandemic.**

## 44 Lassa Fever

**Context:** The Nigerian Academy of Science has called for the current outbreak of Lassa fever in Africa's most populous nation to be declared a national health emergency because of its severity.

**More on News:**

- Lassa fever is a viral haemorrhagic disease caused by the Lassa virus (a member of the arenavirus family of viruses) which naturally infects the widely distributed house rat.
- **Transmission:** It is transmitted through the urine and droppings of infected rats found in most tropical and subtropical countries in Africa.

- **Communicable:** They are able to contaminate anything they come in contact with. The Lassa virus spreads through human to human contact with tissue, blood, body fluids, secretions or excretions.
- **Symptoms:** A fever is usually the first symptom followed by headaches and coughing, nausea and vomiting, diarrhoea, mouth ulcers and swollen lymph glands.
- **Treatment:** Lassa fever can be fatal, but it can be treated if diagnosed early.

## 45 Arsenic-Resistant Rice

**Context:** Researchers have developed and commercialised a rice variety that is resistant to arsenic.

### Muktoshri

- The new rice variety, Muktoshri, also called IET 21845, was developed jointly by the **Rice Research Station** at Chinsurah coming under West Bengal's **Agriculture** Departmentand the **National Botanical Research Institute,** Lucknow, over several years.
- These variety uptakes very less amount of arsenic from soil and water in comparison toother varieties of rice.
- The variety yields 5.5 metric tonnes per hectare in the Boro season and 4.5 to 5 metrictonnes per hectare in the Kharif season, respectively.

### Arsenic Contamination:

- Arsenic is naturally present athigh levels in the groundwaterof a number of countries. It is highly toxic in its inorganicform.
- Arsenic is one of WHO's 10 chemicals of major publichealth concern.
- It is now recognized that atleast 140 million people in 50 countries have been drinkingwater containing arsenicat levels above the WHOprovisional guideline value of **10 µg/L *(4)*.**
- According to the latest report of the **Central Ground Water Board (CGWB),** 21 statesacross the country have pockets with arsenic levels higher than the Bureau of IndianStandards' (BIS) stipulated permissible limit of **0.01 milligram per litre (mg/l).**
- In India, arsenic contamination was first officially confirmed in West Bengal in 1983. Close to four decades after its detection, the scenario has worsened, about 9.6 million peoplein West Bengal are at immediate risk from arsenic contamination in groundwater.
- **West Bengal** is among the States with the highest concentration of arsenic ingroundwater, with as many as 83 blocks across seven districts having higher arseniclevels than permissible limits.

## 46 WHO Guidelines on Naming a Disease

### Context:

- **The UN health agency has announced that "COVID-19" will be the official name of the deadly coronavirus from China.**
- **"Co" stands for "corona", "vi" for "virus" and "d" for "disease", while "19" is for the year, as the outbreak was first identified on December 31.**
- **WHO had earlier given the virus the temporary name of "2019-nCoV acute respiratory disease" and China's National Health Commission was temporarily calling it "novel coronavirus pneumonia" or NCP.**

### WHOGuidelines

- The WHO identified the best practices to name new human diseases in consultation and collaboration with the World Organisation for Animal Health (OIE) and the Food and Agriculture Organization of the United Nations (FAO).
- **Nomenclature Allowed**
  - According to the guidelines, name of a new disease should consist of a combination of terms. These terms consist of a generic descriptive term based on clinical symptoms (respiratory), physiological processes (diarrhoea), and anatomical or pathological references (cardic).
  - It can refer to specific descriptive terms such as those who are afflicted (infant, juvenile, and maternal), seasonality (summer, winter) and severity (mild, severe).
  - The name can also include other factual elements such as the environment (ocean, river), causal pathogen (coronavirus) and the year the new disease is first detected with or without mentioning the month.
  - The year is used when it becomes necessary to differentiate between similar events that happened in different years".
- **Nomenclature Not Allowed**
  - Besides, the WHO has also listed out the terms that should be avoided while naming a new disease.
  - WHO advises against using place names such as Ebola and Zika — where those diseases were first identified and which are now inevitably linked to them in the public mind.
  - More general names such as "Middle East Respiratory Syndrome" or "Spanish flu" are also now avoided as they can stigmatise entire regions or ethnic groups.
  - WHO also notes that using animal species in the name can create confusion, such as in 2009 when H1N1 was popularly referred to as "swine flu". This had a major impact on the pork industry even though the disease was being spread by people rather than pigs.
  - People's names — usually the scientists who identified the disease — are also banned, as are "terms that incite undue fear" such as "unknown" or "fatal".

## 47 Diabetes Atlas

**Context:** On the occasion of World Diabetes Day on 14th November, the International Diabetes Foundation (IDF) has released the ninth edition of the Diabetes Atlas.

### Findings of the Atlas

- **India continues to be home to the second-largest number of adults with diabetes worldwide**, with the latest data from the IDF putting the incidence at 77 million.
- The worldwide prevalence of diabetes has reached 9.3 percent with more than half (50.1 percent) of adults undiagnosed. Type 2 diabetes accounts for around 90 percent of all people with diabetes. **China is at the top of the list with over 116 million diabetics.**
- India is on the top of the table of a clutch of countries from Southeast Asia. Bangladesh,

**Key Facts:**

- The IDF is an umbrella organization of over 230 national diabetes associations in more than 160 countries and territories.
- World Diabetes Day was launched in 1991 by the IDF and the World Health Organization (WHO) in response to the rapid rise of diabetes around the world.
- The theme for diabetes awareness month and **World Diabetes Day 2019 is "Family and Diabetes".**

which is second on the list of top five countries with diabetes (20- 79 years) in South East Asia, however, has only 8.4 million diabetics.

- The rise in the number of people with type 2 diabetes is driven by various factors, including urbanisation, an ageing population, decreasing levels of physical activity and increasing levels of overweight people and obesity.
- More than 1.1 million children and adolescents younger than 20 years are living with type 1 diabetes. For reasons which are unknown, type 1 diabetes is also on the rise.
- Diabetes was responsible for an estimated $760 billion in health expenditure in 2019. The IDF estimates that 10% of global health expenditure is being spent on diabetes.

## 48 First Country to Introduce New Vaccine to Combat Typhoid

**Context:** Pakistan became the first country in the world to introduce a new typhoid vaccine.

**More on News:**

- This has been introduced in an effort to combat a drug-resistant strain of the potentially fatal disease in the Sindh province.
- Pakistan is suffering from drug-resistant typhoid fever since November 2016.
- The strain of Salmonella Typhi bacteria, which has become a so-called "superbug", has developed resistance towards old drugs.
- Vaccine - Typhoid Conjugate Vaccine (TCV), recommended by WHO in 2018 for infants and children over 6 months of age in typhoid-endemic countries.

**Typhoid**

- Typhoid fever is caused by the highly contagious Salmonella Typhi bacteria.
- The bacteria spread through contaminated food or water.
- Symptoms are prolonged fever, headache, nausea, loss of appetite, and constipation or sometimes diarrhoea.

## 49 Sexual Transmission of Dengue Viruses

**Context:** Recently, Spanish health authorities confirmed world's first case of dengue being transmitted through sex, which until recently was thought to be transmitted only by mosquitos.

**More on News:**

- Dengue is a viral disease (vector borne) transmitted mainly through the **Aedes Aegypti mosquito, which thrives in tropical climates.**
- There are 4 serotypes of the virus that causes dengue. These are known as DEN-1, DEN-2, DEN-3, DEN-4.
- Dengue causes flu-like symptoms and lasts for 2-7 days. Dengue fever usually occurs after an incubation period of 4-10 days after the bite of the infected mosquito.
- High Fever (40°C/ 104°F) is usually accompanied by at least two of the following symptoms: headaches, pain behind eyes, nausea, vomiting, swollen glands, joint, bone or muscle pains and rash.
- There is no vaccine or specific medication for dengue fever. Patients should seek medical advice, rest and drink plenty of fluids.

## 50 New HIV subtype found by Genetic Sequencing

**Context:** Recently, a new subtype of the Human Immunodeficiency Virus (HIV) that causes AIDS has been identified through genome sequencing. It is called HIV-1 Group M, subtype L. Such a discovery was made for first time in two decades.

### More on News:

- There are two major types of the human immunodeficiency virus. HIV-1, representing the vast majority of infections worldwide, while HIV-2 is far less common and primarily concentrated in the west and central African regions.
- Group M viruses are responsible for the global pandemic, which can be traced back to the Democratic Republic of Congo (DRC) in Sub-Saharan Africa.

## 51 Global Tuberculosis Report

**Context:** World Health Organization released its annual Global Tuberculosis Report for 2019.

### Major findings of the report

- The world is not on track to reach the 2020 milestones of the **End TB Strategy.** For instance:
  - The END TB strategy by the WHO aimed to reduce TB by 20 percent from 2015-18. However, between 2015 and 2018, only 6.3 percent TB cases showed a cumulative decline.
  - The End TB Strategy milestone of 35 percent decrease by 2020.
- **Funding challenges:**
  - In 2019, the low- and middle-income countries, accounting for 97 percent of reported TB cases, received a global funding of $6.8 billion. This amount is $3.3 billion less than the $10.1 billion estimated to be required in the Stop TB Partnership's Global Plan to End TB 2018–2022.
  - Also, it is only just over half of the global target of at least US$ 13 billion per year by 2022 that was agreed at the UN high-level meeting on TB.
  - Funding gap for TB research was US$ 1.2 billion in 2017.
- **Under reporting of the cases:** Of the 10 million new cases worldwide, 3 million cases went unreported to the authorities. In India 1.99 million of the 2.69 million in India were reported.
- Globally, TB claimed 15 lakh lives in 2018, including 2.51 lakh with HIV. The 15lakh included 4.49 lakh deaths in India (9,700 lakh had HIV), down from over 6 lakh in 2000.
- **66 percent of that burden came from eight countries:** India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (6%), Nigeria (4%), Bangladesh (4%), and South Africa (3%).
- Based on survey conducted in 14 countries the percentage facing total costs that were catastrophic ranged from 27% to 83% for all forms of TB, and from 67% to 100% for drug resistant TB.

#### WHO- End TB Strategy

- **Vision**: A world free of TB with zero deaths, disease and suffering due to TB.
- It has three high-level, overarching indicators and related targets:
  - 95% reduction by 2035 in number of TB deaths compared with 2015.
  - 90% reduction by 2035 in TB incidence rate compared with 2015.
  - Zero the level of catastrophic costs for TB-affected families by 2035.

- **Key five risk factors attributable to new cases of TB**: undernourishment, smoking (especially among men), alcohol abuse, HIV infection, and diabetes.
- Other findings with respect to India
  - **Fall in total TB incidence rate:** The total TB incidence rate in India has decreased by 50,000 patients over the past one year. In 2017, India had 27.4 lakh TB patients, which came down to 26.9 lakh in 2018.
  - **TB incidence rate in India** dropped from almost 300 per lakh population in 2000 to 199/lakh in 2018, as compared to a global decline from 170/lakh to 132/lakh.
  - **Increased diagnosis:** The number of patients being diagnosed for resistance to rifampicin (one of the frontline TB drugs) increased from 32 percent in 2017 to 46 percent in 2018 due to mandatory testing for resistance.
  - The number of drug-resistant cases detected increased from 38,000 in 2017 to 58,000 in 2018. This is good because these cases would normally go undetected and continue to spread drug-resistant TB.
  - Treatment success rate increased to 81 percent for new and relapse cases (drug-sensitive) in 2017, which was 69 percent in 2016.
  - Children below 14 years comprised 6 percent of patients and women were 34 percent.

