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MAINSTORMING 2020

SCIENCE & TECHNOLOGY



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MAINSTORMING 2020
SCIENCE & TECHNOLOGY
(JANUARY 2020 TO OCTOBER 2020)

1. SPACE..... 4	4.10 Delhi's Plasma Bank..... 54
1.1 Private Participation in Space Sector..... 4	4.11 Withdrawal of Lancet Study 55
1.2 IN-SPACE 5	5. HEALTH..... 57
1.3 Draft Space Activities Bill, 2017.....7	5.1 Nutrition & Union Budget 57
1.4 Space Debris 8	5.2 Cough Syrup Poisoning58
1.5 Origin of Carbon 10	5.3 Ending Tuberculosis by 2025..... 60
1.6 Recent Indian Missions and Initiatives..... 11	5.4 Eliminating Lymphatic Filariasis..... 61
2. DEFENCE 17	5.5 National Digital Health Mission 63
2.1 CAG Report on Defence Offsets.....17	5.6 National Health ID..... 64
2.2 IAF's Role in Ladakh18	5.7 Diseases of Animal Origin 65
2.3 Pinaka Missile System 20	5.8 Epidemic Disease Act, 1897 66
2.4 SMART Test21	5.9 Emergence of Epidemics..... 67
2.5 Defence Offset Dilution 22	5.10 Initial Infection Points for SARS-CoV2 68
2.6 Anti-Tank Guided Missiles 24	5.11 Covid-19 - Importance of Testing 70
2.7 K Missile Family..... 25	5.12 Rapid Testing Kits71
3. ROBOTICS, IT AND COMPUTERS.... 26	5.13 Kasaragod Model..... 72
3.1 Non-Personal Data Governance..... 26	5.14 Handling of COVID-19 - Kerala's Strategy73
3.2 US-Huawei-ZTE tussle 28	5.15 COVID-19 Treatment 75
3.3 Indigenising India's Cyber Space 29	5.16 Covid-19 Containment Strategies 77
3.4 Banning of Blockchain..... 30	5.17 World Health Assembly Session..... 78
3.5 Blockchains for Internet of Things31	5.18 Taiwan's COVID-19 Strategy and WHO... 79
3.6 5G Technology 33	5.19 Vaccine Development..... 81
3.7 Internet of Things..... 35	5.20 Air-Conditioners..... 82
3.8 Significance of Artificial Intelligence 36	5.21 Covid-19 Treatment: Remdesivir..... 83
3.9 Need for a Legal Framework for AI 38	5.22 Homoeopathic Drug Arsenicum Album 84
3.10 National Policy on Electronics 2019..... 39	5.23 Caps on Fee by Private Hospitals 86
3.11 Digital Divide41	5.24 Serological Survey in Delhi 87
4. BIOTECHNOLOGY..... 42	5.25 COVID-19 & Consumer Behaviour..... 89
4.1 Indian Cobra Genome Decoded 42	5.26 Pandemic Modelling90
4.2 Genome India Project 43	5.27 Solidarity Trial 91
4.3 Genetically Modified Seeds..... 45	5.28 Masks Are Helpful 93
4.4 Potentials of Genetic Modification..... 46	5.29 Regulation of Indian Pharmacy Market ... 94
4.5 RT-PCR and Antibody tests..... 47	6. OTHERS..... 95
4.6 Rapid Antigen Detection Test..... 49	6.1 Government Notification on RO System ... 95
4.7 Covid-19 Vaccine51	6.2 Indian Science Congress 96
4.8 Research on Coronavirus' Proteins 52	6.3 Draft Pharma Policy 97
4.9 ICMR's Trial on Plasma Therapy 53	6.4 Internet shutdowns in India..... 98
	6.5 Rising Game Revolution in India..... 99

MAINSTORMING 2020

SCIENCE & TECHNOLOGY

1. SPACE

1.1 Private Participation in Space Sector

What is the issue?

- Elon Musk's SpaceX has become the first private company to launch human beings into orbit.
- In this context, here is a look on the role of private participation in the space sector.

How did private participation evolve in the U.S.?

- NASA used to have a fleet of five spaceships under its Space Shuttle programme.
- These were used to make a total of 135 of journeys into space and the International Space Station (ISS), in the 30 years from 1981 to 2011.
- Two of these were destroyed in accidents, the Challenger in 1986 and Columbia in 2003.
- Each resulted in the death of seven astronauts.
- In the 2003 accident, India-born astronaut Kalpana Chawla was among those killed.
- After that, the US government had decided to close the Space Shuttle programme.
- The three remaining spaceships, Discovery, Atlantis, and Endeavour, were formally retired in July 2011.
- But they were fit for many more flights.
- It was decided that it probably no longer made sense for NASA to build and operate these spaceships.
- It was not just costly, but was also consuming a lot of scientific resources.
- The transportation needs could easily be fulfilled by space vehicles that some private companies were promising to make.
- Accordingly, it was decided to help and support these companies in building these spaceships.
- These can be hired by other agencies as well and even private individuals.
- The NASA collaboration with SpaceX and Boeing was a result of this.
- In the meanwhile, NASA utilised Russian spaceships to travel to the ISS, for which it paid tens of millions of dollars for every trip.
- Russia also uses the ISS facility, and routinely sends its astronauts to the space station on its own spaceships.
- For NASA, private companies' role is expected to be a cheaper option.
- It also offers the comfort of operating from home soil and eliminates dependence on a foreign country.

How has private participation so far been?

- World over, more and more work of space agencies is already being done in collaboration with private companies.
- There are literally hundreds of private entities building commercial satellites for their clients.
- However, launch services remain a somewhat restricted zone, considering that it requires elaborate facilities and deep pockets.

- But here too, there are several players apart from SpaceX and Boeing.
- Many, like Virgin Galactic of businessperson Richard Branson, have already made space flights.
- It might soon start offering passenger rides to space to those who can afford to pay.
- In fact, in 2019, a spacecraft built by Scaled Composites, a US company, even took a human being for a very short ride into space, becoming the first private spacecraft to do so.

What is the case with India?

- Most of the private companies operating in the space sector in India collaborate with the ISRO.
- They contribute in building and fabricating the components that go into making rockets and satellites.
- There are several companies that have started making satellites for their own use, or for their clients.
- However, launch services, including the building of rockets or launch vehicles, is still some distance away in India right now.
- ISRO has been collaborating more and more with private industry.
- However, the capability to independently carry out even routine space missions, like that by SpaceX/Boeing/Virgin Galactic, has been missing in India.

What are the future prospects?

- SpaceX's flight underlines the fact that space research and exploration is now a much more collaborative enterprise than before.
- Space agencies of different countries are sharing data and resources.
- More importantly, they are increasingly getting together to carry out joint missions as well.
- The ISS itself is a good example of international cooperation in the space sector.
- The space facility (ISS) is set to retire somewhere around 2028.
- ISS's replacement being planned is likely to have participation from at least 10 countries, and possibly private players as well.
- There is also a growing realisation that space agencies need to direct their energies and resources more towards scientific research and deep space exploration.
- It's been 50 years since the landing on moon, and efforts to take human beings to Mars and other celestial bodies, needs to be expedited.
- Getting back to the Moon, which NASA and some other agencies plan to do in the next few years, is just the first step in that direction.
- But that would also require huge amounts of financial resources that most of the space agencies, including NASA, are currently starved of.
- Private players are expected to infuse fresh investments as well as technological innovation in this area.

1.2 IN-SPACE

Why in news?

The Government of India has announced the creation of a new 'Indian National Space Promotion and Authorisation Centre' (IN-SPACE).

What is IN-SPACE for?

- IN-SPACE will be an autonomous nodal agency under the Department of Space.
- It is expected to be functional within 6 months (from June 2020).

- IN-SPACe is supposed to be a facilitator and a regulator.
- It will act as an interface between ISRO and private parties.
- It will provide the necessary support for the private space industry to conduct its activities.
- IN-SPACe will assess the needs and demands of private players including educational and research institutions.
- It will explore ways to accommodate these requirements in consultation with ISRO.
- It will also assess how best to utilise India's space resources and increase space-based activities.
- Existing ISRO infrastructure, scientific and technical resources and even data are planned to be made accessible to interested parties.
- [The infrastructure includes both ground- and space-based.]
- The decision comes as a part of an important set of reforms to open up the space sector.
- The objective is to make space-based applications and services more widely accessible to everyone.

How is India's private sector participation in space industry?

- Currently, there does exist private industry involvement in India's space sector.
- In fact, a large part of manufacturing and fabrication of rockets and satellites now happens in the private sector.
- There is an increasing participation of research institutions as well.
- However, Indian industry had a barely 3% share in a rapidly growing global space economy.
- Currently, the value of the global space industry is estimated to be \$360 billion.
- Only 2% of this market goes for rocket and satellite launch services, which require fairly large infrastructure and heavy investment.
- A huge 95% are related to satellite-based services, and ground-based systems.
- Indian industry, however, is unable to compete.

Why is Indian space industry lagging behind?

- Till now, Indian space industry's role has been mainly that of suppliers of components and sub-systems.
- Indian industries do not have the resources or the technology to undertake independent space projects or provide space-based services.
- Additionally, the demand for space-based applications and services is growing even within India.
- The need for satellite data, imageries and space technology now cuts across sectors.
- It ranges from weather to agriculture to transport to urban development, and more.
- But, ISRO is unable to cater to this.
- ISRO would have to be expanded 10 times the current level to meet all the demand that is arising.

What opportunity will IN-SPACe offer?

- Currently, all launches from India happen on ISRO rockets, the different versions of PSLV and GSLV.
- Several Indian companies were waiting to make use of the opportunities as IN-SPACe provides.
- A few companies were also in the process of developing their own launch vehicles.
- ISRO is now willing to extend its support to them.
- ISRO would provide all its facilities to private players whose projects had been approved by IN-SPACe.

- Private companies, if they wanted, could even build their own launchpad within the Sriharikota launch station.
- ISRO would provide the necessary land for that.

What does ISRO gain by this?

- **Commercial** - There is a need for greater dissemination of space technologies, and better utilisation of space resources.
- Moreover, there is an increased requirement of space-based services.
- ISRO seems unable to satisfy this need on its own and thus private participation would fill the gap.
- Notably, the private players will not take away the revenues that ISRO gets through commercial launches.
- The space-based economy is expected to “explode” in the next few years, even in India.
- So, there would be more than enough for all.
- Also, ISRO can earn some money by making its facilities and data available to private players.
- **Strategic** - Right now, too much of ISRO’s resources is consumed by routine activities.
- This delays its more strategic objectives.
- There is no reason why ISRO alone should be launching weather or communication satellites.
- The world over, an increasing number of private players are taking over this activity for commercial benefits.
- ISRO, like NASA, is essentially a scientific organisation whose main objective is exploration of space and carrying out scientific missions.
- So, with private participation, ISRO can concentrate more on science, R&D, interplanetary exploration and strategic launches.

1.3 Draft Space Activities Bill, 2017

Why in news?

The Department of Space has released a draft Space Activities Bill, 2017.

What are the key provisions?

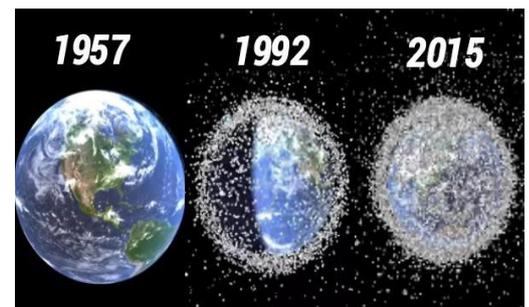
- The provisions of the legislation shall apply to every citizen of India.
- And also to all sectors engaged in any space activity in India or outside India.
- **Regulatory mechanism** - The central government is responsible for setting mechanisms and promoting space activity.
- This includes exploration and use of outer space, and development of the sector.
- The central government can:
 - i. grant, transfer, or terminate licenses to any person for commercial space activities
 - ii. provide professional and technical support, and authorisation to launch or operate space objects
 - iii. regulate the procedures for conduct and operation of space activity by monitoring the conformity with international space agreements to which India is a party
 - iv. ensure safety requirements and investigate any incident or accident in connection with the operation of a space activity
- **Licences** - A non-transferable licence shall be provided by the Central Government to any person carrying out commercial space activity.

- A license granted by the central government includes -
 - i. permission for the central government to inspect any space activity and documents related to space activity
 - ii. obligation on the licensee to insure himself/herself against any liability incurred due to any activity authorised by the license
- **Liabilities** - A licensee should compensate the central government against claims brought against the government.
- This would be regarding damages arising out of commercial space activities covered under the license.
- **Penalties** - The draft Bill provides for penalties in case of:
 - i. unauthorised commercial space activity
 - ii. furnishing false information or documents
 - iii. causing environmental damage
 - iv. entry into prohibited areas
 - v. disclosure of restricted information
- **Protection** of action taken by the central government i.e. no legal proceedings can lie against the central government with respect to anything done in good faith in pursuance of space activity.
- **IPR** - Intellectual property rights developed during the course of space activity will be protected under the law.
- Further, any intellectual property right developed onboard a space object in outer space will be deemed to be the property of the central government.