## 52 Penicillin To Cure Rheumatic Heart Disease

**Context:** In a bid to fight drug resistance and tackle rheumatic heart disease, the government is planning a revival of penicillin, one of the oldest antibiotics known to man.

### More on News:

- The government is planning to procure penicillin centrally for three years and give it to all children between 5-15 years who have a sore throat, at least once. The drug will be dispensed through primary health centres or administered by ASHAs.
- **Penicillins**
  - These are a group of antibacterial drugs that attack a wide range of bacteria..
  - Penicillin, discovered in 1928 is one of the oldest antibiotics and in many western countries still remains the first antibiotic. Yet in India it has almost gone out of the market because of price control. The prices were kept so low that manufacturers stopped making the drug.
  - People generally attribute the discovery of penicillins to Alexander Fleming.
- **Rheumatic Heart Disease(RHD)** is damage to one or more heart valves that remains after an episode of acute rheumatic fever (ARF) is resolved. It is caused by an episode or recurrent episodes of ARF, where the heart has become inflamed.
- Population-based studies indicate the prevalence of rheumatic heart disease in India to be about 2/1000 population. However, surveys conducted in school children in the age group of 5-16 years by ICMR give overall prevalence of 6/1000.
- Rheumatic fever is endemic in India and remains one of the major causes of cardiovascular disease, accounting for nearly 25-45% of acquired heart disease.

## 53 Second Poliovirus Strain Eradicated

**Context:** World Health Organisation (WHO) recently announced on World Polio Day (October 24), that wild poliovirus type 3 (WPV3) has been eradicated worldwide. This follows the eradication of smallpox and wild poliovirus type 2.

**More on News:**

- Commitment from partners and countries, coupled with innovation, means that of the three wild polio serotypes, only type one remains.
- There are three individual and immunologically distinct wild poliovirus strains: wild poliovirus type 1 (WPV1), wild poliovirus type 2 (WPV2) and wild poliovirus type 3 (WPV3).
- Symptomatically, all three strains are identical, in that they cause irreversible paralysis or even death. But there are genetic and virological differences, which make these three strains three separate viruses that must each be eradicated individually.
- Poliomyelitis (polio) is a highly infectious viral disease, which mainly affects young children.
- The virus is transmitted by person-to-person spread mainly through the faecal-oral route or, less frequently, by a common vehicle and multiplies in the intestine, from where it can invade the nervous system and can cause paralysis. The polio vaccine was developed in 1953 and made available in 1957.

## 54 Elephant Endotheliotropic Herpesvirus

**Context:** Since the middle of August, a rare disease has killed five elephants in Odisha.

**More on News:**

- The disease is caused by a virus called EEHV, or elephant endotheliotropicherpesvirus.
- The four deaths in NandanKanan Zoo are the first reported cases of EEHV-related deaths in an Indian zoo, while the death in the forest too is the first known such case in the wild in India.
- EEHV is a type of herpesvirus that can cause a highly fatal haemorrhagic disease in young Asian elephants.
- Most elephants like most humans carry a cold virus. When EEHV is triggered, the elephant dies of massive internal bleeding and symptoms which are hardly visible.
- The disease is usually fatal, with a short course of 28-35 hours. Further, there is no true cure for herpesviruses in animals or in humans.

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# 5

# ALTERNATIVE TECHNOLOGIES

## 1 Facial Recognition

**Context:** The Automated Facial Recognition System (AFRS) has been proposed by the Ministry of Home Affairs that aims to modernise the police force by identifying criminals and also enhances information sharing between police units across the country.

### Automated Facial Recognition System (AFRS)

- The AFRS will use images from sources like CCTV cameras, newspapers, and raids to identify criminals against existing records in the **Crime and Criminal Tracking Networks and System** (CCTNS) database, which is managed by **National Crime Record Bureau**.
- The new facial recognition system will also be integrated with **Integrated Criminal Justice System** (ICJS), as well as state-specific systems, the **Immigration, Visa and Foreigners Registration & Tracking** (IVFRT), and the **KhoyaPaya portal** on missing children.
- It works by maintaining a large database with photos and videos of peoples' faces.

**Criminal Tracking Network & Systems (CCTNS)**

- It is a countrywide integrated database on crime incidents and suspects, connecting FIR registrations, investigations, and charge sheets of all police stations and higher offices.
- It also plans to offer citizen services, such as passport verification, crime reporting, online tracking of case progress, grievance reporting against police officers.

- Then, a new image of an unidentified person is compared to the existing database to find a match and identify the person.
- Neural networking is the artificial intelligence technology used for pattern-finding and matching.
- It will not only create a biometric map of our faces, but also track, classify, and possibly anticipate our every move.
- The system will treat each person captured in images from CCTV cameras and other sources as a potential criminal, creating a map of her face, with measurements and biometrics, and match the features against the CCTNS database.
- This means that we are all treated as potential criminals when we walk past a CCTV camera — turning the assumption of "innocent until proven guilty" on its head.
- Accuracy rates of facial recognition algorithms are particularly low in the case of minorities, women and children, as demonstrated in multiple studies across the world.
- Use of such technology in a criminal justice system where vulnerable groups are over-represented

makes them susceptible to being subjected to false positives (being wrongly identified as a criminal).

## 2 NASA's all-electric Aircraft

**Context:** Recently NASA showcased an early version of its first all-electric experimental aircraft X-57 Maxwell at its aeronautics lab in the California desert.

### More on News::

- The Maxwell is the latest in a line of experimental aircraft NASA has developed over many decades for many purposes, including the bullet-shaped Bell X-1 that first broke the sound barrier and the X15 rocket plane flown by Neil Armstrong before he joined the Apollo moon team.
- NASA's X-57 venture is aimed at designing and proving technology according to standards that commercial manufacturers can adapt for government certification.
- These will include standards for airworthiness and safety, as well as for energy efficiency and noise.
- Because electric motor systems are more compact with fewer moving parts than internal-combustion engines, they are simpler to maintain and weigh much less, requiring less energy to fly and are quieter than conventional engines.
- The challenge is improving battery technology to store more energy to extend the plane's range, with faster re-charging.
- Due to current battery limitations, the Maxwell's design is envisioned for use in short-haul flights as an air-taxi or commuter plane for a small number of passengers.

## 3 Elastocaloric Effect

**Context:** Researchers from multiple universities, including Nankai University in China, have found that the elastocaloric effect, if harnessed, may be able to do away with the need of fluid refrigerants used in fridges and air-conditioners.

### What is Elastocaloric effect?

- When rubbers bands are twisted and untwisted, it produces a cooling effect. This is called the "elastocaloric" effect.
- In the elastocaloric effect, the transfer of heat works much the same way as when fluid refrigerants are compressed and expanded.
- When a rubber band is stretched, it absorbs heat from its environment, and when it is released, it gradually cools down.

### Methodology

- In order to figure out how the twisting mechanism might be able to enable a fridge, the researchers compared the cooling power of rubber fibres, nylon and polyethylene fishing lines and nickel-titanium wires. They observed high cooling from twist changes in twisted, coiled and supercoiled fibres.
- The level of efficiency of the heat exchange in rubber bands is comparable to that of standard refrigerants and twice as high as stretching the same materials without twisting.

- The researchers suggested that their findings may lead to the development of greener, higherefficiency and low-cost cooling technology.

## 4 Microbial Fuel Cells

**Context:** The Zoological Society of London, recently announced that a fern at the London Zoo has started taking its own selfies. The feat has been achieved by installing microbial fuel cells in Pete, a maidenhair fern.

### More on News::

- Microbial fuel cells are devices that use bacteria as the catalysts to oxidise organic and inorganic matter and convert chemical energy to electrical energy and generate current.
- Plants naturally deposit biomatter as they grow, which in turn feeds the natural bacteria present in the soil, creating energy that can be harnessed by fuel cells and used to power a wide range of vital conservation tools remotely, including sensors, monitoring platforms and camera traps.

### Mechanism:

- Under sunlight, plants produce sugars and oxygen from water and $CO_2$ (photosynthesis). These sugars do not remain in the leaves but are transported throughout the plant to the stem and roots.
- Some of these sugars are excreted by the roots as a waste product from the plant. Soil microorganisms break this down further, releasing energy, which is captured using an anode and a cathode and charges a super capacitor. When the super capacitor is full, the power is discharged and a photo is taken.

## 5 India ranks third in research on Artificial Intelligence

- India ranks third in the world in terms of high quality research publications in artificial intelligence (AI) but is at a significant distance from world leader China, according to an analysis by research agency Itihaasa.
- The agency computed the number of 'citable documents'— the number of research publications in peer-reviewed journals — in the field of AI between 2013-2017 as listed out by Scimago, a compendium that tracks trends in scientific research publications. China has emerged as the world leader in this field.

## 6 Eugenics

### Context: Eugenics in relation to Jeffrey Epstein

### More on News::

- Eugenics is the science of improving the human species by selectively mating people with specific desirable hereditary traits.
- It aims to reduce human suffering by "breeding out" disease, disabilities and so-called undesirable characteristics from the human population.
- Modern eugenics, more often called human genetic engineering, has come a long way scientifically and ethically and offers hope for treating many devastating genetic illnesses.

- While eugenic principles have been practiced as early as ancient Greece, the contemporary history of eugenics began in the early 20th century, when a popular eugenics movement emerged in the United Kingdom,
- A major criticism of eugenics policies is that, regardless of whether negative or positive policies are used, they are susceptible to abuse because the genetic selection criteria are determined by whichever group has political power at the time.
- Negative eugenics in particular is criticized by many as a violation of basic human rights, which include the right to reproduce.

## 7 Artificial Intelligence – Based Solutions to Combat TB

**Context:** The Health Ministry has signed a Memorandum of Understanding (MoU) with Wadhwani Institute for Artificial Intelligence (AI) to explore the application of Artificial Intelligence technology in its fight against tuberculosis (TB) in 2019.

**More on News::**

- **Revised National TB Programme (RNTCP) aims** at adoption of AI technologies for building easy TB combats. RNTCP is **the state-run tuberculosis (TB) control initiative** of the Government of India.
- As per **the National Strategic Plan 2012–17,** the program has a vision of achieving a "**TB free India",** and aims to achieve Universal Access to TB control services.
- As part of the collaboration, Wadhwani AI would support the National TB programme by helping it become AI-ready which includes developing, piloting, and deploying AI-based solutions. It would support the programme in vulnerability and hot-spot mapping, modeling novel methods of screening and diagnostics.

## 8 eSIM

**Context:** The new technology which would remove the need to have a physical SIM card

**More on News::**

- An eSIM is exactly what it sounds like an **electronic, or embedded, SIM**. Instead of a physical card, SIM technology is built right into your phone. It's a small chip that's used to authenticate your identity with your carrier.
- One of the advantages of eSIM technology is that it makes it much **easier to switch carriers**. Instead of having to order a new SIM and wait around for it to arrive, you can switch to a new carrier straight from your phone.
- eSIM technology **supports multiple accounts** and switching between them is super easy.
- It will help make **devices smaller**.
- It could be extremely helpful for **wearables devices.**

## 9 Hydrogen-Based Cars

**Context:** Recently, Supreme Court has asked government to look into the feasibility of hydrogen-based technology to deal with vehicular air pollution in capital.

### More on News::

- A hydrogen car is a vehicle that uses hydrogen fuel for motive power.
- Hydrogen vehicles include hydrogen-fueled space rockets, as well as automobiles and other transportation vehicles.
- The power plants of such vehicles **convert the chemical energy of hydrogen to mechanical energy** either by burning hydrogen in an internal combustion engine, or by reacting hydrogen with oxygen in a fuel cell to run electric motors.
- Widespread **use of hydrogen for fueling transportation is a key element of a proposed hydrogen economy.**
- **India is looking closely at Japan**, which has made progress in this field.

### How does the hydrogen fuel cell work?

- At the heart of the fuel cell electric vehicles (FCEV) is a device that uses a source of fuel, such as hydrogen, and an oxidant to create electricity by an electrochemical process.
- The fuel cell combines hydrogen and oxygen to generate electric current, water being the only byproduct.
- Like conventional batteries under the bonnets of automobiles, hydrogen fuel cells too convert chemical energy into electrical energy.
- From a long-term viability perspective, FCEVs are billed as vehicles of the future, given that hydrogen is the most abundant resource in the universe.

## 10 NEON: The Virtual Human

**Context:** NEON was one of the most-discussed new concepts at the annual Consumer Electronics Show (CES) held in Las Vegas in 2020.

### More on News::

- NEONs, being called the world's first artificial humans, have been created by Samsung's Star Labs headed by Pranav Mistry, an India - born scientist.
- NEONs are computationally created virtual humans — the word derives from **NEO (new) + humaN.**
- For now the virtual humans can show emotions when manually controlled by their creators. But the idea is for NEONs to become intelligent enough to be fully autonomous, showing emotions, learning skills, creating memories, and being intelligent on their own.
- A virtual human is a Computer Generated (CG) human simulation with artificial intelligence. A virtual human can have a CG human body, and CG voice and computer empowered senses. Virtual humans can be applied in various domains such as education, marketing, branding, training & sales.
- Star Labs started work on NEONs by trying to replicate a friend. Initially, the models were trained on his face, and there were significant errors. But then, they started getting better, almost indistinguishable from the original.

### How does it work?

- There are two core technologies behind virtual humans:
  - First, there is the proprietary CORE R3 technology that drives the "reality, real time and responsiveness" behind NEONs.
  - It is the front-end reality engine that is able to give you that real expression.

- The company claims CORE R3 "leapfrogs in the domains of Behavioral Neural Networks, Evolutionary Generative Intelligence and Computational Reality", and is "extensively trained" on how humans look, behave and interact.
- But in the end, it is like a rendition engine, converting the mathematical models to look like actual humans.
- The next stage will be SPECTRA, which will complement CORE R3 with the "spectrum of intelligence, learning, emotions and memory".
- But SPECTRA is still in development, and is not expected before NEONWORLD 2020 later this year.

## 11 Hyper loop Technology

**Context:** The proposed Pune-Mumbai Hyper loop project, an ultra-modern transport system that will reduce the travelling time between the two cities to 25 minutes from 2.5-3 hours, may be scrapped by the state government.

### What is the Hyper loop technology?

- In 2012, Elon Musk, co-founder of Tesla, Inc and several other firms, unveiled his vision of the new transport system, which he called a 'Hyper loop'.
- It is envisioned as a transport system which would never crash and would be immune to weather's vagaries.
- It would also be thrice or four times as fast as a bullet train, with an average speed that would be twice of an aircraft.
- It could be passenger-packed pods which would travel through long tubes at 1,220 km/h, using solar energy.
- The Hyper loop project could be the right solution for high-traffic city pairs which are about 1,500 km apart.
- The high speed is achieved as the pods, which carry passengers, move using magnetic levitation.
- The speed increases further due to the near-vacuum conditions inside the tubes, which reduce resistance to the pod as it travels within the tube.

## 12 Biorock or Mineral Accretion Technology

**Context:** The Zoological Survey of India (ZSI), with help from Gujarat's forest department, is attempting for the first time a process to restore coral reefs using biorock or mineral accretion technology.

### Locating the biorock:

- Biorock is the name given to the substance formed by electro accumulation of minerals dissolved in seawater on steel structures that are lowered onto the sea bed and are connected to a power source, in this case solar panels that float on the surface.
- A biorock structure has been installed one nautical mile off the Mithapur coast in the Gulf of Kachchh.
- The location for installing the biorock had been chosen keeping in mind the high tidal amplitude in the Gulf of Kachchh.

- The low tide depth where the biorock has been installed is four metres, and at high tide it is about eight metres.

### About the technology:

- Mineral Accretion Technology is a coral reef restoration technology that utilizes **low voltage electricity** to improve the health and growth rates of corals and other marine organisms.
- The technology works by passing a small amount of electrical current through electrodes in the water.
- When a positively charged anode and negatively charged cathode are placed on the sea floor, with an electric current flowing between them, calcium ions combine with carbonate ions and adhere to the structure (cathode).This results in calcium carbonate formation. Coral larvae adhere to the $CaCO_3$ and grow quickly.
- Fragments of broken corals are tied to the biorock structure, where they are able to grow at least four to six times faster than their actual growth as they need not spend their energy in building their own calcium carbonate skeletons.

## 13 Govt to Host Artificial Intelligence Summit 'RAISE 2020'

**Context:** India will organize its first Artificial Intelligence summit- "RAISE 2020: Responsible AI for Social Empowerment 2020" between April 11-12, 2020 in New Delhi.

### More on News::

- **Organized by -** the union government in coordination with the Union Ministry of Electronics and Information Technology.
- The two-day summit will be organized to spearhead social empowerment, inclusion and transformation.
- **Aim -** To outline India's vision for using the power of AI responsibly to transform the social landscape for a better future.
- The summit will enable the smooth exchange of ideas to create mass awareness about the need to ethically develop and practice AI in the digital era.

## 14 Biofuel from Microorganisms

**Context:** Recently, International Centre for Genetic Engineering and Biotechnology (ICGEB) scientists developed a method to improve the growth rate and sugar content of a marine microorganism.

### More on News::

- They have successfully engineered a marine cyanobacterium called Synechococcus sp. PCC 7002, which showed a higher growth rate and sugar (glycogen) content of the cells, which will help in biofuel production.
- Generally, sugars come from the photosynthesisin plants that converts carbon

**International Centre for Genetic Engineering and Biotechnology (ICGEB)**

- The ICGEB is an intergovernmental organisation established as a special project of United Nations Industrial Development Organization, in 1983.

dioxide into biological components such as sugars, proteins and lipids.

- However, Cyanobacteria (blue-green algae) can also perform photosynthesis and produce sugar by fixing the carbon dioxide in the atmosphere. Further, cyanobacterial biomass provides a nitrogen source in the form of proteins.
- Bio fuel is any hydrocarbon fuel that is produced from organic matter (living or once living material) in a short period of time.

- The Organisation has three Component laboratories in: Trieste, Italy; New Delhi, India; Cape Town, South Africa.
- It became fully autonomous since 1994 and is running 46 laboratories and forms an interactive network with over 65 Member States.
- It operates within the United Nations Common System, as Centre of excellence for Research, Training and Technology Transfer to industry to promote sustainable global development.

## 15 Indian Brain Atlas (IBA 100)

**Context:** Researchers at the International Institute of Information Technology, Hyderabad (IIIT Hyderabad) have created the first ever Indian Brain Atlas known as IBA 100.

**More on News::**

- To construct this Indian population-specific human brain atlas, the researchers took MRI scans of 100 Indians.
- The study from this atlas has revealed the average brain size of an Indian was smaller in height, width and volume in comparison to people of the Caucasian and eastern (Chinese and Korean) races.
- Until now, Montreal Neurological Institute (MNI)'s Caucasian brains were used as standard to study brain. So, these MNI templates were not ideal for Indian population due to difference in ethnicity and ran the risk of misdiagnosis due to the difference in size of the brains.
- IBA 100 will help in better/early diagnosis of Alzheimer's and other brain-related ailments.
- The MNI and International Consortium for Brain Mapping (ICBM) had created first-ever digital human brain atlas in 1993.

## 16 Winter-Grade Diesel for High Altitude Regions

**Context: Indian Oil Corporation (IOC) has launched a special winter-grade diesel for high altitude regions like Ladakh.**

**More on News::**

- In regular diesel fuel, paraffin wax is added to improve for improving viscosity and lubrication but at low temperatures of -30° Celsius, it thickens or "gels" leading to freezing of diesel.
- The winter-grade diesel developed by IOC has a low pour point of -33° Celsius which means that it has certain additives that enable the fuel to remain fluid in extremely low temperatures during the winter months in high-altitude sectors like Ladakh or Kargil.
- **Pour Point - It is the temperature below which the liquid loses its flow characteristics.**
- It is likely to reduce the hardships faced by the local people for transportation and mobility during winter months, helping facilitate the local economy and tourism.

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# 6

# SCHEMES & INITIATIVES

## 1 UNNATI

**Context:** India announced a capacity building programme UNNATI (UNispace Nanosatellite Assembly & Training) on Nano-satellites development through a combination of theoretical coursework and hands-on training on Assembly, Integration and Testing (AIT).

**UNNATI**

- Itis an initiative by ISRO to commemorate the 50th anniversary of the first United Nations conference on the exploration and peaceful uses of outer space (UNISPACE-50).
- The programme provides opportunities to the participating developing countries to strengthen in assembling, integrating and testing of Nanosatellites.
- The programme aims at capacity building in satellite technology for participants from countries interested in developing space programme by providing hands-on experience in building and testing of Nanosatellites.
- UNNATI programme is planned to be conducted for 3 years by U.R. Rao Satellite Centre of ISRO in 3 batches and will target to benefit officials of 45 countries.

## 2 National Policy on Software Products – 2019

**Context: The National Policy on Software Products (NPSP) – 2019 has been approved by the Union Cabinet to develop India as a Software Product Nation.**

**More on News:**

- Initially, an outlay of Rs.1500 crore is involved to implement the programmes/ schemes envisaged under this policy over the period of 7 years. Rs1500 crore is divided into Software Product Development Fund (SPDF) and Research & Innovation fund.
- **"Software Product Development Fund'** will participate in venture funds having objectives aligned to this policy and so can leverage private investments targeted to promote software product ecosystem. The SPDF will be financially managed by a professional financial institution.
- The policy proposes to create a ₹5,000-crore fund with industry participation to promote emerging technology such as Internet of Things, Artificial Intelligence, Blockchain, Big Data and robotics. Of this, government contribution will be ₹1,000 crore.

- The Policy will lead to the formulation of several schemes, initiatives, projects and measures for the development of Software products sector in the country as per the roadmap envisaged therein.