1.4 Space Debris

What is space debris?

- Anything launched into the space remains in space, almost forever, unless it is specifically brought down or it slowly disintegrates over decades or centuries.
- Satellites that are past their life and are no longer required also remain in space, orbiting aimlessly in some orbit.
- As per the recent Orbital Debris Quarterly News, published by NASA, there were 19,137 man-made objects in space that were large enough to be tracked.
- These included active and inactive satellites, rockets and their parts, and other small fragments.
- Besides these, there are millions of other smaller objects that have disintegrated from these and keep floating around in space.
- According to the European Space Agency, there were an estimated 7,50,000 objects of size one cm or above in space.
- In this context, a satellite that is destroyed by a missile disintegrates into small pieces, and adds to the space debris.



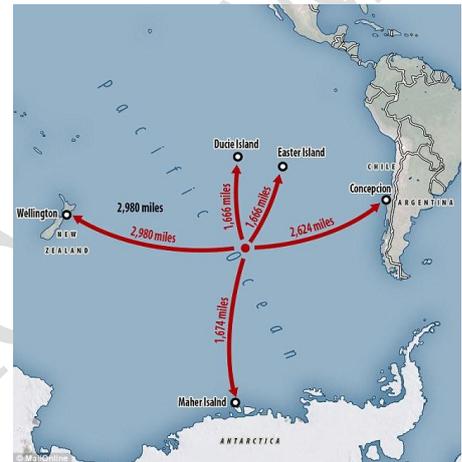
How is space debris a threat?

- Space debris is one of the principal threats to satellites as they could collide with the operational satellites and render them dysfunctional.
- E.g. China carried out its first anti-satellite missile test in 2007, destroying its Fengyun-1C weather satellite.

- This created more than 2,300 large pieces of space debris, and an estimated 1.5 lakh pieces of objects that were larger than 1 cm in size.
- Each of them could render a satellite useless on collision, and the debris damaged a functional Russian satellite.
- Debris also came close to hitting the International Space Station.
- Countries are launching more and more satellites, with each of them being a strategic or commercial asset.
- So avoiding collisions could become a challenge in the future for all.

What are the international agreements in place?

- The Outer Space Treaty of 1967 prohibits countries from placing into orbit around the Earth any objects carrying nuclear weapons or other weapons of mass destruction.
- India is a signatory to the Outer Space Treaty.
- The treaty also prohibits the stationing of such weapons on celestial bodies, like the moon, or in outer space.
- It mandates that outer space, and celestial bodies like the Moon, must only be used for peaceful purposes.
- There are at least four more multilateral treaties that deal with specific concepts agreed to in the Outer Space Treaty.
- But besides these, the problem of space debris is a key reason why countries resist from destroying each other's satellites.



What is a spacecraft graveyard?

- There are larger space objects that may not entirely burn up before reaching the ground.
- Spacecraft operators can thus plan for the final destination of their old satellites to make sure that any debris falls into a remote area.
- A 1,500 sq km area in Southern Pacific Ocean is said to be the spacecraft graveyard or spacecraft cemetery.
- This is suitably far from any coast and human habitations thereby.
- Notably, more than 260 satellites were brought down there so far.

What could be done?

- **Passivation** - Satellite explosions are reduced by deactivating various systems.
- **Design for demise** - Designing with material that burn up on re-entry.
- **Deorbiting systems** - Under international guidelines, satellites are brought down within 25 years after mission life.
- **Design for servicing** - Grips or handles can be caught by a robotic arm or astronauts for repairs.
- **RemoveDEBRIS** - An innovation led by University of Surrey's Space Centre, UK.
 - It was launched on a SpaceX flight to International Space Station recently.
 - It will be released into low-earth orbit, where it will release a smaller satellite that will recapture space junk with a harpoon.
- **ISRO** - ISRO is looking to develop reusable launch vehicles.
 - It had notably conducted a space capsule recovery experiment in 2007.

United Nations Office for Outer Space Affairs (UNOOSA)

- The UNOOSA works to promote international cooperation in the peaceful use and exploration of space.
- The Office assists any United Nations Member States to establish legal and regulatory frameworks to govern space activities.
- It also strengthens the capacity of developing countries to use space science technology and applications for economic and social development.
- It does this by helping to integrate space capabilities into national development programmes.

Inter-Agency Space Debris Coordination Committee (IADC)

- The IADC is an international governmental forum.
- It works for worldwide coordination of activities related to the issues of man-made and natural debris in space.
- The primary purposes of the IADC are to -
 - i. exchange information on space debris research activities between member space agencies
 - ii. facilitate opportunities for cooperation in space debris research
 - iii. review the progress of ongoing cooperative activities
 - iv. identify debris mitigation options

1.5 Origin of Carbon

Why in news?

A study on 'white dwarfs' has provided new insights on the origins of the carbon in the Milky Way galaxy.

What are white dwarfs?

- White dwarfs are the dense remnants of a star after its death, whose nuclear energy supplies have been used up.
- They consist of degenerate matter with a very high density due to gravitational effects.

What is the importance of carbon?

- Carbon is essential for life.
- It is the simple building block of all the complex organic molecules that organisms need.
- It is known that all the carbon in the Milky Way came from dying stars that ejected the element into their surroundings.
- However, there is a debate on what kind of stars made the major contribution.

How does carbon come from stars?

- Most stars, except the most massive ones, turn into white dwarfs.
- When the massive ones die, they go with a spectacular bang known as the supernova.
- Both low mass and massive stars eject their ashes into the surroundings before they end their lives.
- These ashes contain different chemical elements, including carbon.

How carbon is released?

- In both the type of stars, carbon is synthesised in its deep and hot interiors through the triple-alpha reaction.
- [Triple-alpha reaction = Fusion of three helium nuclei]

- **In low-mass stars**, the newly synthesised carbon is transported to the surface from the interiors via gigantic bubbles of gas.
- From the surface, the carbon is injected into the cosmos through stellar winds.
- **Massive stars** enrich the interstellar medium with carbon before the supernova explosion, when they also experience powerful stellar winds.

What did the study find?

- In 2018, the researchers analysed a few white dwarfs belonging to open star clusters of the Milky Way.
- They measured the masses of the white dwarfs, derived their masses at birth, and from there calculated the “initial-final mass relation”.
- [Initial-final mass relation is a key astrophysical measure that integrates information of the entire life cycles of stars.]
- They found that the more **massive the star** at birth, the more **massive the white dwarf** left at its death.
- So far, stars born roughly 1.5 billion of years ago in our galaxy were thought to have produced white dwarfs about 60-65% the mass of Sun.
- Instead, they were found to have died leaving behind more massive compact remnants, about 70-75% solar masses.

What explains this?

- The stripping of carbon-rich outer mantle of these stars occurred slowly.
- This is slow enough to allow the central cores of these stars, the future white dwarfs, to grow considerably in mass.
- By analysing the initial-final mass relation, the size range for the stars that contributed carbon to the Milky Way was concluded.
- Stars more massive than 2 solar masses contributed to the galactic enrichment of carbon.
- Stars less massive than 1.65 solar masses did not spread its carbon-rich ashes upon death.
- Having fixed the minimum initial mass for the production of carbon in low-mass stars is great, since it helps putting the pieces together.

1.6 Recent Indian Missions and Initiatives

GSAT-30

- It is a 3,357-kg satellite launched by Ariane-5 VA-251 vehicle from the Guiana Space Centre in Kourou
- It will replace INSAT-4A which was launched in 2005.
- The mission life is more than 15 years.
- The high-power satellite is equipped with 12 normal C band and 12 Ku band transponders.
- It provides Indian mainland and islands coverage in Ku-band and extended coverage in C-band covering Gulf countries, a large number of Asian countries and Australia.
- It will provide DTH television services, connectivity to VSATs (that support working of banks') ATMs, stock exchange, television up linking and teleport services, digital satellite news gathering and e-governance applications.
- The satellite will also be used for bulk data transfer for a host of emerging telecommunication applications.
- For this operation ISRO hired a foreign launcher as GSAT-30 is much heavier than the 2,000-kg lifting capacity of its geostationary launch vehicle GSLV-Mk II.

PSLV C-48

- PSLV in its 50th flight (PSLV-C48), successfully launched RISAT-2BR1 along with 9 commercial satellites.
- RISAT-2BR1 is a radar imaging earth observation satellite weighing about 628 kg.
- It will provide services in the field of Agriculture, Forestry and Disaster Management. The mission life of RISAT-2BR1 is 5 years.
- The nine commercial satellites were from Israel, Italy, Japan and USA.
- These satellites were launched under a commercial arrangement with New Space India Limited (NSIL), the commercial arm of ISRO.
- PSLV-C48 has launch vehicle in 'QL' configuration i.e with 4 solid strap-on motors.

PSLV C-47

- PSLV C-47 has launched CARTOSAT 3 satellite along with 13 nano satellites from the US.
- Cartosat 3 is a third-generation earth imaging satellite.
- It is an advancement over the previous cartosat series satellites with higher spatial resolution parameter.
- It is deployed for cartography (map-making applications), infrastructure planning, coastal land use and regulation, road-network monitoring and more importantly, change detection in bringing out geographical and man-made features.
- Among the American satellites aboard is a technical demonstration spacecraft from US-based company Analytical Space Inc, which enables users to gain faster access to satellite data.



PSLV – C46 / RISAT-2B

- PSLV-C46 has launched RISAT-2B into space, which is a radar imaging earth observation satellite.
- The satellite is intended to provide services in the field of Agriculture, Forestry and Disaster Management.
- It has been developed for military and general surveillance purposes.
- RISAT-2B is equipped with synthetic aperture radar that can take pictures of the earth during day and night, and also under cloudy conditions.
- RISAT – 1 was India's first indigenous all-weather Radar Imaging Satellite

GSLV-Mk III - M1 / Chandrayaan-2 Mission

- GSLV MkIII-M1, successfully launched Chandrayaan-2 spacecraft into its planned orbit but failed to soft-land the lander on the moon.
- **Chandrayaan-1** was designed to just orbit the Moon and make observations, while **Chandrayaan-2** is created to land on the Moon.
- It has three important components — the Orbiter, the Lander 'Vikram', and Rover 'Pragyan'
- The mission aims to explore the unexplored South Pole of the Moon.
- According to ISRO, there is a possibility of the presence of water in permanently shadowed areas around it.
- South Pole region also has craters that are cold traps and contain a fossil record of the early Solar System.
- GSLV MK – III also called as '**Baahubali**', the country's heaviest and most powerful rocket to date.
- ISRO provides four reasons for what made the Chandrayaan-2 mission "special".

- Chandrayaan-2 would be -
 1. the first space mission to conduct a soft landing on the moon's south pole
 2. the first Indian expedition to attempt a landing on lunar surface using home-grown technology
 3. the first Indian mission to explore lunar terrain with home-grown technology
 4. the mission that would make India only the 4th country to soft land on the moon
- **Orbiter** - The Orbiter will 100 km away from the moon, which will observe lunar surface and relay communication between Earth and the Lander.
- The orbiter is equipped with different kinds of camera to take create high-resolution three-dimensional maps of the surface, would remain in orbit for a year.
- **Vikram Lander** - Lander module Vikram was named after Vikram Sarabhai.
- It is the first time that ISRO is attempting to soft-land a module in extra-terrestrial space to mainly study the moon's atmosphere and look out for seismic activity.
- However, it failed in its attempt.
- **Pragyaan Rover** - Rover module Pragyaan means wisdom.
- The 6-wheeled, AI Solar powered rover was designed, developed and build indigenously by ISRO.
- The rover will be landed closer to the Moon's equator to receive more sun light.
- Its primary objective will be to study the composition of the surface near the lunar landing site, and determine its abundance of various elements.
- Both the Lander and Rover are designed to work for only 14 days (1 lunar day).
- This mission will help us to better understand the origin and evolution of the moon.
- Studies of lunar topography, mineralogy, elemental abundance, and signatures of water ice are the prime objectives.
- The orbiter has 8 instruments fitted into it and 7 of them are India's.
- NASA has one payload onboard called the Laser Retroreflector Array (LRA).
- The '**Terrain Mapping Camera-2**'(TMC-2) will map the lunar surface and help to prepare 3D maps of it.
- The '**Miniature Synthetic Aperture Radar**' (Mini SAR) will also map the surface of water-ice in the South Pole and thickness of the lunar dust on the surface.
- The '**Dual Frequency Radio Science**'(DFRS) will study the density of the electrons in the moon's ionosphere.
- The orbiter has a high-resolution camera (**OHRC**) that ensures that the lander makes a safe touchdown on the lunar surface by taking 3D images of the landing site.
- The '**Solar X-ray Monitor**'(XSM) measures the intensity of the solar rays and the outer most part of the atmosphere or its corona.
- **CLASS** (Chandrayaan 2 Large Area Soft X-ray Spectrometer) measures the light absorbed by the Moon and will check for different metals that are present in its spectrum.
- Thermo-physical property of the lunar surface and seismic activities will also be measured.
- The orbiter will continue to orbit the Moon for a year, at an altitude of 100 kilometres.
- The Rover which is 6-wheeled, AI-powered and the Lander are designed to work for only 14 days (1 lunar day).
- **China's mission** - China landed a lander and rover on the Moon's far side (not facing the Earth).