### Five Missions of NPSP-2019:

- To promote the creation of a sustainable Indian software product industry, driven by intellectual property (IP), leading to a ten-fold increase in India share of the Global Software product market by 2025. The objective of the programme will be to promote IP driven software product entrepreneurship. The programme with a budgetary outlay of ₹500 crore will provide financial support to MSMEs and will have matching contribution from the government and the industry
- To nurture 10,000 technology startups in software product industry, including 1000 such technology startups in Tier-II and Tier-III towns & cities and generating direct and in-direct employment for 3.5 million people by 2025.
- To create a talent pool for software product industry through (i) up-skilling of 1,000,000 IT professionals, (ii) motivating 100,000 school and college students and (iii) generating 10,000 specialized professionals that can provide leadership.
- To build a cluster-based innovation driven ecosystem by developing 20 sectoral and strategically located software product development clusters having integrated ICT infrastructure, marketing, incubation, R&D/test-beds and mentoring support. The Policy will encourage innovation towards solving societal challenges.
- In order to evolve and monitor scheme & programmes for the implementation of this policy, National Software Products Mission will be set up with participation from Government, Academia and Industry.

## 3 Statement of Intent between Atal Innovation Mission and Adobe

**Context:** Recently, NITI Aayog'sAtal Innovation Mission (AIM) and Adobe signed a Statement of Intent (SOI) to collectively develop creative skills and spread digital literacy across all Atal Tinkering Labs in India.

### More on News:

- Adobe will adopt 100 schools under Atal Tinkering Labs (ATL) initiative.
- It will be implementing its Digital Disha Program in ATLs, under which free licenses of Adobe Spark premium shall be offered to ATLs.

### Atal Innovation Mission

- It is a flagship initiative set up by the NITI Aayog to promote innovation and entrepreneurship across the country.
- It is envisaged as an umbrella innovation organization that would play an instrumental role in alignment of innovation policies between central, state and sectoral innovation schemes.
- Long term goals of AIM include establishment and promotion of Small Business Innovation Research and Development at a national scale.

### Atal Tinkering Labs- to promote creative, and innovative mind set in schools

- AIM is setting up state of the art ATL in schools across all districts in India.
- These ATLs are dedicated innovation workspaces of 1200-1500 square feet where do-it-yourself (DIY) kits on latest technologies like 3D Printers, Robotics, Internet of Things (IOT), Miniaturized electronics are installed using a grant of Rs 20 Lakhs from the government so that students from Grade VI to Grade XII can tinker with these technologies and learn to create innovative solutions using these technologies.

### Atal Incubators (AIC) – promoting entrepreneurship in universities and industry

- At the university, NGO, SME and Corporate industry levels, AIM is setting up world-class Atal Incubators that would trigger and enable successful growth of sustainable startups in every sector /state of the country
- It is aimed at providing a grant of uptoRs 10 Crores to successful applicants for setting up greenfield incubators or scaling up existing ones.
- Women led incubators and entrepreneurial startups are strongly encouraged by AIM.

## 4 National Mission on Transformative Mobility and Battery Storage

**Context:** The Union Cabinet chaired recently approved the setting up of a National Mission on Transformative Mobility and Battery Storage, to drive clean, connected, shared, sustainable and holistic mobility initiatives.

### More on News:

- Other than setting up of a National Mission on Transformative Mobility and Battery Storage followings were also approved:
- Phased Manufacturing Programme (PMP) valid for 5 years till 2024 to support setting up of a few large-scale, export-competitive integrated batteries and cell-manufacturing Giga plants in India.
- Creation of a PMP valid for 5 years till 2024 to localize production across the entire Electric Vehicles value chain.

### National Mission on Transformative Mobility and Battery Storage

- The Mission with an Inter-Ministerial Steering Committee will be **chaired by CEO NITI Aayog.**
- The Mission will recommend and drive the **strategies for transformative mobility and Phased Manufacturing Programmes** for EVs, EV Components and Batteries.
- A **Phased Manufacturing Program (PMP)** will be launched to localize production across the entire EV value chain.
- It will determine the contours of PMP, and will finalise the details of such a program.
- The details of the value addition that can be achieved with each phase of localisation will be finalised by the Mission with a clear Make in India strategy for the electric vehicle components as well as battery.
- The Mission will coordinate with key stakeholders in Ministries/ Departments and the states to integrate various initiatives to transform mobility in India.
- A phased roadmap to implement battery manufacturing at Giga-scale will be considered with initial focus on large-scale module and pack assembly plants by 2019-20, followed by integrated cell manufacturing by 2021-22.
- Details of the PMP for Batteries shall be formulated by the Mission. The Mission will ensure holistic and comprehensive growth of the battery manufacturing industry in India.
- It will prepare the necessary roadmap that will enable India to leverage upon its size and scale to produce innovative, competitive multi-modal mobility solutions that can be deployed globally in diverse contexts.
- It will define the roadmap for transformative mobility in “New India” by introducing a sustainable mobility ecosystem and fostering Make-in-India to boost domestic manufacturing and employment generation in the country.

# 5 Food Fortification

**Context:** To tackle the menace of Malnutrition, NITI Aayog seeks creation of roadmap by Department of Food and Public Distribution for taking the Rice Fortification Pilot Scheme Pan India.

## More on News:

- The government had approved centre-sponsored pilot scheme on "**Fortification of Rice and its Distribution under Public Distribution System**".
- Under this scheme **rice is fortified with Iron, Folic Acid and Vitamin B-12**. The Pilot Scheme had been approved for a period of three year beginning 2019-20.
- Under the budget a total Rs 42.65 crore had been allocated.
- Currently, the scheme focuses **on 15 districts preferably 1 district per State during the initial phase of implementation.**
- The operational responsibilities for implementation of the pilot scheme lie with states which fortifies the rice for distribution through Public Distribution System (PDS).
- This scheme will **now be implemented across the country**.

## Food fortification in India

- India's National Nutritional strategy, 2017, had listed food fortification as one of the interventions to address anaemia, vitamin A and iodine deficiencies apart from supplementation and dietary diversification.
- The **Food Safety and Standards Authority of India (FSSAI)** made standards for fortification in the Food Safety and Standards (Fortification of Foods) Regulations, 2018, for five staples — **wheat, rice, milk, oil and salt.**
- The standards are given for **wheat and rice fortification with iron, folic acid, and vitamin B12**, the deficiency of which cause anaemia. Besides, **other B vitamins** are also added.
- Standards are provided for **oil and milk fortification with vitamin A and vitamin D**; **and salt fortification** with iron along with iodine to prevent goitre.
- The food companies who wish to add micronutrients to these staples sold in the packages will also have to follow the standards set by FSSAI. If the product is fortified according to the standards, the package **will carry an F+ label**.
- The Union Ministries of Women and Child Development, Human Resource Development and Consumer Affairs, Food and Public Distribution have mandated the **distribution of fortified wheat flour, rice, oil and double fortified salt in their schemes** — Integrated Child Development Services (ICDS) and Mid-Day Meal (MDM) and Public Distribution System (PDS) respectively.

Some of the important features of **Food Safety and Standards (Fortification of Foods) Regulations, 2018** are as follows:

- It prescribes the standards of addition of micronutrients for the purpose of food fortification.
- The manufacturers of the fortified food are required to provide a quality assurance undertaking.
- Packaging and labelling of the fortified food **must state the food fortificant added, logo and the tagline "Sampoorna Poshan SwasthJeevan**".
- It should be in compliance to the Food Safety and Standards (Packaging and Labelling) Regulations, 2011.

## 6 National Animal Disease Control Programme

**Context:** Prime Minister has launched National Animal Disease Control Programme and National Artificial Insemination Programme.

### More on News:

- National Animal Disease Control Programme (NADCP)
  - It has been launched for eradicating the **foot and mouth disease and brucellosis** in livestock.
  - It aims to **control** the livestock diseases by 2025 and **eradicate** these by 2030.
  - It aims at **vaccinating** over 500 million livestock including cattle, buffalo, sheep, goats and pigs against the FMD.
  - It also aims at **vaccinating 36 million female bovine calves** annually in its fight against the brucellosis disease.
  - **Funding**: It is a 100% **centrally funded** programme for a period from 2019 to 2024.

### National Artificial Insemination Programme:

- It has been launched in all the **Krishi Vigyan Kendras (KVKs)**.
- It is launched across the country for **vaccination and disease management, Artificial Insemination and Productivity.**

## 7 Samudrayaan Project

**Context:** India to join developed nations in ocean studies with 'Samudrayaan' project

### More on News:

- The 'Samudrayaan' is a part of the Ministry of Earth Sciences' pilot project for deep ocean mining for rare minerals.
- The project proposes to send a submersible vehicle with three persons to a depth of about 6000 metres to carry out deep underwater studies.
- The indigenously developed vehicle is capable of crawling on the sea bed at a depth of six kilometre for 72 hours.
- Similar to ISRO's plan to carry persons on a space mission, NIOT has undertaken Samudrayaan. The ₹200 crores project proposes to carry three persons in a submersible vehicle to a depth of 6000 metres under sea for various studies.

## 8 UMMID Initiative

**Context:** The Union Minister for Science & Technology, Earth Sciences and Health & Family Welfare, Dr. Harsh Vardhan launched UMMID (Unique Methods of Management and treatment of Inherited Disorders) initiative and inaugurated NIDAN (National Inherited Diseases Administration) Kendras.

### More on News:

- The Department of Biotechnology (DBT) has started the UMMID**(Unique Methods of Management and treatment of Inherited Disorders)** Initiative which is designed on the concept of 'Prevention is better than Cure'.
- **UMMID aims** to create awareness about genetic disorders amongst clinicians to establish molecular diagnostic in hospitals.

### Goals of UMMID initiative:

- To establish **NIDAN (National Inherited Diseases Administration) Kendras** to provide counselling, prenatal testing and diagnosis, management, and multidisciplinary care in Government Hospitals wherein the influx of patients is more.
- To produce skilled clinicians in Human Genetics.
- To undertake screening of pregnant women and new born babies for inherited genetic diseases in hospitals at aspirational districts.

## 9 BHIM 2.0

**Context:** The Ministry of Electronics and Information Technology launched BHIM 2.0.

### Features of BHIM:

- **Send Money:** Money can be sent by entering Virtual Payment Address (UPI ID), Account number and QR Scan.
- **Request Money:** Money can be collected by entering Virtual Payment Address (UPI ID). Additionally through BHIM App, one can also transfer money using Mobile No. (Mobile No should be registered with BHIM or *99# and account should be linked).
- **Scan & Pay:** Easy payment by scanning the QR code through Scan & Pay.
- **Profile:** You can view the static QR code and Payment addresses linked to your account. You can also share the QR code through various messenger applications like WhatsApp, Email etc. available on phone and can also download the QR code.
- **Bank Account:** BHIM provides switching between multiple bank accounts linked with BHIM App.
- **Language:** Currently BHIM is available in **13 languages, i.e., Hindi, English, Tamil, Telugu, Malayalam, Bengali, Odia, Kannada, Gujarati, Marathi, Assamese and Bengali**.