- This was the first time any landing had taken place on that side.
- The Chinese mission, Chang'e 4, was designed to function for three lunar days but has already entered its fifth lunar night.

Geotail and its impact on Chandrayaan-2

- Recently, **ISRO** tweeted that an instrument on Chandrayaan-2, **CLASS**, had detected charged particles during the mission.
- This happened during the orbiter's passage through the 'Geotail'.
- The Geotail is a region in space that allows the best observations.
- The region exists as a result of the interactions between the Sun and Earth.
- The Sun emits the solar wind, which is a continuous stream of charged particles.
- These particles are embedded in the extended magnetic field of the Sun.
- Since the Earth has a magnetic field, it obstructs the solar wind plasma.
- This interaction results in the formation of a magnetic envelope around Earth.
- On the Earth side facing the Sun, the envelope is compressed into a region that is approximately 3 to 4 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 tail that is called the **Geotail**.
- Once every 29 days, the Moon traverses the geotail for about six days.
- When Chandrayaan-2, which is orbiting the Moon, crosses the geotail, its instruments can study the properties of the geotail.
- It can help to detect the presence of key elements like Na, Ca, Al, Si, Ti and Fe in the lunar soil.

Gaganyaan

- Gaganyaan is the India's first Human Space Flight Programme set for 2022.
- The programme will make India the fourth nation in the world to launch a Human Spaceflight Mission, only after the USA, Russia and China.
- It is being operated under a newly formed Centre, Human Space Flight Centre (HSFC).
- It aims to send a three-member crew to space for a period of five to seven days.
- Objectives of Gaganyaan Mission-
 1. Enhance of science and technology levels in the country,
 2. Serve as national project involving several institutes,
 3. Inspire youth,
 4. Develop technology for social benefits and
 5. Improve international collaboration
 6. Improve of industrial growth.
- Critical Technologies for Human Space Flight (HSF)-
 1. Orbital Module
 2. Crew Escape System
 3. Integration facility



4. Crew Module
5. Deep Space Network
6. Re-entry and Recovery system

- ISRO has developed some critical technologies through demonstrations like Space Capsule Recovery Experiment (SRE-2007), Crew module Atmospheric Reentry Experiment (CARE-2014) and Pad Abort Test (2018).
- The spacecraft will be placed in a low earth orbit of 300-400km.
- GSLV Mk-III launch vehicle will be used to for the mission. It has the payload capacity of 4000 kg satellites in Geosynchronous Transfer Orbit (GTO) and 8000 kg payload to Low Earth Orbit.
- The crew will be selected by Indian Air Force (IAF) and ISRO jointly after which they will undergo training for two-three years.
- **Re-entry & Recovery tech** - ISRO has already tested the GSLV Mk-III with experimental crew module.
- It came back to Earth after being taken to an altitude of 126 km into space. This this known as Crew module Atmospheric Re-entry Experiment (CARE).
- **Crew Escape System** – It is an emergency escape measure to quickly pull the astronaut crew out to a safe distance from launch vehicle during a launch abort.
- Pad Abort test was conducted earlier to demonstrate this to ascertain the efficiency of crew escape system.
- **Life support** -The Environmental Control & Life Support System (ECLSS) is meant for humans inside to live comfortably.
- It ensures that conditions inside the crew module are suitable for living.
- The ECLSS -
 - i. maintains a steady cabin pressure and air composition
 - ii. removes carbon dioxide and other harmful gases
 - iii. controls temperature and humidity
 - iv. manages parameters like fire detection and suppression, emergency support
 - v. takes care of food and water management
- The crewed vehicle is planned to be launched on ISRO's GSLV Mk III in December 2021.

Launch Vehicle	Mission	Application
PSLC C-44	Microsat-R and Kalamsat-V2 satellites	Kalamsat - 10cm cube communication nano-satellite weighing about 1.2kg designed by students First satellite to use PS4 as an orbital platform, thus reducing space debris Microsat-R - 130-kg military imaging satellite
PSLV C-43	HysIS and 30 international co-passenger satellites	HysIS – India's first Hyper spectral Imaging Satellite Aim - Study the earth's surface in the visible, near infrared and shortwave infrared regions of the electromagnetic spectrum
PSLV C-42	Foreign satellites - NovaSAR and S1-4 of	Resource Observation Satellite NovaSAR - S-Band Synthetic Aperture Radar satellite



	UK	S1-4- High-resolution Optical Earth Observation Satellite
PSLV C-41	IRNSS - 1I	8th satellite to join the NavIC navigation satellite constellation
Ariane-5 VA-247	GSAT – 31	40 th communication satellite Provide communication services to Indian mainland and islands
GSLV MK-III D2	GSAT 29	Heaviest satellite launched from India Multi-beam, multibank communication satellite for providing high quality internet services
GSLV Mk-II	GSAT -7A	Heaviest satellite launched by GSLV Mk-II First satellite built primarily for the Indian Air Force
GSLV-F09	GSAT-9	South Asia Satellite is to provide various communication applications in Ku-band with coverage over South Asian countries
	ExseedSAT – 1	A CubeSat mission by the Indian private space company Exseed Space Launched by SpaceX, a private aerospace company, from California satellite launch pad. First Indian Private entity satellite launched by SpaceX, in its Falcon9 rocket

India's Space Station

- ISRO has announced to launch India's own space station.
- The space station is an artificial satellite placed in orbit and is used as a long-term base for manned operations in space.
- The proposed Indian space station would be similar to the International Space Station but smaller in size weighing about 20 tones and would take another 5 to 7 seven years to construct.
- India would be the fourth country to launch a space station as the US and Russia have already launched their space stations and China is planning to launch its in 2020.
- The International station (ISS) is currently the only active space station in the earth's orbit.
- ISS is a joint project between five participating space agencies NASA (USA), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada).
- The Indian space station would be stationed at an altitude of 400 kilometres from Earth.
- The newly planned Indian space station will conduct microgravity experiments in space where astronauts can stay for 15-20 days.
- This project would be an extension of the Gaganyaan mission, which intends to put two or three Indian astronauts in space for a maximum of a week and is scheduled to be launched by August 2022.

Vyommitra

- Vyommitra is ISRO's first woman half-humanoid astronaut.
- It will simulate human functions before real astronauts in Gaganyaan crew take off.
- It will be used for an unmanned flight of ISRO's GSLV III rocket (Gaganyaan Mission) in December 2020, which, along with a second unmanned flight in July 2021.

- ISRO will send the human-resembling model in a space capsule around the end of 2020 or early 2021 to study how she and later real astronauts respond to living outside earth in controlled zero gravity conditions.
- She can detect and give out warnings if environmental changes within the cabin get uncomfortable to astronauts and change the air condition.
- She can take up postures suited for launch and tasks and take commands.
- It can also able to perform following functions
 1. Replacing carbon dioxide canisters,
 2. Operating switches,
 3. Monitoring of the crew module,
 4. Receiving voice commands,
 5. Responding via speech (bilingual).

2. DEFENCE

2.1 CAG Report on Defence Offsets

Why in news?

The latest CAG report on the implementation of defence offsets has been released.

What does it reveal?

- It has brought into sharp focus the broader subject of developing India's domestic industrial base.
- It also raises concerns of some bureaucratic incapacity.
- This is in contrast with an unambiguous political vision of turning India into a strong and vibrant powerhouse via Atmanirbhar Bharat.

Is the report on defence offsets new?

- The 2020 CAG report on defence offsets is not the first one.
- Previously, an earlier CAG report in 2011 outlined a number of similar problems with defence offset management in India.
- One should compare the two CAG reports, or with reported findings of the latest CBI charge sheets in the Agusta case.
- This comparison is needed to assess the number and range of mistakes made during offset contract management.
- This qualitative deterioration in defence offset guidelines around 2010-11 is probably more a case of bureaucracies changing the rules to hide their own inadequacies during defence offset contract lifecycles.
- The 2011 guidelines are in contrast to the original guidelines that were issued in 2005-06.
- The guidelines of 2005-06 were based on recommendations of Vijay Kelkar committee on defence procurement and manufacturing.

What are Kelkar Committee's recommendations?

- Kelkar Committee recommendations formed the very basis of India's Defence Offset Guidelines.
- Issued almost a decade-and-a-half ago, it contained some core guiding principles that seem to have been diluted in 2011.

- The original offset guidelines of 2005-06 **allowed direct offsets** relating to manufacturing of defence products alone.
- This is a principle that the defence bureaucracy could not stick to very long in the face of well-coordinated push by foreign vendors.
- A second core principle was **grant of offset credit** only for value-addition in India.
- This was neglected for almost a decade in offset management before it was able to make some re-entry into the Ministry of Defence's procedures.
- A third principle was to keep offset contract **duration short** enough so as to be able to see their visible impacts.
- It also insisted on submitting properly crafted offset offers rather than signing of paper promises by foreign vendors.

What does the repetition mean?

- The repetition of the same mistakes as highlighted by the CAG twice is,
 1. Reflective of a general apathy to oversight,
 2. Demonstrates to some extent bureaucrats' inability to grasp core policy principles that stakeholders draw attention to inform proper policymaking in the first place.
- The defence list is actually 24 items, but then 10 of these are rings of slightly different types.
- Such a tiny list makes one wonder if it has been issued only for demonstrating an optical compliance with the DPIIT's mandate.

2.2 IAF's Role in Ladakh

What is the issue?

- With a resolution to the standoff on the LAC still elusive, the Indian Army is preparing for extended deployment of troops.
- The Indian Air Force (IAF) will play a key role in supporting the troops in the tough terrain through the harsh winter months.

Can the IAF support the logistics of such a large force?

- One part of the logistics for the Army requires land transportation, which would have been planned for before winter sets in and the passes close.
- The IAF will be doing **very urgent missions**, for which it is well prepared with a very good transport fleet like C-130 Super Hercules, Chinook heavy-lift helicopters, etc.

What are the challenges of flying into Ladakh's advanced landing grounds (ALGs)?

- The challenge is the **altitude** of the two airfields of Leh and Thoise.
- But since IAF has been flying there for decades, the air crew are well aware of the peculiarities of these fields.
- The **landing grounds** at high altitude have their own challenges.
- It results in reduction of load-bearing capacity of the planes/choppers.
- The air crew have to call upon their skills to navigate the hills and land on the **small helipads**.
- Bad weather that accompanies the western disturbances that strike northern India in the winter months is a challenge.
- It **reduces visibility** and results in a **low cloud base**.

What effect does extreme cold have on weight-carrying aircraft?

- The lower the temperature, the better the payload.
- This is because the higher air density increases the lift-carrying capability of flying machines.
- So the loads that can be carried during winter are higher than during summer. This is a big advantage.
- Helicopters, whose load-carrying ability to extremely high helipads at altitudes of 17,000 to 20,000 feet, increases substantially in winter.
- It reduces drastically in summer.

Do the high altitude and topography pose a challenge?

- The modern navigation equipment available now overcomes most of the challenges.
- But mission accomplishment is not merely flying from place A to B.
- The aircraft has to land to complete a mission. That is where temperature and altitude plus weather become the final arbiters.
- Navigation is not a problem, but **take-offs and landings are tricky**.
- The night flying has its own challenges because of the shadows cast by hills, and the state and position of the moon relative to the hills and the aircraft.
- A moonless night poses its own challenges, and a full moon has its own.
- In the hills, air crew are specially cleared to carry out operations at night.

Do Ladakh airfields restrict operations to only certain aircraft?

- All air fields in the Ladakh area can be used by the transport aircraft, although weather requirements will vary from one aircraft to the other.
- It depends on the navigational aids on board the aircraft, and the competence of the crew.
- That is why air crews are detailed depending on the mission.
- In a long haul, the IAF will have to transport back and forth mechanised weapons etc for repair, maintenance, etc.

What kind of support does the IAF require for such an operation?

- All the air fields have enough stock of fuel, oil, and lubricants (**FOL**) for which detailed planning are done around the clock.
- There is a well-oiled logistics chain that has been fine-tuned by the IAF in the last six-seven decades of operation.
- The Army Service Corps (ASC) also plays an important part in ground positioning of fuel in forward posts.

What is the threat to aircraft when the ground forces are eye to eye?

- The Leh and Thoise airfields that support fixed wing operations are relatively in the interiors, hence not vulnerable to any ground action.
- They can be attacked by the Air Force and other aerial assets of the foe.
- But there are standard operating protocols (SOPs) in place to deal with such threats.
- However, in ALGs such as Daulat Beg Oldie (DBO), the air crew are well adept at taking tactical action to meet any threat from ground fire or shoulder-fired missiles.
- In this, the aids on board the helicopters also play an important role.