### Features and benefits of BHIM 2.0:

- **Linking of overdraft account:** In addition to current and savings accounts, customers can link their overdraft account to UPI. Customers will be able to transact instantly and all benefits associated with overdraft account shall be made available to the users. UPI 2.0 will serve as an additional digital channel to access the overdraft account.
- **Signed intent and QR:**With this option, while making payment using the intent or through scanning QR, the user will get additional security in the form of signed QR / intent. With the signed QR, issues related to tampering QR as well as having non-verified entities are reduced.
- **One-time mandate:** UPI mandate could be used in a scenario where money is to be transferred later by providing commitment at present. UPI 2.0 mandates are created with one-time block functionality for transactions. Customers can pre-authorise a transaction and pay at a later date. It works seamlessly for merchants as well as for individual users. Mandates can be created and executed instantly. On the date of actual purchase, the amount will be deducted and received by the merchant/individual user.

- BHIM 2.0 supports **three additional languages — Konkani, Bhojpuri and Haryanvi** — over and above the existing 13.

## 10 TechSagar

**Context:** The National Cyber Security Coordinator's office in partnership with Data Security Council (DSCI) of India launched TechSagar – a platform to discover India's technological capability through a portal.

**More on News:**

- **TechSagar –** India's Cybertech Repository was conceptualized by Government of India in partnership with Data Security Council of India.
- TechSagar is a consolidated and comprehensive repository of India's Cybertech capabilities and provides actionable insights about capabilities of the Indian Industry, Academia & Research; across 25 technology areas like IoT, AI/ML, Block Chain, Cloud & Virtualisation, Robotics & Automation, AR/VR, Wireless & Networking, and more.
- It allows targeted search, granular navigation and drilldown methods using more than 3000 niche capabilities.
- TechSagar is a dynamic platform and shall be frequently updated with new entities and information to maintain its relevancy and usefulness.
- As India aspires to become a 'Trillion-Dollar Digital' economy, the repository will facilitate new opportunities for businesses and academia to collaborate, connect and innovate.
- TechSagar will help combat the growing threat from cybercrime.

## 11 Bharat Biotech Launches New Rotavirus Vaccine to Tackle Diarrhoea

**Context:** In order to effectively tackle the menace of diarrhea plaging developing economies including India, Hyderabad-based Bharat Biotech International has commercially launched Rotavac 5D, an oral rotavirus vaccine at virtually one-tenth the cost when compared to private hospitals.

**More on News:**

- Rotovac 5D has been developed with close coordination with the Department of Biotechnology.
- Earlier, Bharat Biotech had originated ROTAVAC and now they have upgraded their already available oral vaccine to ROTAVAC 5D.
- The roll-out of oral rotavirus vaccine is also the lowest dose-volume rotavirus vaccine in the world.
- Along with the reduction in dosage, they have also made the oral vaccine low cold chain proof. This has resulted in making the vaccine stable at 2-degree to 8-degree Celsius for up to 24 months.
- Globally, rotavirus causes approximately 200,000 deaths and about 2 million hospitalizations annually, mostly in low-income countries.
- Currently, ROTAVAC 5D is being supplied in seven countries including India and 50 more countries have registered for it.

### What is Rotavirus?

- Rotavirus is a virus that infects the bowels, causing a severe inflammation of the stomach and bowels (known as gastroenteritis). It is a very contagious virus that causes diarrhea.
- Rotavirus is the most common cause of severe diarrhea among infants and children throughout the world and causes the death of about 500,000 children worldwide annually.
- The name rotavirus comes from the characteristic wheel-like appearance of the virus when viewed by electron microscopy.
- Rotavirus is transmitted between hand and mouth contact.
- Infants and children under 3 are at the highest risk for rotavirus infection.

| Symptoms of rotavirus | |
|---|---|
| • Vomiting<br>• Black or tarry stools<br>• Stools with blood or pus in them<br>• Severe fatigue | • A high fever<br>• Irritability<br>• Dehydration<br>• Abdominal pain |

## 12 'Polycrack Technology'

**Context:** Indian Railways has commissioned the country's first governmental waste to energy plant in Mancheswar Carriage Repair workshop at Bhubaneswar in East Coast Railway.

### Waste-To-Energy Plant:

- This Waste to Energy Plant, a patented technology called **POLYCRACK**, is first-of-its-kind in Indian Railways in India.
- While this is the first such plant over railways, it is the fourth in the country. The first plant is a small one with capacity of 50 kg/day set up by Infosys at Bangalore in 2011.
- It is world's first patented heterogeneous catalytic process which converts multiple feed stocks into hydrocarbon liquid fuels, gas, carbon and water.
- **Important features:**
  - Pre-segregation of waste is not required to reform the waste. Waste as collected can be directly fed into Polycrack.
  - It has high tolerance to moisture hence drying of waste is not required.
  - Waste is processed and reformed within 24 hours.
  - It is an enclosed unit hence the working environment is dust free.
  - Excellent air quality surrounding the plant.
  - Biological decomposition is not allowed as the Waste is treated as it is received.
  - The foot print of the plant is small hence the area required for installing the plant is less when compared with conventional method of processing.
  - All constituents are converted into valuable energy thereby making it Zero Discharge Process.
  - Gas generated in the process is re-used to provide energy to the system thereby making it self-reliant and also bring down the operating cost.
  - There is no atmospheric emission during the process unlike other conventional methods except for combustion gases which have pollutants less than the prescribed norms the world over.
  - Operates around 450 degrees, making it a low temperature process when compared with other options.

- Safe and efficient system with built-in safety features enables even an unskilled user to operate the machine with ease.
- Low capital cost and low operating cost.
- Fully automated system requires minimum man power.

## 13 'Project NETRA'

**Context:** The Indian Space Research Organization (ISRO) has initiated 'Project NETRA' to safeguard Indian space assets from debris and other harm.

### What is Project NETRA?

- Project NETRA is an early warning system in space to detect debris and other hazards to Indian satellites.
- The project is estimated to cost ₹400 crores.
- NETRA's eventual goal is to capture the GEO, or geostationary orbit, the scene at 36,000 km where communication satellites operate.
- Under NETRA, or Network for space object Tracking and Analysis, the ISRO plans to put up many observational facilities:
  - connected radars, telescopes
  - data processing units
  - a control centre
- They can, among others, spot, track and catalogue objects as small as 10 cm, up to a range of 3,400 km and equal to a space orbit of around 2,000 km.

## 14 Genome India Project

**Context:** The government has cleared an ambitious gene-mapping project that is being described by those involved as the "first scratching of the surface of the vast genetic diversity of India".

### About the Project:

- The first stage of the project will look at samples of "10,000 persons from all over the country" to form a "grid" that will enable the development of a "reference genome".
- **Nodal agency:** The IISc's Centre for Brain Research, an autonomous institute, will serve as the nodal point of the project.
- **Aim:** Its aim is to ultimately build a grid of the Indian "reference genome", to understand fully the type and nature of diseases and traits that comprise the diverse Indian population.

## 15 SATHI

**Context:** The Department of Science & Technology has launched a unique scheme called Sophisticated Analytical & Technical Help Institutes (SATHI).

**More on News:**

- The scheme will address the need for building shared, professionally managed and strong Science and Technology infrastructure in the country which is readily accessible to academia, start-ups, manufacturing, industry and R&D labs
- These Centres are expected to house major analytical instruments to provide common services of high-end analytical testing, thus reducing dependency on foreign sources. The centres would be operated with a transparent, open access policy.
- DST has already set up three such centres in the country, one each at IIT Kharagpur, IIT Delhi and BHU at a total cost of Rs 375 Cores. The plan is to set up five SATHI Centres every year for the next four years. Impact.
- SATHI will address the problems of accessibility, maintenance, redundancy and duplication of expensive equipment in Institutions, while reaching out to the less endowed organizations in need, e.g., industry, MSMEs, startups and State Universities.
- It will also foster a strong culture of collaboration between institutions and across disciplines to take advantage of developments, innovations and expertise in diverse areas.

## 16 5G Hackathon

**Context:** 5G Hackathon is aimed at shortlisting India focused cutting edge ideas that can be converted into workable 5G products and solutions. It is organised by Department of Telecommunications (DoT) in association with government, academia & industry stakeholders.

**More on News:**

- It will convert innovating ideas into products and solutions in different verticals and develop India specific use cases around 5G.
- It is open to developers, students, start-ups, SMEs, academic institutions & registered companies in India & NRIs.
- It was organised alongside India Mobile Congress (IMC), 2020, New Delhi. India Mobile Congress is the largest digital technology forum in South Asia organised by the DoT and Cellular Operator Association of India.

## 17 Bhuvan Panchayat V 3.0

**Context:** It has been developed by National Remote Sensing Centre of ISRO.

**More on News:**

- It is a user-friendly web Geo portal under ISRO's SISDP project (Space Based Information Support for Decentralised Planning) for better planning and monitoring of government projects.
- SISDP project aims to assist Gram Panchayats at grass-root level with basic planning inputs derived from satellite data for preparing developmental plans, its implementation and monitoring the activities.
- It will provide geo-spatial services to aid gram panchayat development planning process of Ministry of Panchayati Raj.
- It aids database visualization, data analytics, generation of automatic reports, model based products and services for the benefit of Gram Panchayat members and other stake holders such as PRIs and the public.

- For the first time, thematic database on high scale for the entire country is available with high integrated High Resolution satellite data for planning.
- Bhuvan, is the national Geo-portal developed and hosted by ISRO comprising of Geo Spatial Data, Services and Tools for Analysis.

## 18 DRDO Young Scientists Laboratories

**Context:** Prime Minister dedicated the five Young Scientists Laboratories of Defence Research and Development Organisation (DRDO) to the nation.

**More on News:**

- DRDO Young Scientist Laboratories (DYSLs) are located in five cities viz, Bengaluru, Mumbai, Chennai, Kolkata and Hyderabad.
- Each lab will work on a key advanced technology of importance to the development of futuristic defence systems viz, Artificial intelligence, Quantum technologies, Cognitive technologies, Asymmetric technologies and Smart materials.
- DYSLs will employ only scientists under age of 35 to develop cutting-edge and futuristic technologies for military weaponry.
- It will boost indigenous research capabilities in the defence sector by involving youth in defence research related activities.

## 19 Haryana Police Launches Trakea

**Context:** Haryana Police has adopted unique barcoding software — Trakea — to ensure that thousands of forensic reports that form the backbone of the criminal investigation system and subsequent trials in the courts of law are not tampered with.

**More on News:**

- Trakea is aimed at ensuring security and a tamperproof tracking system for forensic reports. It streamlines the functioning of Forensic Science Laboratories.
- Essentially, it is a forensic evidence management system that helps in automation of the entire procedure, right from the stage when forensic experts collect vital samples from the scene of crime to conducting analysis of the samples, followed by tracking case-wise forensic reports electronically through barcodes.
- Due to the unique barcoding, only the authorised investigating officers and forensic science experts shall be able to track the crime exhibits and scientific examination reports, reducing the chances of tampering/leakage of the report at any stage

## 20 Geochemical Baseline Atlas of India

**Context:** For the first time, 'Geochemical Baseline Atlas of India' developed by CSIR-National Geophysical Research Institute (NGRI) for use by policy makers to assess environmental damage was released.

**More on News:**

- The atlas consists of 45 maps of metals, oxides and elements present in top and bottom soils across India.
- The map trace elements from top soil i.e. top 25 cm depth and bottom soil at 100 cm depth from the year 2006 to 2011.
- The geochemical data presented in these maps will be a part of the Global Map to be prepared by **the International Union of Geological Sciences (IUGC).**
- It will serve as a reference against which future generations of the country would be able to assess the chemical compositional changes on Earth's surface.
- Both human activities and natural processes are continuously modifying the chemical composition of our environment. These maps will form the backbone for environment management.
- It will help in finding out future contaminations due to industries across the country. Government and policymakers can leverage it in planning the land use accordingly."
- This is the third map among the series of maps published by NGRI. Earlier, The Gravity map of India and Seismic map of India were released.