Are there any special challenges for fighter aircraft?

- Fighters flying in those altitudes have special challenges because of their high speeds, reduced air density, the closeness of the hill tops.
- Hitting the targets which are very small comprising bunkers having small number of troops requires special weapons and air crew capability.
- Fortunately, India has experienced this during Kargil.
- So, the lessons would have been passed on to the present band of pilots.
- In the present day, an individual weapon system is only as good as the overall war fighting architecture that the force designs.

2.3 Pinaka Missile System

Why in news?

The Ministry of Defence (MoD) signed contracts with three Indian companies for supply of six regiments of the Pinaka Rocket System.

What is the contract?

- The acquisition wing of MoD has signed contracts with,
 - a) Bharat Earth Movers Ltd,
 - b) Tata Power Company Ltd (TPCL) and
 - c) Larsen & Toubro (L&T).
- The six regiments would be added to the Regiment of Artillery of the Indian Army at a cost of Rs 2,580 crore.
- These Regiments will be operationalised along the Northern and Eastern Borders of our country.
- They are long range artillery systems that comprise 114 launchers with,
 - a) 45 Command Posts to be procured from L&T,
 - b) Automated Gun Aiming and Positioning System from TPCL and
 - c) 330 vehicles to be procured from BEMBL.
- The induction is planned to be completed by 2024.

What is the significance of this acquisition?

- India is facing hostilities on both fronts.
- So, the announcement enhancing the long range artillery capabilities can be looked as a strong signal to the adversaries.
- The ministry has called this step a major boost to 'Make in India.'
- This flagship project showcases public private partnership under the aegis of Government of India (DRDO and MoD).
- [DRDO - Defence Research and Development Organisation]

What is the origin of Pinaka rocket system?

- Pinaka attacks the targets prior to the close quarter battles which involve smaller range artillery, armoured elements and the infantry.
- The development of the Pinaka was started by the DRDO in 1980s.
- It was developed as an alternative to the multi-barrel rocket launching systems of Russian make, called like the 'Grad'.

- Pinaka Mark-1 was first used in the battlefield during the Kargil War of 1999, quite successfully.
- Subsequently multiple regiments of the system came up over the 2000s.

What are Pinaka's capabilities?

- Pinaka is primarily a multi-barrel rocket system (MBRL) system.
- It can fire a salvo of 12 rockets over a period of 44 seconds.
- One battery of Pinaka system consists of six launch vehicles.
- This is accompanied by the loader systems, radar and links with network based systems and a command post.
- One battery can neutralise an area one kilometre by one kilometre.
- The launchers have to 'shoot and scoot' to ensure that they themselves do not become the targets, especially due to its back blast.
- Thus the launcher vehicles should have a high degree of maneuverability.

What are its versions?

- **Mark-I version** of Pinaka has a range of around 40 kilometres.
- **Mark-II version** can fire up to 75 kilometres.
- Over late 2010s, multiple successful tests of the Mark-II version have been carried out by the DRDO.
- This version of the rocket has been modified as a guided missile system by integrating it with the navigation, control and guidance system.
- The navigation system of the missile is linked with the Indian Regional Navigation Satellite System (IRNSS).
- In comparison to artillery guns, rockets are less accurate, but with addition of guidance and navigation systems, this aspect is taken care of.
- With its upgrades, the Pinaka Mark-II can be a key element in the "network centric warfare".
- The rocket system can operate various modes.
- They can carry different types of warheads.

2.4 SMART Test

Why in news?

India conducted the flight test of a Supersonic Missile Assisted Release of Torpedo (SMART) system.

What are Torpedoes?

- Torpedoes are self-propelled weapons that travel underwater to hit a target.
- They are limited by their range.

What is SMART system?

- The SMART system is developed by the Defence Research and Development Organisation (DRDO).
- The system has a mechanism by which the torpedo is launched from a supersonic missile system with changes that would take the torpedo to a far longer range than its own.
- The system also gives flexibility in terms of the missile system's launch platform.

Who were involved in the development?

- A number of DRDO laboratories have developed the technologies required for SMART. They are,

1. Defence Research and Development Laboratory (DRDL) and Research Centre Imarat (RCI), both in Hyderabad;
2. Aerial Delivery Research and Development Establishment, Agra;
3. Naval Science and Technology Laboratory (NSTL) Visakhapatnam.

What is the significance?

- SMART is a game-changing technology demonstration in **anti-submarine warfare**.
- India's anti-submarine warfare capacity building is crucial in light of **China's growing influence** in the Indian Ocean region.
- The Navy's anti-submarine warfare capability got a boost after the conclusion of a contract for Advanced Torpedo Decoy System Maareech.
- [Maareech is capable of being fired from all frontline warships.]
- India has been indigenously developing and building several anti-submarine systems and vessels in the recent past.
- [In January 2020, DRDO conducted two tests of the K Family missiles.]
- The capability of launching nuclear weapons from submarine platforms has strategic importance in light of the "**no first use**" policy of India.
- These submarines can not only survive a first strike by an adversary but also can launch a strike in retaliation.
- The nuclear-powered Arihant submarine and its class members in the pipeline are assets capable of launching missiles with nuclear warheads.

2.5 Defence Offset Dilution

Why in news?

The government has diluted the offset policy in defence procurement.

Why was it diluted?

- Reportedly, it was diluted in response to the Comptroller and Auditor General (CAG) of India's report.
- Many contend that the move is a setback for augmenting domestic capabilities or for realising the goal of Atmanirbhar Bharat.

Why defence trading is done?

- Most countries restrict trade in defence equipment and advanced technologies in order to safeguard national interest.
- Yet, for commercial gains and for global technological recognition, governments and firms do like to expand the trade.
- Negotiated bilateral sales between countries are a way out of the dilemma.

What are the factors?

- **Soft credit** often sweetens the deals with restrictions imposed on use, modification and resale of such equipment and technologies.
- In such trade negotiations, the price of the product is one of the many other factors.
- **Geopolitics** and the **technical knowhow** involved in the equipment weigh-in considerably as the contracts are for the long term, with technological fixities.
- The **product and technology** compel buyers to stick to them for:
 1. The advantages of bulk purchase, and

2. Dependence on the supplier for spares and upgrades.

- In other words, there is considerable “path dependency” in such choices, rendering the decisions difficult to reverse.
- Developing country buyers often lack an industrial base and research and development (R&D) facilities (which take a long time to mature).

How will offset clause help?

- The price and the terms of the contract reflect the government’s relative bargaining strength, and political and economic considerations.
- Large buyers such as India seek to exercise their “buying power” to secure not just the lowest price.
- They also try to acquire the technology to upgrade domestic production and build R&D capabilities.
- The offset clause is the instrument for securing these goals.

What was the initial offset clause?

- Initiated in **2005**, the offset clause has a requirement of sourcing 30% of the value of the contract domestically.
- Indigenisation of production in a strict time frame, and training Indian professionals in high-tech skills, required for promoting domestic R&D.
- However, the policy has been tweaked many times since.

What are the changes made?

- As of November 2019, the Defence Ministry had signed 52 offset contracts worth \$12 billion via Indian offset partners, or domestic firms.
- The duration of these contracts extends up to **2022**.
- According to the CAG report, between 2007 and 2018, the government signed 46 offset contracts worth ₹ 66,427 crore of investments.
- But, the realised investments were merely 8%, or worth ₹ 5,457 crore.
- Reportedly, technology transfer agreements in the offsets were not implemented, failing to accomplish the stated policy objective.
- Recently, the government has diluted this policy further.
- Henceforth, the offset clause will **not be applicable to bilateral deals** and deals with a **single seller** (monopoly), to begin with.

Why is it a setback for defence?

- Most defence deals are bilateral, or a single supplier deal (due to the monopoly over the technology).
- The dilution means practically giving up the offset clause.
- This may mean an end to India’s prospects for boosting defence production and technological self-reliance.
- But, the government defended the decision by claiming a cost advantage.
- Price is but one of many factors in such deals, as explained above.
- The higher (upfront) cost of the agreement due to the offset clause would pay for itself by,
 1. Reducing costs in the long term by indigenisation of production,
 2. The potential technology spill-overs for domestic industry.
- Hence, giving up the offset clause is undoubtedly a severe setback.

What should be learnt from the aerospace industry episode?

- Despite the heft of Hindustan Aeronautics Limited, India is a lightweight in global civilian aircraft manufacturing.
- This is due to the fact that the public sector giant mostly devotes itself to defence production.
- With the introduction of the offset policy in 2005, things changed dramatically.
- For contracts valued at ₹ 300 crore or more, 30% of it will result in offsets, implemented through Indian offset partners.
- As aerospace imports rose rapidly, so did the exports via the offsets by 544% in 2007, compared to the previous year.
- By 2014, exports increased to \$6.7 billion from \$62.5 million in 2005.
- The offset clause enabled India to join the league of the world's top 10 aerospace exporters.
- The success was short-lived, however. The policy dilution undid success.
- Exports plummeted after the offset clause was relaxed.

2.6 Anti-Tank Guided Missiles

Why in news?

The indigenously developed laser-guided version of the Anti-Tank Guided Missile (ATGM) was successfully test fired by the DRDO.

What are the ATGMs?

- ATGMs are missile systems that can strike and neutralise armoured vehicles such as tanks.
- They can pierce the armours of tanks and the material that can withstand such ammo.

When did ATGMs first come into use?

- The development of such kind of ammunition has been an ongoing race since World War I.
- But it wasn't until the World War II that armies across the world began to use the ATGMs.
- Indian Army mainly uses various imported ATGMs.
- But, the Defence Research and Development Organisation (DRDO) has been working on ATGMs that can be launched from different platforms as part of the Integrated Guided Missile Development Programme.

What were the previously tested ATGMs?

- In 2018, ATGM **Nag** was successfully tested in desert conditions.
- In 2019, the indigenously developed low weight, fire and forget **Man Portable ATGM (MPATGM)** was successfully tested.
- All these systems are in their various stages of development.
- They are mainly used by infantry units of the Army.
- In 2019, the government said that it has procured **Anti-Tank Spike Missiles** from Israel to meet the requirements of the Indian Army.

How are laser-guided ATGMs different?

- The laser-guided ATGM was successfully tested twice recently for a target placed at different ranges.
- They mainly differ in one aspect from other ATGMs developed till date.
- This ATGM (which is yet to receive an operational name) is designed to be fired from tanks.

- With its range limited to 1.5 to 5 kms, it locks and tracks the targets with the help of laser designation to precisely strike the target.
- The missile uses a 'tandem' High Explosive Anti Tank (HEAT) warhead.
- The term tandem refers to the missiles using more than one detonation in order to effectively penetrate the protective armours.
- This missile has the capacity of piercing armoured vehicles which use specially designed armour plates to counter the impact of projectiles.

Where was this ATGM developed?

- This Laser Guided ATGM has been developed by two facilities of the DRDO's Armament and Combat Engineering Cluster in association with Instruments Research & Development Establishment.
- [Two facilities of the Armament and Combat Engineering Cluster are
 1. Armament Research and Development Establishment (ARDE) and
 2. High Energy Materials Research Laboratory (HEMRL)]
- This missile is currently undergoing tests to be integrated with India's Main Battle Tank (MBT), Arjun.
- DRDO scientists said more tests for hitting targets at different ranges and for testing other flight parameters are planned in coming days.
- After these series of validation tests, the system will be ready for the user trial by the Army.
- These tests were conducted from MBT Arjun at the field ranges of the Armoured Corps Centre and School (ACC&S) of the Indian Army.

What is its importance in armoured warfare?

- The role of armoured vehicles has remained decisive even in modern day warfare because of their ability to **go past conventional defenses**.
- Tank battles are generally fought in a close range of under five kms.
- The objective is to hit the enemy tank before they can take a clear shot.
- Development of missile systems that can defeat tanks built using modern armour **act as a deterrent** against enemy tanks from advancing.
- DRDO scientists say the operability of the missile from a tank is a key feature in armoured warfare.
- The missile has the capability of engaging with the target even if it is not in the line of sight, thus further enhancing its capability.

2.7 K Missile Family

Why in news?

A successful trial of the Shaurya missile was conducted by India.

What is Shaurya missile?

- The nuclear capable Shaurya missile is a land-based parallel of the submarine launched K-15 missile.
- These ballistic weapons belong to the K missile family.
- They are named after late Dr APJ Abdul Kalam, the centre figure in India's missile and space programmes.
- They are launched from Arihant class of nuclear submarines.

What does this test reveal?

- Shaurya was examined for several advanced parameters compared to its earlier tests, according to sources.

- Shaurya is a canister-based system, which means that it is stored and operated from specially designed compartments.
- In the canister, the inside environment is controlled, thus it will
 - 1) Make its transport and storage easier,
 - 2) Improve the shelf life of weapons.
- These recent tests of these systems can be looked at as a strong message to China and Pakistan in light of the present situation in the region.

What are the K Family of missiles?

- The K family of missiles are primarily Submarine Launched Ballistic Missiles (SLBMs).
- They have been indigenously developed by the Defence Research and Development Organisation (DRDO).
- The development of these naval platform launched missiles began in the late 1990s as a step towards completing India's nuclear triad.
- [Nuclear Triad - The capability of launching nuclear weapons from land, sea and air based assets.]
- Because these missiles are to be launched from submarines, they are lighter, smaller and stealthier than their land-based counterparts.
- Their land-based counterparts are the Agni series of missiles which are medium and intercontinental range nuclear capable ballistic missiles.

What are the variants?

- Land and air variants of the K family have been developed by the DRDO.
- Shaurya is a land variant of short range SLBM K-15 Sagarika, which has a range of at least 750 kilometers.
- India has also developed and successfully tested multiple times the K-4 missiles from the family which has a range of 3500 km.
- It is reported that more members of K-family with ranges of 5000 and 6000 km are also under development.

What is the strategic importance of SLBMs?

- The capability of being able to launch nuclear weapons submarine platforms has strategic importance in achieving the nuclear triad.
- The sea-based underwater nuclear capable assets increases the second strike capability of a country and thus boosts its nuclear deterrence.
- These submarines can survive a first strike by the adversary.
- Also, it can launch a strike in retaliation thus achieving Credible Nuclear Deterrence.
- The 2016 commissioned nuclear powered Arihant submarine and its class members are capable of launching missiles with nuclear warheads.

3. ROBOTICS, IT AND COMPUTERS

3.1 Non-Personal Data Governance

Why in news?

A report by the Committee of Experts on Non-Personal Data Governance Framework was released recently.

What does the report seek to do?

- The report has sought to bring some clarity to a pack of contentious issues in India's data privacy space.
- It has defined, but with a limited success, non-personal data.
- It has delved into subjects such as ownership of data, undertaking a data business and data sharing.
- It suggests setting up a Non-personal Data Regulatory Authority.
- This authority would manage India's vast and emerging data space, while nurturing a creative and egalitarian technology architecture.

How does the report define non-personal data?

- It considers non-personal data to be data that is not related to an identified or identifiable natural person.
- This would include data on weather conditions, from sensors installed on industrial machines, from public infrastructure, etc.
- Another category of this data could pertain to information that initially was personal data but were later made anonymous.
- The aggregated data to which certain data transformation techniques are applied to the extent that the specific events related them are no longer identifiable can qualify as anonymous data.
- The data transformation techniques that can be used to anonymise personal data are not clearly defined.

How does the report classify data?

- The report suggests that data can be classified into three categories — public, community and private non-personal data.
- This classification is based on the data's ownership and origin of creation.
- The report defines and identifies stakeholders such as data principal, data custodian, data trustee and data trust.
- The roles of these parties are still not delineated.

What are some controversies?

- The report is not free of the ambiguities embedded in earlier policy papers on the subject, including the Personal Data Protection (PDP) Bill.
- This 2019 bill, which awaits Parliament approval, gives rise to long-term concerns.
- The suggestions of the report end up giving the State immense powers to determine non-personal data and use that for its interests.
- This doesn't augur well for a democracy, besides hurting business interests.
- Another controversial idea is the suggestion to create a Non-Personal Data Authority.

What needs to be done?

- The above issues need to be addressed to avoid unethical practices, as India is witnessing a data economy explosion.
- The legal framework needs to be revisited to avoid a chain of exploitative practices, legal wrangles and policy deadlocks.
- Bringing transparency into the data debate is the need of the hour.

3.2 US-Huawei-ZTE tussle

Why in news?

The US Federal Communications Commission (US FCC) designated Chinese telecom vendors Huawei and ZTE as national security threats.

Why has the US banned Huawei and ZTE?

- The first official action on these Chinese telecom equipment makers was taken based on House Intelligence Committee's report (2012).
- The report said that both the companies posed a risk to national security.
- It also said that the US businesses should avoid buying equipment from them.
- On most occasions, the US had accused Huawei and ZTE of working in ways that were contrary to national security or foreign policy interests.

Why is this ban important?

- Huawei is the world's largest maker of telecom equipment and the second largest maker of mobile phone parts.
- It has been at the forefront of innovation that allowed many companies to build large telecom infrastructure at very low costs.
- ZTE has tied up with several big corporations to manufacture their patented equipment in China at very low costs.
- A ban on both Huawei and ZTE could mean an **increase of up to 30% in cost** of telecom equipment across the board.
- Apart from hardware, Huawei has also been trying to make inroads into the software and operating systems (OS) industry.

Will the Huawei ban impact India?

- This decision could put pressure on India to take similar action.
- **Equipment market** - The low cost equipment from Huawei or ZTE could provide some relief to domestic telcos.
- Huawei was a major equipment supplier to companies like Vodafone Idea and Airtel during the initial rollout of the 4G services in India.
- Over the years, Huawei has made inroads into nearly 25% of the total telecom equipment market in India.
- **4G expansion** - Now, Department of Telecommunications said that it would rework the 4G network expansion tenders of BSNL and MTNL.
- This would bar global vendors like Huawei and ZTE from participating.
- **5G trials** - In 2019, the telecom minister said that all players, including Huawei, were permitted to participate in 5G trials in India.
- To allay security fears, Huawei had said it was ready to sign a no backdoor agreement with the government.
- Under the agreement, Huawei would vouch that it did not gain access to any Indian customer's equipment under any circumstance.
- Barring Huawei and ZTE from even bidding in the 5G auctions could mean equipment as much as 30% costlier.

3.3 Indigenising India's Cyber Space

What is the issue?

With emerging cyber threats and national security challenges, it is crucial for India to indigenise the IT infrastructure of its military.

What are India's aims in this regard?

- The following were spelt out at different instances as priorities in the cyber space -
 - i. a Digital Armed Force and the increasing importance of dominating the cyber space
 - ii. preparing for rivalries in cyber space
 - iii. the role of the services in encouraging the development of domestic capabilities
- The first vision is on its way to realisation as the government has sanctioned recently the raising of a cyber agency.
- This will steer the planning and conduct of cyber warfare in the military.
- Hopefully, once the doctrine has matured, the cyber agency will be expanded to a much-needed cyber command.
- But the goal of building domestic capability remains largely unfulfilled.

What is the emerging global threat?

- Under the PRISM programme, the US National Security Agency (NSA) collected data from internet communications.
- Leaked documents showed the close involvement of US technology companies like Microsoft, Google, Yahoo, Facebook and Apple.
- The NSA was collecting data directly from the servers of US service providers.
- Microsoft had actively helped the NSA to avoid its own encryption of web chats on Outlook.com.
- It also permitted PRISM to access its cloud storage service SkyDrive, and monitor Skype chats.
- Microsoft denied these allegations, but the evidence was overwhelming.
- Likewise, a recent Bloomberg report highlighted China's intelligence services' similar moves.
- It ordered subcontractors in China to plant malicious chips in Supermicro server motherboards bound for the US.
- Faced with these dangers, countries have moved to restrict foreign products from use in critical networks.
- E.g. in 2014, China banned government offices from buying Microsoft Windows
- Recently, US President Trump signed a bill banning the use of Chinese Huawei and ZTE technology by the US government.
- This followed a 2017 ban on the Moscow-based Kaspersky Lab.

What is the case with India?

- India seems to be largely unaware of the vulnerabilities that exist in the critical networks due to foreign hardware and software.
- **BSNL** - Over 60% of software and hardware being used by BSNL is sourced from Chinese Huawei or ZTE.
- This is despite Huawei being probed for hacking a BSNL network in 2014.
- In 2017, BSNL signed a memorandum of understanding with ZTE for research and commercialisation of future 5G technology.

- Notably, Australia has banned Huawei from supplying equipment for 5G mobile network, citing national security risks.
- **AFNET** - The Air Force Network (AFNET) was launched in 2010.
- Cisco (US network equipment maker) was a major supplier of equipment for AFNET.
- The army's latest communication backbone, Network for Spectrum (NFS), also uses Cisco equipment.
- Rather than looking at indigenous equipment, the request for proposal for NFS equipment had been manipulated to favour Cisco.
- **Software** - The Indian Army mostly uses the Microsoft Windows operating system on its official computers.
- Windows is an outstanding system but is a closed-source software owned by a company that is bound by US laws.
- It is historically tied to the American intelligence community.
- Notably, India is a prime target for American spying as India stood at the 5th place in the overall list of countries targeted by PRISM.

What is the proposal in this regard?

- In 2015, the Northern Command of the army decided to adopt the Bharat Operating System Solutions (BOSS) for all its official computers.
- BOSS is an indigenously developed open-source system by the Centre for Development of Advanced Computing.
- [It is an R&D organisation of the Ministry of Electronics and Information Technology.]
- **Concerns** - Replicating the user-friendliness of Windows and re-training of a generation that had grown up with Windows were key challenges.
- But three years later, the army is still debating the merits of BOSS.
- The arguments are still centered on simplicity of usage, and not on security of networks.
- There is even a push to return to Windows, instead of supporting BOSS.

What lies ahead?

- Building domestic capability for the manufacture of sophisticated weapons and equipment is indeed a major challenge.
- But the same cannot be said for the hardware and software being used in the military information technology (IT) infrastructure.
- Despite Indian products being available, a concerted effort to use indigenous solutions is conspicuously absent.
- But with clear dangers in cyber space, India needs to move towards making changes that are essential to protect national interests.
- A key task is for the Indian military to take the lead in indigenising its IT infrastructure.

3.4 Banning of Blockchain

Why in news?

The Banning of Cryptocurrency and Regulation of Official Digital Currency Bill, 2019 has been leaked recently.

Why is there support for the ban?

- There are high chances of cryptocurrencies being misused in money laundering.

- Various government bodies such as IT, CBDT, and the customs departments are supporting its ban.
- The bill has proposed stringent penalties, including 10 years of imprisonment for holding, selling or dealing in cryptocurrencies.

What is a blockchain?

- It is an **accounting ledger** which can store data on any real-world transaction of any kind.
- The unique feature of this ledger is the **decentralised style**.
- Every computer connected to a blockchain network helps validate and record transactions.
- People who connect their computers to a network are known as validators and receive transaction fees in the form of tokens.
- It also has **data encryption**, which makes it highly resistant to tampering.
- It can perform on **public basis** (such as Bitcoin) **or private**, with a single entity operating a closed blockchain system.

What is the potential of blockchain?

- Blockchain technology has the **potential to create new industries** and transform existing ones.
- Some **new companies are investing millions** in research and development.
- Venture capitalists invested \$2.4 billion in blockchain and cryptocurrency start-ups in 2018.
- **Even big technology companies** have started to take blockchain seriously. E.g Facebook's cryptocurrency Libra.

Why shouldn't there be a ban?

- A law to ban cryptocurrency would **prevent Indians from reaping economic benefits** by participating in blockchain networks as validators and earning transaction fees.
- The ban also will **stifle any innovation related** to this disruptive emerging technology.

What India can learn from Europe?

- The European Parliament and European Council are working on an **anti-money laundering directive** known as AMLD5.
- All crypto exchanges and wallet custodians operating in Europe will have to **implement strict know-your-customer (KYC)** onboarding procedures and need to **register with local authorities**.
- They will be required to **report suspicious activities** to relevant bodies.
- The EU Commission is also proposing
 1. self-declaration by virtual currency owners,
 2. the maintenance of central databases registering users' identities and wallet addresses, and
 3. norms while using virtual currencies as payment or investment means by 2022.
- This is a more reasonable approach, and the Indian government could follow suit.

3.5 Blockchains for Internet of Things

What is the issue?

- The Internet of Things is gaining momentum as the much deployed technology in the world across sectors.
- In this backdrop, here is how the blockchain architecture could satisfy the key demands of IoT.

What is IoT?

- The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people.
- These are provided with unique identifiers (UIDs) and the ability to transfer data over a network.
- The transfer happens without requiring human-to-human or human-to-computer interaction.

How significant is this becoming?

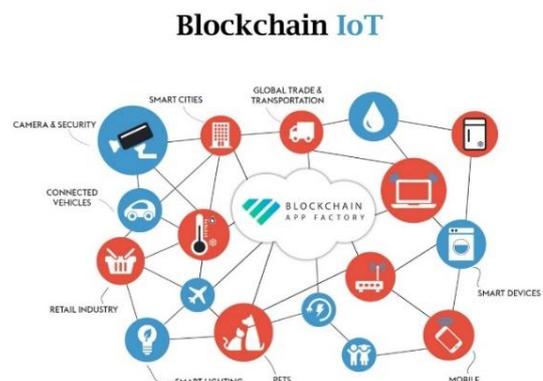
- Estimatedly, the number of connected devices in the world could grow 2.4-fold, from 6.1 billion in 2017 to 14.6 billion by 2022.
- Traffic from these connected devices is expected to grow seven-fold over the same period.
- With this, there will be an exponential increase in both the number of devices and amount of data transmitted.

What are the challenges?