## 21 Global Bio-India Summit, 2019

**Context:** Recently Global Bio-India Summit, 2019' was held in Delhi. It was India's first largest biotechnology conference.

**More on News:**

- It was organised by The Department of Biotechnology (under Ministry of Science and Technology) and Biotechnology Industry Research Assistance Council (BIRAC).
- It showcased the potential of India's biotech sector to the international community.
- BIRAC is a not-for-profit, Public Sector Enterprise, set up by Department of Biotechnology (DBT).
- It acts as an Interface Agency to strengthen and empower the emerging Biotech enterprise to undertake strategic research and innovation, addressing nationally relevant product development needs.

## 22 Accelerator Lab

**Context:** The United Nations Development Programme (UNDP) has launched the India chapter of its new initiative, Accelerator Labs, for which it is partnering with Germany and Qatar.

**More on News:**

- It seeks to drive innovation in order to address some of the most pressing issues facing India, including air pollution, sustainable water management and client-resilient livelihoods.
- The project has been launched in collaboration with the government's Atal Innovation Mission.
- They identify grassroots solutions together with local actors and validate their potential to accelerate development.
- Accelerator Labs are built on UNDP's partnerships with governments to scale solutions. This is highlighted in the Indian Accelerator Lab team's philosophy to 'work out loud', or share the issues.

## 23 National Digital Health Blueprint

**Context:** J. Satyanarayana committee has recently submitted its report named National Digital Health Blueprint (NDHB) to Ministry of Health.

**More on News:**

- NITI Aayog mooted the idea of National Health Stack (NHS) last year. NDHB is the architectural document for the implementation of the NHS.
- Vision:
  - To create a National Digital Health Eco-system that supports Universal Health Coverage in an efficient, accessible, inclusive, affordable, timely and safe manner.
  - Ensuring the security, interoperability, confidentiality and privacy of health-related personal information.
- **Institutional Framework:** envisages a specialised organisation, National Digital Health Mission (NDHM) that can drive the implementation of the blueprint, and promote and facilitate the evolution of a national digital health ecosystem.
- **Standards and Regulations:** Interoperability is possible only if all the building blocks and the digital systems are built using the defined standards. So, standards related to exchange of healthcare data, data privacy and patient security are given.
- **Action Plan:** Expected outcomes like access to Electronic Health Records, continuum of care etc have been outlined.
- Methods needed for systematic implementation of the blueprint include:
  - A Federated Architecture
  - Unique Health Id (UHID)
  - Data Analytics
  - EHR (Electronic Health Record)
  - Multiple access channels like call centre, Digital Health India portal and MyHealth App.
  - Legislation and Regulations on Data Management, with focus on Privacy and Security
  - Directories of Providers, Professionals and Para-medicals.

## 24 Youth Co:Lab

**Context:** In an initiative to recognize young people as critical drivers of sustainable development, Atal Innovation Mission (AIM), NITI Aayog and United Nations Development Programme (UNDP) India have launched Youth Co:Lab which aims at accelerating social entrepreneurship and innovation in young India.

**More on News:**

- Targeted at supporting young people to overcome challenges, it will empower young people through innovative development ideas.
- In this regard, Youth Co:Lab will convene social innovation challenges at the national and subnational level, which will invite young people in the age group of 18-29 years and start-ups to showcase their proposed ideas and solutions to tackle some of the region's biggest social challenges.

- Through Youth Co:Lab, young entrepreneurs and innovators will get a chance to connect with governments, mentors, incubators and investors, who will help equip them with entrepreneurial skills.
- The first phase of Youth Co:Lab will focus on six SDGs: SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 12 (Sustainable Consumption and Production) and SDG 13 (Climate Action).

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# 7

# MISCELLANEOUS

## 1 Cyber Safe Women

**Context:** Maharashtra Government has launched a 'Cyber Safe Women' initiative to educate women about how the web is used by anti-social elements and child predators to commit various types of crimes.

### About the initiative:

- It aims to create awareness on the cyberspace in light of the increasing number of cases where women and children are targeted.
- This initiative was launched in 34 districts and 90 places across the state, all at once.
- It will help in educating women about how the web is used by anti-social elements and child predators to commit various types of crimes.

### Cybercrimes in India:

- As per a recent ASSOCHAM-NEC joint study, **India has witnessed a 457% rise in cybercrime incidents** under the Information Technology (IT) Act, 2000 from the year 2011 to 2016.
- **India is ranked third after the United States and China in terms of cybercrime incidents.**
- According to the annual report released by the National Crime Records Bureau (NCRB) in 2016, with 762 cases, **Bengaluru had the second-highest number of cybercrime cases among the metros, behind Mumbai with 980 cases**.
- Other metro cities were far behind, with Hyderabad recording 291 cases, Kolkata 168, Delhi 90 and Chennai 36.

## 2 Glass Fibre Reinforced Gypsum Concrete

**Context:** Glass Fibre Reinforced Gypsum Concrete, developed by IIT Madras over the last decade is now being considered by the Kerala government for the housing needs of those whose homes were ravaged by the floods in August 2018.

### Glass Fibre Reinforced Gypsum Concrete

- Glass Fibre Reinforced Gypsum (GFRG) Panel known as **Rapidwall** is a building panel made-up of calcined gypsum plaster, reinforced with glass fibers. The panel was originally developed by GFRG Building System Australia and since 1990 is being used for mass scale building construction. Now, these panels are being produced in India.

- The panel is manufactured to a thickness of 124mm, length of 12m and height of 3m, under carefully controlled conditions, contains cavities that may be unfilled, partially filled or fully filled with reinforced concrete as per structural requirement.
- Experimental studies and research in Australia, China and India have shown that GFRG panels, suitably filled with plain reinforced concrete possesses substantial strength to act not only as load bearing elements but also as shear wall, capable of resisting lateral loads due to earthquake and wind.
- GFRG panel can also be used advantageously as in-fills (non-load bearing) in combination with RCC framed columns and beams (conventional framed construction of multi-storey building) without any restriction on number of storeys.
- Micro beam sand RCC screed (acting as T-beam) can be used as floor/ roof slab. The GFRG Panel is manufactured in semi-automatic plant using slurry of calcined gypsum plaster mixed with certain chemicals including water repellent emulsion and glass fibrerovings, cut, spread and imbedded uniformly into the slurry with the help of screen roller.
- The panels are dried at a temperature of 275C before shifting to storage area or the cutting table. The wall panels can be cut as per dimensions & requirements of the building planned.
- It is an integrated composite building system using factory made prefab load bearing cage panels & monolithic cast-in situ RC in filled for walling & floor/roof slab, suitable for low rise to medium rise (single to 10 storeys) building.

## 3 Retreating snow line reveals organic molecules around young star

- Astronomers from Kyung Hee University, Korea using ALMA (Atacama Large Millimeter/ submillimeter Array) have detected various complex organic molecules around the young star **V883 Ori**. A sudden outburst from this star is releasing molecules from the icy compounds in the planet forming disk. The chemical composition of the disk is similar to that of comets in the modern solar system. Sensitive ALMA observations enable astronomers to reconstruct the evolution of organic molecules from the birth of the solar system to the objects we see today.

## 4 UMMID Initiative Engineers translate brain signals directly into speech

- Neuro-engineers have created a system that translates thought into intelligible, recognizable speech. This breakthrough, which harnesses the power of speech synthesizers and artificial intelligence, could lead to new ways for computers to communicate directly with the brain. It also lays the groundwork for helping people who cannot speak, such as those living with as amyotrophic lateral sclerosis (ALS) or recovering from stroke, regain their ability to communicate with the outside world.

## 5 Smart India Hackathon 2019

**Context:** The Smart India Hackathon (SIH) 2019 – Software edition, was recently held at 49 different centers simultaneously across India where more than 34,000 ideas were evaluated.

**More on News::**

- It is a nationwide initiative to provide students a platform to solve some of pressing problems we face in our daily lives, and thus inculcate a culture of product innovation and a mindset of problem solving.

- It is the largest ever Hackathon in the world and the only one to be held at the national level involving 1 Lakh+ technical students, 3000+ technical institutions, 200+ organizations from across India this year.
- In SIH 2019, the students also have the opportunity to work on challenges faced within the private sector organizations and create world class solutions for some of the top companies in the world, thus helping the Private sector hire the best minds from across the nation.
- The Nodal Center for Grand Finale Hackathon 2019 was IIT Kanpur.

## 6 World Autism Day

**Context:** The World Autism Awareness Day was observed across the world on April 2, 2019 with an aim to raise awareness about autism throughout the world.

### More on News::

- The theme of World Autism Awareness Day 2019 was "Assistive Technologies, Active Participation".
- Also, it aims to encourage the Member States of the United Nations to take measures to raise awareness about autism.

### What is Autism?

- Autism or Autism Spectrum Disorder is a lifelong developmental disability that manifests itself during the first three years of life.
- It results from a neurological disorder that affects the functioning of the brain, mostly affecting children and adults in many countries irrespective of gender, race or socio-economic status.
- It is characterized by impairments in social interaction, problems with verbal and non-verbal communication and restricted, repetitive behaviour, interests and activities.
- Though there is no cure for it, therapeutic and behavioural guidance can considerably improve quality of life.

## 7 World Homeopathy Day

### Context:

- The two-day Convention on World Homeopathy Day was inaugurated by Secretary; Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy) in New Delhi on 10 April. AYUSH systems also includes SOWA-RIGPA.
- The theme of the convention this year is-linking research with education and clinical practice.

### Initiatives of Ministry of AYUSH to promote Homoeopathy

- It launched the **Short Term Studentship in Homoeopathy Scheme (STSH)** for undergraduate Students and also the **Central Council for Research in Homeopathy (CCRH) Scholarship Scheme** for MD Students as a step towards capacity building and encouraging research aptitude among students.
- It is undertaking clinical research on cure of epidemic diseases like Dengue, Influenza, Chikungunya, Tuberculosis and other infectious diseases.

- A Dossier on 'Homoeopathy – A Science of Gentle Healing'and 'Standard Treatment Guidelines' on 15 more diseases have been developed by CCRH.
- The 'CCRH Archives on Homeopathy' a digital repository of accumulated knowledge in homeopathy, having important homoeopathic literary material spread all over the world has been launched.

**Central Council for Research in Homeopathy (CCRH)**

- It is an apex research organization under Ministry of AYUSH, Govt. of India which undertakes, coordinates, develops, disseminates and promotes scientific research in Homoeopathy. It was constituted in 1978.
- The Headquarters of the Council are situated in New Delhi and multi-centric research is conducted through a network of 26 institutes/units all over India.

## 8 World Haemophilia Day

**Context:** April 17 is recognised as World Haemophilia Day (WHD) worldwide to increase awareness of haemophilia and other inherited bleeding disorders.