- With IoT, a large amount of data is being captured from all around people by millions of devices.
- So there are reasonable concerns with respect to scalability, reliability and security, when considering the creation of large IoT networks.
- So it is essential to provide for an acceptable level of confidence in the platforms that will power the Internet of Things.
- Besides, a key question is if optimum economic value could be derived from the vast amount of data generated.
- The answer is not that encouraging as the quality and adequacy of the back-office systems and technologies are not adequate yet.
- Globally, only about 30% of IoT projects survive beyond the pilot phase.
- This is a powerful indicator that much needs to be done to effectively tap this new technology.

How does blockchain help here?

- The blockchain or multi-ledger technology provides the possible solution in handling the large amount of data.
- Blockchain was designed specifically as a back-end for Bitcoin, a crypto-currency.
- [It is a digital public ledger that records every transaction. Once a transaction is entered in the blockchain, it cannot be erased or modified.]
- But the conceptual architecture of blockchain, being versatile, has evolved and found theoretical application in nearly every industry.
- It can work as a distributed network, and safely execute on a wide variety of requirements.
- This makes it an ideal candidate to support the level of innovation and adoption required for IoT to succeed.
- The key issues of scalability, identity management, autonomy, reliability, security and marketing can all be addressed.
- But the IoT - Blockchain combination rarely gets the attention it deserves.



What are the key features of IoT-Blockchain use?

- **Decentralisation** - The current centralised architectures of IoT networks is problematic when it comes to citywide networks.
- Decentralisation is a core feature of blockchains; the expected points of failure and scalability bottlenecks in IoT can be adequately addressed.
- If implemented appropriately it could allow for a shift to peer to peer network designs, greater fault tolerance and expedited scalability.
- **Managing identities** - A massive IoT network would also be required to manage identities - of both users and things.
- With blockchain, all identity records can be contained within a single network, thus facilitating their discovery and management.
- **Autonomy** - The very nature of IoT mandates a certain level of autonomy in the functioning of enabling platforms.
- The reliance on server farms is expected to be significant for any large scale IoT implementation.
- With blockchain, devices would be able to communicate without the need for large server farms.
- **Security** - In IoT, authenticity and verification of data are critical, especially in the case of digitised citywide networks.
- The tamper-proof nature of the blockchain provides the much-needed security to IoT platforms.
- Powered by smart contracts, the blockchain could enable secure communications between devices, with scope for radical innovation.

How could large scale adoption be ensured?

- The blockchain possesses the ability to increase market access for deployed services.
- Transactions between peers can be simplified to a significant degree, and without the need for authorities or third parties.
- The blockchains' trustless environment ironically offers unprecedented levels of distributed security.
- This is ideal for the deployment of micro services and for the simplified execution of micro transactions.

3.6 5G Technology

What is the issue?

The transition to fifth-generation cellular networks (known as 5G for short) is soon to happen.



Where 5G technology can be applied

Healthcare

- Reduce pharmaceutical R&D costs
- Video/3D video appointments for non-life-threatening ailments
- Development of robotics in surgery
- More efficient health and fitness monitors

Smart cities and homes

- 3D video calls and holograms
- Innovative augmented and virtual reality applications
- Improved public safety with more efficient trackers
- Remote device control

Transport

Connected vehicles which allow data collection from traffic signals and road-side sensors will lead to

- Reduced congestion
- Intelligent fleet and logistics management

Autonomous cars with little or no help from humans can

- Improve road safety
- Increase mobility

What is the change in the making?

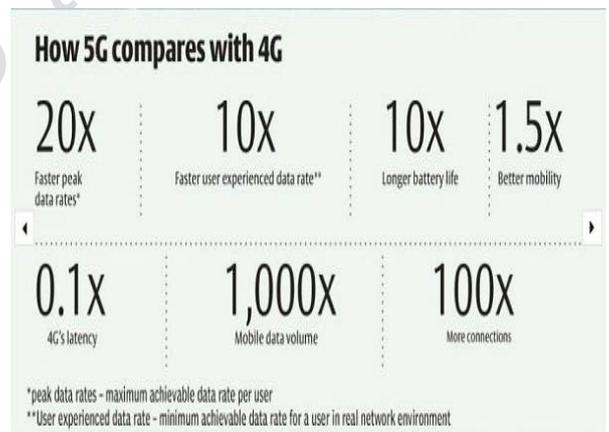
- The transition to 5G is an upgrade to wireless systems that will start reaching mobile phone users in a matter of months from now (Aug, 2019).
- But this is not just about faster smartphones.
- This will affect many other kinds of devices, including industrial robots, security cameras, drones and cars that send traffic data to one another.
- This new era will leap ahead of current wireless technology, known as 4G.
- This would offer mobile internet speeds that will let people download movies within seconds and bring big changes to video games, sports and shopping.
- To get the benefits of 5G, users will have to buy new phones, while carriers will need to install new transmission equipment to offer the faster service.

What exactly is 5G?

- Essentially, 5G is a set of technical ground rules.
- They define the workings of a cellular network, including the radio frequencies used and how various components like computer chips and antennas handle radio signals and exchange data.

What are the key benefits?

- **Speed** - The speed depends on where one is, and which wireless services is used.
- Qualcomm, the wireless chipmaker, said it had demonstrated peak 5G download speeds of 4.5 gigabits a second.
- However, it predicts initial median speeds of about 1.4 gigabits.
- In other words, it would be roughly 20 times faster than the current 4G experience.
- E.g. downloading a typical movie at the median speeds cited by Qualcomm would take 17 seconds with 5G, compared with 6 minutes for 4G
- The speeds will be particularly noticeable in higher-quality streaming video.
- **Latency** - There is another kind of speed, a lag known as latency, that may become even more important with 5G.
- The response is not exactly immediate when issuing a command now on a smartphone, such as starting a web search.
- A lag of 50 to several hundred milliseconds is common, partly because signals often must pass between different carrier switching centers.
- 5G, which uses newer networking technology, was designed to reduce this latency down to a few milliseconds.
- **Reliability** - 5G is also designed to deliver signals more reliably than earlier cellular networks.
- [Networks now frequently drop bits of data that are not essential for tasks like watching movies on a phone.]
- This change could bring many benefits, notably in fields such as virtual reality.
- The highest-quality VR applications now typically require bulky headsets that are connected by wire to nearby personal computers that generate 3-D images.



- With 5G, that would be off-loaded wirelessly to other machines, freeing users to move and making it easier to develop goggles the size of eyeglasses.
- In the related field of augmented reality, a smartphone camera could be pointed at a football game to see both live video on the display and superimposed player statistics or other data.
- **Besides** these, 5G's impact extends to medicine and other fields that increasingly rely on high-speed connections.
- Officials in the United States and China see 5G networks as a competitive edge.
- The faster networks could help spread the use of artificial intelligence and other cutting-edge technologies too.

3.7 Internet of Things

What is the issue?

Though Internet of Things throws up several data privacy challenges, India must push ahead.

What is the Internet of Things?

- The Internet of things (IoT) is the network of devices, vehicles, and home appliances that contain electronics, software, actuators, and connectivity which allows these things to connect, interact and exchange data.
- IoT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets to everyday objects.
- These objects may be anything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices.
- It can also be components of machines, for example a jet engine of an airplane or the drill of an oil rig.
- Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.
- Thus, it is all about connecting devices over the internet and letting them 'talk' to us, applications and each other.
- However, Internet of Things doesn't necessarily have to be connected to the internet; it can also be a network of things.

What is the case with India?

- IoT is the natural evolution of the internet and has many benefits including boosting global economies, improving public utilities, and increasing efficiencies.
- Many of our global counterparts have already begun reaping the rewards of investing in IoT-based infrastructure.
- The Indian government outlined a plan to leverage IoT as part of the Digital India mission.
- Indian IoT market is expected to reach \$15 billion by 2020 and constitute 5% of the global market.
- Investing in IoT will boost our economy on par with global leaders and it will also bring in investments, create jobs and improve Indian public infrastructure.

What are the concerns?

- IoT devices collect and share personal data in real-time, thus raising concerns on protecting personal information and privacy.
- There is growing concern about the potential for increased government surveillance and a resulting encroachment of civil rights to suppress dissent or marginalise communities.
- Additionally, the annual cost of cybercrime is over \$1 trillion.

- Since the IOT is capable of processing the tremendous amount of real-time data, it is possible for hackers and miscreants from accessing and manipulating those data.
- Also, several regulations across the world indicate that IoT companies need to collect user consent prior to collecting the said data.
- However, there is a debate around how best to communicate and receive consent for personal data collected.
- Thus, IoT manufacturers will have to build and sustain consumer trust in their devices.

What should be done?

- Policy-makers, regulators, device manufacturers, supporting industries and service providers will all have to join hands in creating a safer space online.
- The state of California in the US just passed the first IoT Cybersecurity law that holds IoT device manufacturers to higher security standards.
- The EU and the UK published guidelines and codes for IoT manufacturers.
- The Internet Society's Online Trust Alliance (OTA) Trust Framework provides strategic principles to increase the security of IoT devices and data.
- In India, the NDCP (National Digital Communications Policy) brought alignment from critical stakeholders to advance India's infrastructure and security around digital communications.
- The draft IoT policy seeks to establish committees to govern and drive IoT-specific initiatives.
- It is not yet clear how much access to personal data these committees get and how their actions will be monitored.
- The Justice Srikrishna Committee had recommended some provisions for personal data protection including a consumer's right to information, consent, and right to request companies to erase their data if preferred.
- However, it leaned heavily towards greater regulations and did not specify how to protect consumer data from unnecessary government surveillance.
- Despite these challenges, India must drive full speed ahead towards IoT technology for the greater good of our citizens.
- With effective global alliances and Indian stakeholder alignment, we can work to create more secure devices and help our citizens.

3.8 Significance of Artificial Intelligence

What is the issue?

- The countries with advantage in Artificial Intelligence (AI) could soon take form as concentrations of global power.
- It is high time that India use to its fullest advantage the IT and entrepreneurial competence, and a huge domestic market.

What is Artificial Intelligence (AI)?

- The human brain uses multiple techniques to both formulate and cross-check results.
- AI is the simulation of this human intelligence processes by machines, especially computer systems.
- These processes include learning, reasoning and self-correction.

Why is AI unique?

- Most industrial technologies develop in laboratories and then get applied by businesses.
- But, uniquely, AI develops within business processes as data are mined from digital platforms.

- These are then turned into intelligence and reprocessed to produce more data and intelligence.
- So any country's AI largely exists within its huge, domestically owned commercial digital/data systems.
- E.g. in the U.S. it is with Google, Amazon, Facebook, Apple and Microsoft.
- In China it lies with Baidu, Alibaba and Tencent.

How is India in this regard?

- India is not making a rational use of its great advantages of high IT capabilities.
- It also leaves unplanned, the big domestic market required for data harvesting.
- India is thus far behind in this emerging Artificial Intelligence race.
- It has no large domestically owned commercial data systems as that of US and China.
- Bleak chance, if any, could be hampered by allowing takeovers like that of Flipkart by Walmart.

What is the threat?

- **Economic** - India's consumer-behavioural and other economic data may soon be owned by Walmart and Amazon.
- This will offer them the scope to develop various kinds of Artificial Intelligence.
- Eventually, such AI will allow them to control everything.
- Every participant, along various economic value chains linked to consumer goods would be under their control.
- **Power** - Intelligent systems typically tend to centralise and monopolise control.
- Thus beyond economic dominance, AI influences cultural, political and military power.
- Notably, Google and Microsoft are partnering with U.S. military on AI applications.
- Likewise, China's AI platforms are working even more closely with its military.
- Logically, in the coming time, whoever rules Artificial Intelligence will rule the world.
- A non-AI military against an AI-powered one would be at a great disadvantage.

What are the concerns for India?

- **Competition** - The digital/AI industry works in huge ecosystems with global digital corporations at the centre.
- The US and Chinese firms are trying to ensure the largest number of clients and followers possible.
- Given this, start-ups, including in India, are struggling to find a place in huge global ecosystems.
- **Understanding** - Indian IT industry leaders are conveying a wrong message that India is doing well with AI.
- But these are only in reference to the fragment of IT/digital business.
- The real need is creating the highest levels of new value chains that AI will create in every sector.
- **Applications** - AI applications talked about in India are largely in reference to eased agriculture output, precision medicine or tailored learning.
- But these are just a miniscule of global digital/AI corporations, giving one-off benefits here and there.
- Evidently, the AI engine owned by Google or Microsoft is gathering further data from each new instance.
- In the course of time, they become more intelligent about India's problems and solutions.
- So a big nation like India cannot derive satisfaction from rapidly becoming a client country for AI.

- Owning the centres of systemic AI from controlling huge commercial data ecosystems is the real power.

What is the way forward?

- Policy makers should aim at building the systemic cores of AI where the real national advantage lies.
- India must welcome global technology companies to help India's digital development.
- But the challenge is, while technology is global, data are essentially local.
- So India must start treating its collective social/economic data as a strategic national asset.
- It thus has a right to provide domestic data protection through policy.
- So data-based sectoral platforms, like in e-commerce, agriculture, health, education, should largely be domestic.
- Such policy protection will encourage large-scale data-driven Indian companies to develop the highest AI in every sector.
- After developing enough AI proficiency domestically, it should be used to go global.

3.9 Need for a Legal Framework for AI

What is the issue?

Artificial Intelligence-/AI-driven tech will become counterproductive if a legal framework is not devised to regulate it.

What are the recent developments?

- Recently, the Kerala police inducted a robot for police work.
- Around the same time, Chennai got its second robot-themed restaurant.
- Here, robots not only serve as waiters but also interact with customers in English and Tamil.
- In Ahmedabad, a cardiologist performed the world's first in-human telerobotic coronary intervention on a patient nearly 32 km away.
- All these examples symbolise the arrival of Artificial Intelligence (AI) in everyday lives of human beings.

What are the global measures in this regard?

- Only recently, there has been interest across the world to develop a law on smart technologies.
- In the U.S., discussions are being taken up about regulation of AI.
- Germany has come up with ethical rules for autonomous vehicles.
- It stipulates that human life should always have priority over property or animal life.
- China, Japan and Korea are following Germany in developing a law on self-driven cars.

What is the need now in India?

- Traffic accidents lead to about 400 deaths a day in India, 90% of which are caused by preventable human errors.
- Autonomous vehicles that rely on AI can reduce this significantly, through smart warnings and preventive and defensive techniques.
- Patients dying due to non-availability of specialised doctors can be prevented with AI reducing the distance between patients and doctors.
- AI has several positive applications, as seen in the above examples.
- AI systems have the capability to learn from experience and to perform autonomously for humans.

- This also makes AI the most disruptive and self-transformative technology of the 21st century.
- So, if AI is not regulated properly, it is bound to have unmanageable implications.
- E.g. the consequence if electricity supply suddenly stops while a robot is performing a surgery and access to a doctor is lost
- These questions have already confronted courts in the U.S. and Germany.
- All countries, including India, need to be legally prepared to face such kind of disruptive technology.

What are the challenges involved?

- Predicting and analysing legal issues in regards with AI use and their solutions are not that simple.
- E.g. an AI-based driverless car getting into an accident that causes harm to humans or damages property
- In such cases, criminal law may face drastic challenges as the party to be held liable is disputable.

How is the AI policy progress in India?

- In India, NITI Aayog released a policy paper, 'National Strategy for Artificial Intelligence', in June 2018.
- The paper considered the importance of AI in different sectors.
- The Budget 2019 also proposed to launch a national programme on AI.
- But notably, all these developments are taking place on the technological front.
- No comprehensive legislation to regulate this growing industry has been formulated in India till date.

What should the priorities be?

- The first need is to have a legal definition of AI in place.
- It is essential to establish the legal personality of AI which means AI will have a bundle of rights and obligations, in the context of India's criminal law jurisprudence.
- Since AI is considered to be inanimate, a liability scheme that holds the producer or manufacturer of the product liable for harm must be considered.
- Moreover, since privacy is a fundamental right, certain rules to regulate the usage of data possessed by an AI entity should be framed.
- This should be a part of the Personal Data Protection Bill, 2018.

3.10 National Policy on Electronics 2019

Why in news?

The Union Cabinet recently gave its approval to the National Policy on Electronics 2019 (NPE 2019).

What is the policy for?

- The National Policy of Electronics 2019 (NPE 2019) replaces the National Policy of Electronics 2012 (NPE 2012).
- It was proposed by the Ministry of Electronics and Information Technology (MeitY).
- The NPE 2019 aims to position India as a global hub for Electronics System Design and Manufacturing (ESDM).
- The policy will lead to the formulation of several schemes, initiatives, and measures for the development of ESDM sector.
- **Targets** - The policy aims at achieving a turnover of US\$ 400 billion (approximately Rs 26,00,000 crore) by 2025 in the ESDM sector through domestic manufacturing and export.

- This will include a targeted production of 1 billion mobile handsets by 2025, valued at US\$ 190 billion.
- A part of this includes 600 million mobile handsets valued at US\$ 110 billion for export.

What are the key features of the policy?

The National Policy on Electronics 2019 provides for the following:

- creating an eco-system for globally competitive ESDM sector for promoting domestic manufacturing and export in the entire value-chain
- providing incentives and support for manufacturing of core electronic components
- providing special package of incentives for mega projects which are extremely high-tech and entail huge investments; e.g. semiconductor facilities display fabrication, etc
- formulating suitable schemes and incentive mechanisms to encourage new units and expansion of existing units
- promoting Industry-led R&D (research and development) and innovation in all sub-sectors of electronics
- [These include grass root level innovations and early stage Start-ups in emerging technology areas such as 5G, IoT/Sensors, Artificial Intelligence, Machine Learning, Virtual Reality, Drones, Robotics, Additive Manufacturing, Photonics, Nano-based devices, etc.]
- providing incentives and support for significantly enhancing the availability of skilled manpower, including re-skilling
- offering special focus on Chip Design Industry, Medical Electronic Devices Industry, Automotive Electronics Industry and Power Electronics for Mobility and Strategic Electronics Industry
- creating Sovereign Patent Fund (SPF) to promote the development and acquisition of IPs (Intellectual Property) in ESDM sector
- promoting trusted electronics value chain initiatives to improve national cyber security profile

How will it be beneficial?

- The provisions are likely to enable the flow of investment and technology, leading to -
 - i. higher value addition in the domestically manufactured electronic products
 - ii. increased electronics hardware manufacturing in the country and their export
 - iii. generation of substantial employment opportunities, to over one crore people
- The global electronics ecosystem has been looking beyond China due to the rising labour costs there.
- So NPE 2019 could pave the way to make India the next major global hub for manufacturing of mobile phones, refrigerators, televisions, ACs, etc.
- **Shortfalls** - Robust R&D is a pre-requisite to move up the value chain.
- Given this, interest subvention and a credit guarantee fund may not be adequate.
- There are other factors that hamper R&D investment by industry, beyond the tax structure, which need redressal.

How is electronics manufacturing in India at present?

- Since the 2012 policy, the Centre has been trying to make India a global hub for electronics equipment but has achieved limited success.
- Imports of electronics hardware account for more than half of India's domestic production.
- This has been increasing rapidly, from \$37 billion in 2014-15 to \$53 billion in 2017-18.
- India's electronics hardware output accounts for just 1.5% of world output.

- Actual investments into the electronics sector have not been impressive.
- E.g. an incentive package for setting up a fabrication unit for semiconductor, which is the heart of any electronic product, has had no takers
- Getting a global player to start semiconductor manufacturing in India will be the key to the Make in India vision.
- The Modified Special Incentive Package Scheme (M-SIPS) which offers subsidies for electronics industry was launched in 2012.
- However, the rate of approval for applications filed and the investments made thereafter remain low.
- There has been some success in the manufacturing of mobile phones in the country.
- But even in this area, local value addition is only around 7-8% as most of the critical components are imported.

3.11 Digital Divide

Why in news?

The report of the National Statistics Office's (NSO's) the survey of 'Household Social Consumption on Education in India' for July 2017-June 2018 was released.

What does the report highlight?

- It highlights the poor state of computer and internet access in several States.
- The disparities are glaring among different economic strata as well.
- The digital gap that separates the privileged from the deprived remains unbridged years after the broadband policy of 2004.
- Its effects are painfully evident during the pandemic as students struggle to log on to online classes.
- Some poorly connected States have improved since the survey period.
- But, the gaps are so stark that any development could only be modest.

What are the findings?

- Only Delhi, Himachal Pradesh and Kerala had internet access exceeding 50% for urban and rural households taken together.
- Punjab, Haryana and Uttarakhand exceeded 40%, unimpressive numbers still.
- Large States like Uttar Pradesh, Tamil Nadu, Andhra Pradesh and Karnataka had access below 20%.

What is critical?

- In today's environment, net access is critical.
- Even where mobile phones and laptops are available, they cannot be meaningfully used in the absence of net access.
- If net connectivity is 5% to 10% in rural Odisha, Madhya Pradesh, Telangana, Karnataka and West Bengal, only a slim minority can hope to do any academic work.
- Many remote locations have reliability problems and power deficits, making it a challenge to keep gadgets operational even offline.

What is the target?

- Prime Minister has announced in his Independence Day address that all villages would be connected with optical fibre cable in 1,000 days.

- This enhanced target follows the one set in 2011 to link panchayats through a national optical fibre network.
- - to raise administrative capacities through information infrastructure.
- Evidently, successive governments have dropped the ball.
- States have not shown the alacrity to make a big leap either, and the deficit has now dealt a blow to students.

What could be done?

- To make up for lost time, connectivity for education must be prioritised.
- Mapping the needs of each district based on the NSO data will help identify areas where children do need equipment and connectivity.
- Such efforts have been launched globally in the wake of COVID-19, some in partnership with the telecom sector to leverage its capacity for surveys and mapping.
- Some companies in India have made the valuable suggestion that their used desktop computers could be refurbished and donated.
- For this, the governments need to open a programme. The government needs to look at all possibilities and go into overdrive to bridge the digital divide.

4. BIOTECHNOLOGY

4.1 Indian Cobra Genome Decoded

Why in News?

An international team of researchers have sequenced the genome of the Indian cobra, in the process identifying the genes that define its venom.

What is the significance?

- This genome sequence can provide a blueprint for developing more effective anti-venom.
- The cobra genome sequence is of really high quality.
- Sequence information of the genes that code for venom proteins is very important for the production of recombinant anti-venoms.

Are existing anti-venoms not effective enough?

- Their **efficacy varies**, besides producing side effects.
- In India, the challenge has been producing anti-venom for the species known collectively as the “big four”,
 1. The Indian cobra (*Naja naja*),
 2. Common krait (*Bungarus caeruleus*),
 3. Russell’s viper (*Daboia russelii*), and
 4. Saw-scaled viper (*Echis carinatus*).
- **Common anti-venom** is marketed for the treatment of bites from the “big four”, but its effectiveness came under question in a recent study.
- The common anti-venom worked against the saw-scaled viper and the common cobra.
- But this anti-venom fell short against some neglected species and also against one of the “big four” - the common krait.
- **Facts** - Accidental contacts with snakes lead to over 100,000 deaths across the world every year.

- India alone accounts for about 50,000 deaths annually, and these are primarily attributed to the “big four”.

Why has production of effective anti-venom been challenging?

- Venom is a **complex mixture** of an estimated 140-odd protein or peptides.
- Only some of these constituents are toxins that cause the physiological symptoms seen after snakebite.
- But anti-venom available today does not target these toxins specifically.
- Anti-venom is currently produced by a century-old process.
- In this process, a small amount of venom is injected into a horse or sheep, which produces antibodies that are then collected and developed into anti-venom.

What are the issues with this ‘horse technique’?

- This is expensive, cumbersome technique and comes with complications.
- Some of the antibodies raised from the horse may be completely irrelevant.
- The horse also has a lot of antibodies floating in its blood that have nothing to do with the venom toxins.
- One more problem with horse antibodies is that our immune system recognises it as foreign and when anti-venom is given our body mounts an antibody response. This leads to what is called **serum sickness**.

How does decoding the genome help?

- In the Indian cobra genome, the researchers have identified 19 key toxin genes, the only ones that should matter in snakebite treatment.
- They stress the need to leverage this knowledge for creation of safe and effective anti-venom using synthetic human antibodies.
- The next step would be obtaining the genomes and the venom gland genes from the other three of the “big four” and the deadly African species.
- However, there is a very long way to go from genomes to effective anti-snake venoms.

4.2 Genome India Project

Why in News?

The Government of India has cleared a gene-mapping project called “Genome India” recently.

What is a genome?

- A genome is defined as an organism’s complete set of Deoxyribose Nucleic Acid (DNA), including all of its genes.
- Each genome contains all of the information needed to build and maintain that organism.
- In humans, a copy of the entire genome — more than 3 billion DNA base pairs — is contained in all cells that have a nucleus.
- The discovery that DNA is structured as a “double helix” was the spark in the long, continuing quest for understanding how genes dictate life.

Hasn’t the human genome been mapped before?

- The Human Genome Project (HGP) was an international programme that began in 1990 and completed in 2003.
- It led to the decoding of the entire human genome by sequencing and mapping all of the genes of humans.
- The HGP gave us the ability, for the first time, to read nature’s complete genetic blueprint for building a human being.

What then is the 'Genome India' Project?

- **Aim** - To 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.
- This is spearheaded by the Centre for Brain Research at Bengaluru-based Indian Institute of Science as the nodal point of about 20 institutions.
- Each of these institutions will do their bit in collecting samples, doing the computations, and then the research.

So, what will the project broadly do?

- It hopes to form a grid after collecting 10,000 samples in the first phase from across India, to arrive at a representative Indian genome.
- Most genomes have been sourced from urban middle-class persons and are not really seen as representative.
- Over 95% of the genome samples available, which are the basis of new, cutting-edge research in medicine and pharmacology, use the Caucasian genome as the base.
- So, this Indian genome project is seen as a necessity.
- The Indian project will aim to vastly add to the available information on the human species and advance the cause, both because of the scale of the Indian population and the diversity here.