### World Haemophilia Day

- It was started in 1989 by the World Federation of Haemophilia (WFH) which chose to bring the community together on **April 17 in honour of WFH founder Frank Schnabel's birthday.**
- This year's edition marked as the 30th World Haemophilia Day with the theme of Reaching out - connect to your community.
- Its campaign will feature examples of WFH outreach initiatives such as organizing regional workshops, raising awareness of bleeding through media coverage or training health professionals and collecting data. It will combine these examples with submissions from our community about outreach efforts in their own regions or ideas about what would be helpful for future initiatives.
- This landmark day also helps to illustrate the importance of the WFH Humanitarian Aid Program—an important endeavour for the WFH that provides a range of integrated care development training programs to ensure the local infrastructure and medical expertise are available to optimize and appropriately use donated products.

### Haemophilia

- It is a medical condition, mostly inherited, in which the ability of blood to clot is severely reduced, so that even a minor injury can cause severe bleeding.
- Because of the genetics involved in the way the sex of a child is determined, men are more vulnerable to haemophilia than women.
- Britain's Queen Victoria (1819-1901) is the world's most widely known carrier of haemophilia. From her, the condition spread among a number of European royal families, which is why haemophilia was once known as the **"royal disease".** Victoria passed on a defective X chromosome to three of her children. Her son Prince Leopold died at age 30 as a result of loss of blood after injury. Leopold's daughter, Princess Alice of Albany, was a carrier whose son inherited haemophilia and died at age 21.

## 9 World Malaria Day, 2019

**Context:** April 25 is observed as World Malaria Day. This year the theme is "Zero malaria starts with me".

### What is Malaria?

- Malaria is caused by a **Plasmodium Parasites** that is transmitted from one human to another by the bite of **infected Anopheles mosquitoes.**
- In humans, the parasites (called sporozoites) migrate to the liver where they mature and release another form, the merozoites.
- The majority of Malaria symptoms are caused by the massive release of merozoites into the bloodstream such as anaemia is caused by the destruction of the red blood cells.
- There are five parasites that can cause Malaria in humans and the deadliest of all is Plasmodium Falciparum.
- Children under the age of 5 and pregnant women are most susceptible to the disease.
- More than 70 per cent or two thirds of total malaria deaths constitute children under the age of 5.
- People who have malaria usually have high fever, experience shaking chills and feel very sick.
- Apart from fever and chills, malaria also causes headaches, nausea, vomiting, muscle pain, fatigue, chest pain, cough and sweating.
- India has the third-highest burden of malaria cases in the world and contributes to more than 89 per cent cases in the south-east region.

## 10 Change in the definition of Kilogram

**Context:** The Definition of the Kilogram is changed by redefining the International system of units(SI) on World Metrology Day (20 May, 2019).

### More on News::

- The Kilogram will no longer derive its provenance from the weight of a block of a platinum-iridium alloy housed at the International Bureau of Weights and Measures in France.
- The Kilogram has joined other standard units of measure such as the second, metre, ampere, kelvin, mole and candela that would no longer be defined by physical objects.
- It now hinges on the definition of the Planck Constant, a constant of nature that relates to how matter releases energy.

### Background

- The global standards for measurement are set by the International Bureau of Weights and Measures (BIPM), of which India became a member in 1957. At BIPM in Sèvres, near Paris, stands a cylinder of platinum-iridium locked in a jar.
- Since 1889, the kilogram has been defined as the mass of this cylinder, called **Le Grand K**, or International Prototype Kilogram (IPK). In India, NPL maintains the National Prototype Kilogram (NPK-57), which is calibrated with IPK.
- IPK would put on a little extra mass when tiny dust particles settled on it; when cleaned, it would shed some of its original mass.
- Last year, the International Conference of heads of Metrology Institutes held in Sevres, France had decided that the measure of kilogram will no longer be pegged to cylinder. It was decided

that from 2019 onwards, it will be set by value of Planck constant in combination with definitions of meter and second.

## 11 Parthenogenesis

**Context:** Recently, the New England Aquarium in the US announced that a "virgin" anaconda had given birth during the winter. The aquarium does not have a male anaconda. Yet Anna, a green female anaconda, gave birth to a few babies, two of which have survived. In scientific terminology, it is known as parthenogenesis.

### Parthenogenesis:

- The term parthenogenesis is an amalgam of the Greek words parthenos meaning virgin and genesis meaning origin.
- **It is anasexual reproductive strategy** that involves development of a female (rarely a male) gamete (a mature germ cell which is able to unite with another of the opposite sex in sexual reproduction to form a zygote) without its fertilisation.
- It occurs commonly among lower plants and invertebrate animals (particularly rotifers, aphids, ants, wasps and bees) and rarely among higher vertebrates.
- Many species that reproduce through parthenogenesis do not reproduce sexually. Others switch between the two modes taking cues from the environment.
- Babies born through parthenogenesis are clones of the mother. This was proved by this New England Aquarium through DNA tests.
- Parthenogenetic offspring tend to be clones of the parent because there has been no exchange and rearrangement of genetic information with another individual as happens in case of a sexual reproductive process.
- Stillbirth is common in parthenogenesis.

## 12 Short Wave Transmission

**Context:** Prasar Bharati has asked All India Radio to come up with a proposal to phase out Short Wave (SW) transmitters.

### Advantages of Using Shortwave

- Shortwave radio has a huge range – it can be received thousands of miles from the transmitter, and transmissions can cross oceans and mountain ranges. This makes it ideal for reaching nations without a radio network. SW transmissions are easy to receive, too: even cheap, simple radios are able to pick up a signal.

### Other mode of Transmission

- **Medium-wave radio** is generally used for local broadcasts and is perfect for rural communities. With a medium transmission range, it can reach isolated areas with a strong, reliable signal. Medium-wave transmissions can be broadcast through established radio networks - where these networks exist.
- **Frequency Modulation (FM)** provides a short-range signal - generally to anywhere within sight of the transmitter, with excellent sound quality. It can typically cover the area of a small city or large town - making it perfect for a radio station focusing on a limited geographical area speaking

into local issues.While shortwave and medium-wave stations can be expensive to operate, a license for a community-based FM station is much cheaper.

- **Internet Radio:** The rapid development of web-based technology offers huge opportunities for radio broadcasting. Internet-based stations are quick and easy to set up (sometimes taking as little as a week to get up and running and costs a lot less than regular transmissions. And because the internet has no borders, a web-based radio audience can have global reach.

## 13 Hog Technology in Railways

**Context:** Railway Ministry is upgrading all existing Linke Hofmann Busch (LHB) coaches with the Head on Generation (HOG) technology.This would cause the trains to become more cost-efficient and less polluting.

### What is Head on Generation (HOG) technology?

- The system runs the train's 'hotel load' (the load of air conditioning, lights, fans, and pantry, etc.) by drawing electricity from the overhead electric lines through the pantograph.
- The power supply from the overhead cable is 750 volts at single-phase, and a transformer with a winding of 945 kVA converts it to a 750 Volts 50 Hz output at 3-phase. This energy is then provided to the compartments.

### How is it different from the present EOG technology?

- Under the End on Generation (EOG) system, the train's 'hotel load' (the load of air conditioning, lights, fans, and pantry, etc.) is provided with electricity from two large diesel generator sets, which supply 3-phase power at 750 Volts 50 Hz to the entire length of the train.
- Each coach then picks up the power supply through a 60 KVA transformer, bringing down the voltage to 110 volts at which level the equipment in the compartment is run. The generator cars are attached to either end of the train, giving the system its name.

## 14 Avian Influenza (H5N1)

**Context:** **I**ndia has declared itself free from Avian Influenza (H5N1), commonly called bird flu.

### More on News::

- Avian Influenza was first reported from **HongKong in 1997.**
- H5N1 is a type of virus which is **highly infectious in birds**, and causes avian influenza or bird flu. Human cases of H5N1 are closely linked to **infections from live or dead birds that have H5N1.**
- The symptoms of an H5N1 infection in humans **include mild upper respiratory tract infection (fever and cough), early sputum production and rapid progression to severe pneumonia.**
- It can lead to sepsis with shock, acute respiratory **distress syndrome and even death.**

## 15 Contributions of Homi J. Bhabha

**Context: Recently the birth anniversary of Homi J. Bhabha was celebrated.**

### More on News::

- HomiBhabha belonged to a wealthy Parsi family to Jehangir and MeherenBhabha. He was educated at the Elphinstone College, Bombay and Cambridge University, UK.
- He pursued a degree in mechanical engineering as per the wishes of his family, and then acquired a degree in mathematics too. He studied under mathematician Paul Dirac. He was a brilliant student and won many scholarships.
- He was a nuclear physicist who made vital contributions to quantum theory and cosmic radiation and was the **first chairman of the Atomic Energy Commission of India set up in 1948.**

### Contributions

- In 1933, he secured a doctorate in nuclear physics. His paper for his doctoral thesis was titled **'The Absorption of Cosmic radiation'**. This won him the Newton Studentship which he held for three years. He completed his thesis under Ralph Fowler. Apart from working at Cambridge, he also spent time working in Copenhagen with Nobel laureate Niels Bohr.
- A paper he published in 1935 on electron-positron scattering was appreciated much by the scientific community and this phenomenon was later renamed Bhabha scattering.
- He returned to India in 1939 and then became the Reader in the Physics Department at the Indian Institute of Science, which was then headed by eminent scientist and Nobel laureate C V Raman.
- At the IISC, he established the Cosmic Ray Research Unit. He also played a big role in the establishment of the Tata Institute of Fundamental Research in Mumbai.
- Bhabha convinced the then Prime Minister Jawaharlal Nehru to start a nuclear programme.
- He started research on nuclear weapons in 1944. He set up the Tata Institute of Fundamental Research in 1945 and also the Atomic Energy Commission in 1948. He was the first chairman of the Commission.
- Bhabha represented India in IAEA and in 1955, was also the President of the United Nations Conference on the Peaceful Uses of Atomic Energy in Geneva.
- He was an aggressive promoter of nuclear weapons for the country's defence.
- Bhabha was instrumental in devising the strategy behind the country's nuclear programme. He pioneered the use of thorium to extract uranium from it rather than relying on the meagre reserves of uranium in India. He formulated India's three-stage nuclear power programme.

## 16 Indian Pharmacopoeia

**Context:** The Indian Pharmacopoeia (IP) has been recognised formally by the National Department of Regulation of Medicines and Health Products of the Ministry of Public Health of Islamic Republic of Afghanistan.

### More on News::

- It will also be used based on the requirement as reputable pharmacopoeia in the laboratory of medicines and health products quality.
- With this, a new beginning has been made and Afghanistan has become the first country to recognize IP pursuant to the efforts of Department of Commerce and Ministry of Health and Family Welfare.
- IP is an officially recognized book of standards as per the Drugs and Cosmetics Act, 1940 and Rules 1945 there under.
- The IP specifies the standards of drugs manufactured and marketed in India in terms of their identity, purity and strength.

- The quality, efficacy and safety of the medicines are important from healthcare perspective. In order to ensure the quality of medicinal products, the legal and scientific standards are provided by Indian Pharmacopoeia Commission (IPC) in the form of Indian Pharmacopoeia (IP).
- As per, the Second Schedule of the Drugs and Cosmetics Act, IP is designated as the official book of standards for drugs imported and/or manufactured for sale, stock or exhibition for sale or distribution in India.
- The IP Commission's mission is to promote public and animal health in India by bringing out authoritative and officially accepted standards for quality of drugs including active pharmaceutical ingredients, excipients and dosage forms, used by health professionals, patients and consumers.

## 17 AIM-SIRIUS Deep Technology Learning, Innovation Programme

**Context:** The second phase of NITI Aayog'sAtal Innovation Mission (AIM) and Russia's SIRIUS Deep Technology Learning and Innovation Programme 2019 in Sochi comes to an end as 25 Indian students returned today with best practices of contemporary innovation and entrepreneurship.

### More on News::

- SIRIUS hosted an **eight-day project oriented educational program** from 28 November to 8 December 2019. It was held in accordance with Memorandum of Understanding signed between AIM and SIRIUS last year. val **held in India last year** witnessed a delegation of 10 Russian student innovators and 10 Indian innovators from the best performing Atal Tinkering Labs (ATLs).

## 18 107th Indian Science Congress

**Context:** Recently, PM inaugurated the 107th Indian Science Congress at University of Agricultural Sciences, Bengaluru.

### More on News::

- The theme of **107th Indian Science Congress** is **"Science and Technology: Rural Development".**
- The Congress is to be hosted by Department of Science and Technology.
- The event acts as a common platform for researchers, scientists and academicians. Around 28 plenary sessions are to be held during the event. It includes leading technologies such as Climate Smart Agriculture for food security, challenges in cancer drugs, nano materials for energy, solutions for oil and gas, environment and health care. For the first time, Farmers Science Congress is to be held on the sidelines
  - **Farmers Science Congress:** The congress will cover themes of innovation on integrated agriculture. It will also focus on themes of doubling farmers' income, farmer empowerment, conservation, bio diversity, etc. The experts from ICAR (Indian council of Agricultural Research) and UAS (University of Agricultural Sciences) will also participate at the event along with the farmers whose innovative methodologies have brought in huge harvests.
  - **Children Science Congress**: The Children Science Congress also called the "Rashtriya Kishre Vaiguanik Sammelana" will also be held alongside 107th India Indian Science Congress. The aim of the congress is to motivate students and increase their participation in scientific and technological fields. Apart from these, women science congress will also be held showcasing women achievements. Also, VC Science congress will be held to address the need of higher education institutions. The event will also hold Science Communicators Meet.

## 19 ISRO to set up second launch port

**Context:** Indian Space Research Organisation will establish a second launch port in Thoothukodi district in Tamil Nadu exclusively to launch small satellite launch vehicles.

**More on News::**

- A second Vehicle Assembly Building in SDSC SHAR Sriharikota was dedicated to the nation during the year for increasing the launch frequency. As part of the enhanced outreach activity, a launch viewing gallery was operationalised in Sriharikota to facilitate viewing of launches live by the public.
- In an effort towards horizontal expansion of ISRO, Space Technology Cells, Space Technology Incubation Centres and Regional Academic Centres for Space were established during the year and many more such centres are planned in the future.
- To carry forward the industry production of space systems, ISRO incorporated New Space India Limited (NSIL), under the Department of Space and efforts in realising PSLVs from industry initiated.
- Other projects during the year include SSLV, GSLV with 4m ogive payload fairing, GSAT-20 satellite, NavIC with indigenous atomic clocks, Indian Data Relay Satellite System, Aditya-L1 and XPOSAT.

## 20 What is the YadaYada virus?

**Context:** Team of researchers extracted RNA from a large number of mosquitoes in Australia's Victoria state; they found a new alphavirus, which belonged to a group that includes other alphaviruses such as chikungunya virus and the astern equine encephalitis.

**More on News::**

- The virus poses no threat to human beings, because it is a part of a group of viruses that only infect mosquitoes.
- Other viruses in the same group include the Tai forest alphavirus and the Agua Saludalphavirus.
- It implies a reference to something that is synonymous with "etcetera, etcetera" or "blah blah".

## 21 Wings India 2020

**Context:** Indian aviation and technology leaders gathered in Bengaluru for industry meet ahead of "Wings India 2020", Asia's largest civil aviation event.

**More on News::**

- **Wings India 2020, a flagship event of the Indian Civil Aviation industry will be held at Begumpet Airport, Hyderabad** from 12-15 March 2020. It is organized by the Ministry of Civil Aviation, Govt. of India, AAI and FICCI.
- 'Wings India 2020'- a four-day event themed: **"Flying for All''** is an international platform focused on the new business acquisition, investments, policy formation and regional connectivity in the civil aviation industry.

## 22 VyomMitra:

**Context:** Before orbiting astronauts on India's first manned mission to space in December 2021, the Indian Space Research Organisation will send 'VyomMitra', a 'lady robot' in the unmanned Gaganyaan spacecraft.

**More on News::**

- VyomMitra will be used for an unmanned flight of ISRO's GSLV III rocket in December 2020, which, along with a second unmanned flight in July 2021.
- The lady robot, equipped with a head, two arms and a torso, is built to mimic crew activity inside the crew module of Gaganyaan.
- It is capable of conversing with astronauts, recognising them, and responding to their queries.

## 23 What is Xenobot?

**Context:** Scientists in the United States have created the world's first "living machines" — tiny robots built from the cells of the African clawed frog, that can move around on their own.

**More on News::**

- The species of aquatic frog was found across sub-Saharan Africa from Nigeria and Sudan to South Africa, Xenopuslaevis.
- The living machines are less than a millimetre (0.04 inches) wide-small enough to travel inside human bodies.
- They can walk and swim, survive for weeks without food, and work together in groups.

## 24 How wide is the Gender Gap in science?

**Context:** Between 1901 and 2019, 334 Nobel Prizes have been awarded to 616 Laureates in Physics, Chemistry and Medicine, of which just 20 have been won by 19 women.

**More on News::**

- February 11 was the **International Day of Women and Girls in Science**, established by the **United Nations** to promote equal access to and participation in science for women and girls.
- While some of the greatest scientists and mathematicians have been women, they remain under-represented in comparison to their male counterparts in higher studies involving science, as well as among the top scientific achievers.

### Researchers and achievers

- According to a 2018 fact sheet prepared by UNESCO on women in science, just 28.8% of researchers are women.
- It defines researchers as **"professionals engaged in the conception or creation of new knowledge". In India, this drops to 13.9%.**

- Between 1901 and 2019, 334 Nobel Prizes have been awarded to 616 Laureates in Physics, Chemistry and Medicine, of which just 20 have been won by 19 women.
- The double Laureate is Marie Curie, one of just three women who have won in Physics and one of just fi ve in Chemistry, while 12 women have won the Medicine Nobel.
- In 2019, the American mathematician Karen Uhlenbeck became the fi rst woman to win the Abel Prize, following 16 male mathematicians.
- The Fields Medal so far has also been awarded to only one woman mathematician, the late Maryam Mirzakhani of Iran, as opposed to 59 men since 1936.

### Women in science courses

- UNESCO data from 2014-16 show that only around 30% of female students select STEM (science, technology, engineering and mathematics)-related fi elds in higher education.
- Female enrolment is particularly low in information technology (3%), natural science, mathematics and statistics (5%) and engineering and allied streams (8%).
- **In India, a 2016-17 NITI Aayog report compared female enrolment in various disciplines over five years, until 2015-16.**
- In 2015-16, 9.3% of female students in undergraduate courses were enrolled in engineering, compared to 15.6% across genders. Conversely, 4.3% of female students were enrolled in medical science, compared to 3.3% across genders.
- Then, a master's and doctoral levels, female enrolment remained lower than overall enrolment, and also fell behind for medical science in three of the fi ve years.
- "This reflects that moving up from UG to a higher degree and research programmes, the restricted presence of women in higher studies and research in science becomes evident for a broader range of disciplines.
- Broadly, women showed a preference for arts; however, female enrolment in science streams rose from 2010-11 to 2015-16.
- The report found that in over 620 institutes and universities, including IITs, NITs, ISRO, and DRDO, the presence of women was 20.0% among Scientific and Administrative Staff, 28.7% among Post-Doctoral Fellows, and 33.5% among PhD scholars.

## 25 National Science Day

- **Theme in 2020- "Women in science".**
- It is celebrated every year on **28th February**(since 1986) **to commemorate the discovery of the 'Raman Effect' by Sir C.V. Raman for which he was awarded the Nobel Prize in 1930**.
- **Nodal Agency-National Council for Science & Technology Communication (NCSTC), Department of Science and Technology (DST)** acts as a nodal agency to support, catalyze and coordinate celebration of the National Science Day throughout the country in scientific institutions, research laboratories and autonomous scientific institutions associated with the Department of Science and Technology.

## 26 National Deworming Day

**Context:** Recently, tenth round of National Deworming Day (NDD) was conducted by Ministry of Health and Family Welfare.

### More on News::

- NDD was launched in 2015 to make every child in the country worm free.
- According to World Health Organization 241 million children between the ages of 1 and 14 years are at risk of parasitic intestinal worms in India, also known as Soil-Transmitted Helminths (STH).
- As part of this campaign, children and adolescents aged 1-19 years are being administered Albendazole (400 mg) across government, government-aided schools, anganwadis, private schools and other educational institutions.
- First round of NDD is conducted on February 10 each year. Bi-annual round of deworming is recommended in the States where prevalence of STH infection is more than 20%.
- Soil-transmitted helminths refer to the intestinal worms infecting humans that are transmitted through contaminated soil ("Helminth" means parasitic worm).
- Soil-transmitted helminth infection is found mainly in areas with warm and moist climates where sanitation and hygiene are poor, including in temperate zones during warmer months.

## 27 Nobel Prize

- **Nobel Prize in Physiology or Medicine**
  - The Nobel Prize in Physiology or Medicine has been awarded to William Kaelin, Peter Ratcliffe and Gregg Semenza for discovering the complex processes behind how human cells respond to change in levels of oxygen. The research has tried to explain how cells adapt to higher or lower amounts of the molecule in the atmosphere.
- **Nobel Prize in Chemistry**
  - The 2019 Nobel Prize in Chemistry was awarded to John D. Goodenough, M. Stanley Whittingham and Akira Yoshino for their roles in the development of lithium-ion batteries.
  - **M. Stanley Whittingham:** laid foundations of Lithium (Li) ion batteries in 1970s, when he used titanium disulphide as cathode and metallic lithium, which is highly reactive, as anode.
  - **John B. Goodenough:** In 1980s, he replaced titanium disulphide with cobalt oxide as the cathode doubling the battery's potential. However, the use of reactive lithium remained a concern.
  - **Akira Yoshino:** The first commercially viable lithium-ion battery was developed by him in 1991. He replaced lithium anode with petroleum coke anode, which drew Li-ions towards it from the Lithium Cobalt oxide cathode.
- **Nobel Prize in Physics**
  - The Nobel Prize in Physics 2019 was awarded to three scientists- James Peebles, Michel Mayor and Didier Queloz "for contributions to our understanding of the evolution of the universe and Earth's place in the cosmos".
  - **James Peebles** was awarded for "theoretical discoveries in physical cosmology".
  - **Michel Mayor and Didier Queloz** were awarded for discovering "an exoplanet orbiting a solar-type star". They discovered the first planet outside our solar system, an exoplanet, named 51 Pegasi B orbiting a solartypestar in our home galaxy, the Milky Way, in 1995.

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