Who is an Indian?

- The Indian subcontinent has been the site of huge migrations.
- **Horizontal diversity** - Scientists associated with the project, recognise that the first migrations were from Africa.
- Later too, there were periodic migrations by various populations, making this a special case of almost all races and types intermingling genetically. This can be seen as "horizontal diversity".
- **Vertical diversity** - Later, there has been endogamy or inter-marriage practised among distinct groups resulting in some traits inherited by just some groups. This can be seen as "vertical diversity".
- Studying and understanding both diversities would provide the bedrock of personalised healthcare for a very large group of persons on the planet.

What are the challenges involved?

- **Medical Ethics** - In a project that aims only to create a database of genetic information, gene modification is not among the stated objectives.
- It is important to note, however, that this has been a very fraught subject globally.
- The lure to "intervene" may be much more if this kind of knowledge is available, without one being fully aware of the attendant risks.
- **Data & storage** - After collection of the sample, anonymity of the data and questions of its possible use and misuse would need to be addressed.
- Keeping the data on a cloud is fraught with problems and would raise questions of ownership of the data.
- India is yet to pass a Data Privacy Bill with adequate safeguards.
- So, launching a Genome India Project before the privacy question is settled could give rise to another set of problems.
- **Social issues** - Scientific studies of genes and classifying them could reinforce stereotypes and allow for politics and history to acquire a racial twist.
- In India, a lot of politics is now on the lines of who are indigenous people and who are not.

- So, this Project could add a genetic dimension to the cauldron.

4.3 Genetically Modified Seeds

Why in news?

The farmers' union Shetkari Sanghatana (Maharashtra) announced fresh plans in its agitation for use of genetically modified seeds.

What are GM seeds?

- Conventional plant breeding involves crossing species of the same genus to provide the offspring with the desired traits of both parents.
- Genetic engineering aims to transcend the genus barrier by introducing an alien gene in the seeds to get the desired effects.
- The alien gene could be from a plant, an animal or even a soil bacterium.

What are the GM crops in India?

- **Bt cotton** - It is the only GM crop that is allowed in India.
- It has two alien genes from the soil bacterium *Bacillus thuringiensis* (Bt) that allows the crop to develop a protein toxic to the pest pink bollworm.
- **Ht Bt cotton** - It is derived with the insertion of an additional gene, from another soil bacterium.
- This allows the plant to resist the common herbicide glyphosate.
- **Bt brinjal** - In this, a gene allows the plant to resist attacks of fruit and shoot borer.
- **DMH-11 mustard** - It was developed in University of Delhi.
- In this, genetic modification allows cross-pollination in a crop that self-pollinates in nature.
- Globally, GM variants of maize, canola and soya bean are available.

What is the legal position of GM crops in India?

- In India, the Genetic Engineering Appraisal Committee (GEAC) is the apex body that allows for commercial release of GM crops.
- In 2002, the GEAC had allowed the commercial release of Bt cotton.
- More than 95% of the country's cotton area has since then come under Bt cotton.
- Use of the unapproved GM variant can attract a jail term of 5 years and fine of Rs 1 lakh under the Environmental Protection Act, 1989.

Why are farmers rooting for GM crops?

- **Cotton** - In the case of cotton, farmers cite the high cost of weeding.
- This cost goes down considerably if they grow Ht Bt cotton and use glyphosate against weeds.
- **Brinjal** - Brinjal growers in Haryana have rooted for Bt brinjal.
- This is because it reduces the cost of production by cutting down on the use of pesticides.

What is the problem?

- **Unauthorised crops** are widely used.
- Of the 4-4.5 crore packets (each weighing 400 g) of cotton sold in the country, 50 lakh are of the unapproved Ht Bt cotton.
- Haryana has reported farmers growing Bt brinjal in pockets which had caused a major agitation there.

- Environmentalists argue that the **long-lasting effect of GM crops** is yet to be studied and thus they should not be released commercially.
- Genetic modification brings about changes that can be harmful to humans in the long run.

4.4 Potentials of Genetic Modification

What is the issue?

Despite the critical views on Genetic Modification (GM), there have been substantial benefits out of it, which needs recognition for further betterment.

What benefits has the GM technology brought?

- *Bacillus thuringiensis* (Bt) in maize and cotton from 1996 to 2015 contributed to a reduction in the gap between actual yield and potential yield.
- This was under circumstances in which targeted pests caused substantial damage to non-GE (Genetic Engineering) varieties.
- Also, synthetic chemicals could not provide practical control.
- But GM technology adoption has reduced pesticide use by 37%, increased crop yield by 22%, and increased farmer profits by 68%.
- Yield gains and pesticide reductions are larger for insect-resistant crops than for herbicide-tolerant crops.
- Yield and profit gains are higher in developing countries than in developed countries.

What is the case with India?

- **Cotton** - Certainly, Bt cotton is not a failure in India. Farmers continue to grow Bt cotton.
- The yields hovering around 300 kg/ha at the time of introduction of Bt cotton (2002) have increased to an average of over 500 kg/ha.
- It has converted India from a cotton-importing country to the largest exporter of raw cotton.
- There was a small dip for a couple of years and the yield has now increased to over 550 kg/ha.
- Further, the development of resistance can be tackled through practices like Integrated Pest Management and by stacking Bt genes to fight secondary pests.
- The priority now is to accelerate development of Bt cotton varieties that can be packed densely in fields.
- By doing so, yields could be increased to over 800 kg/ha, as is the case with other countries.
- **Mustard** - GM mustard (DMH-11) is a technology to create mustard hybrids.
- Being a self-pollinator, mustard is difficult to hybridise through conventional methods.
- So genetic modification allows different parents to be combined easily, helping yields go up substantially.

What lies ahead?

- Genetic engineering technology has opened up new avenues of molecular breeding.
- However, their potential undesirable impacts will have to be kept in view.
- What is important is to choose the one which can take the country to the desired goal sustainably, safely and economically.
- There is scope for further improvement in terms of technology and regulatory protocols for GM technology in India.

4.5 RT-PCR and Antibody tests

What is the issue?

- The role of ‘silent spreaders’ in the coronavirus pandemic highlights the significance of testing. Click here to know more on this
- In this backdrop, here is a look at the two types of tests to detect the virus infection - RT-PCR based and the antibody based.

How does the Coronavirus express itself?

- A virus is a microscopic package of genetic material (either DNA or RNA) surrounded by a molecular envelope.
- Some viruses such as the coronavirus (SARS-Cov2) only contain RNA.
- This means that they rely on infiltrating healthy cells to multiply and survive.
- Once inside the cell, the virus uses its own genetic code to take control of and ‘reprogramme’ the cells to make them become virus-making factories.

What is the RT-PCR method in testing?

- Real time RT-PCR (reverse transcription–polymerase chain reaction) is now one of the most accurate laboratory methods for detecting, tracking, and studying the coronavirus.
- RT-PCR is a nuclear-derived method for detecting the presence of specific genetic material from any pathogen, including a virus.
- It uses markers to detect the presence targeted genetic materials.
- Originally, radioactive isotope markers were used.
- Subsequent refining has led to the replacement of the isotopic labelling with special markers, most frequently fluorescent dyes.
- With real time RT-PCR, scientists can see the results almost immediately while the process is still ongoing. [Conventional RT-PCR only provides results at the end.]

What is the principle behind?

- In order for a virus like the coronavirus to be detected early in the body, using real time RT-PCR, scientists need to convert the RNA to DNA.
- This is a process called ‘reverse transcription’.
- They do this because only DNA can be copied - or amplified - which is a key part of the real time RT-PCR process for detecting viruses.
- Scientists amplify a specific part of the transcribed viral DNA hundreds of thousands of times.
- By this amplification, instead of trying to spot a minuscule amount of the virus among millions of strands of genetic information, scientists have a large enough quantity of the target sections of viral DNA.
- This facilitates in the accurate confirmation that the virus is present.

How does RT-PCR work in Coronavirus case?

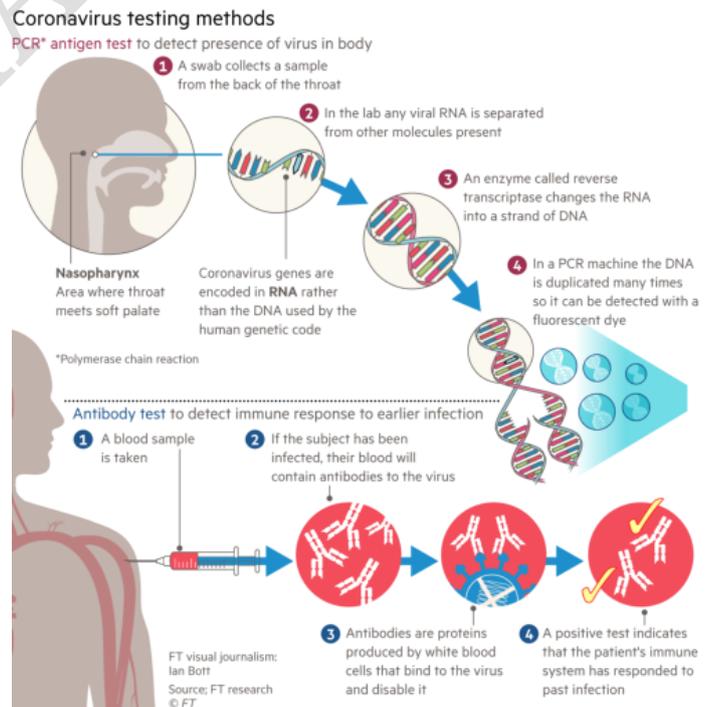
- A sample is collected from parts of the body where the coronavirus gathers, such as a person’s nose or throat.
- The sample is treated with several chemical solutions.
- This remove the substances, such as proteins and fats, and extracts only the RNA present in the sample.
- This extracted RNA is a mix of a person’s own genetic material and, if present, the coronavirus’ RNA.
- The RNA is reverse transcribed to DNA using a specific enzyme.

- Then, additional short fragments of DNA are added that are complementary to specific parts of the transcribed viral DNA.
 - i. Some of the added genetic fragments are for building DNA strands during amplification.
 - ii. The others are for building the DNA and adding marker labels to the strands, which are then used to detect the virus.
- These fragments attach themselves to target sections of the viral DNA if the virus is present in a sample.
- The mixture is then placed in a RT-PCR machine.
- The machine cycles through temperatures that heat and cool the mixture to trigger specific chemical reactions.
- These reactions then create new, identical copies of the target sections of viral DNA, and the cycle repeats over and over to continue copying.
- [Each cycle doubles the previous amount: two copies become four, four copies become eight, and so on.
- A standard real time RT-PCR setup usually goes through 35 cycles.
- So, by the end of the process, around 35 billion new copies of the sections of viral DNA are created from each strand of the virus present in the sample.]
- As new copies of the viral DNA sections are built, the marker labels attach to the DNA strands and then release a fluorescent dye.
- This is measured by the machine's computer and presented in real time on the screen.
- The computer tracks the amount of fluorescence in the sample after each cycle.
- When the amount goes over a certain level of fluorescence, this confirms that the virus is present.
- Scientists also monitor how many cycles it takes to reach this level in order to estimate the severity of the infection.

- [The fewer the cycles, the more severe the viral infection is.]
- **Advantages** - This technique is highly sensitive and specific and can deliver a reliable diagnosis as fast as 3 hours, though usually laboratories take on average between 6 to 8 hours.
- Comparatively, real time RT-PCR is significantly faster and has a lower potential for contamination or errors.
- This is because the entire process can be done within a closed tube.

What is the anti-body test?

- The antibody test is based on a biological phenomenon.
- In response to entry of any 'foreign invader' (virus, in this case), antibodies are generated by the body's own immune system.
- Such antibodies are specific to that invader.
- Therefore, detection of specific antibodies in a blood sample may indicate that 'at some point', that individual is exposed to that invader.



What are the drawbacks in anti-body test?

- Unlike DNA, antibodies cannot be copied in a test tube, and therefore, this test is generally less sensitive than PCR.
- Also, the human body takes some time to generate antibodies after it is exposed to an invader.
- Antibodies continue to be present in the blood for some time even after the invader is completely eliminated from the body and there are no clinical symptoms.
- [The human body is capable of generating immunological memory after first infection.
- So, the next time, if same invader re-enters, the body is better prepared to eliminate the infection (a principle behind all vaccinations).
- In some cases, this memory (which is typically called “immunity”) is life long; in other cases, it is short termed.]

Why are both tests relevant now?

- Clearly, the controversy of one test over the other is misplaced; both are important, but their purposes are different.
- RT-PCR is the confirmatory test to be done when someone comes with clinical symptoms.
- The same test will certify if the patient is fully recovered or not.
- RT-PCR will give an idea if people within the immediate proximity of a newly-confirmed patient are infected by the virus.
- However, in this case, the first negative result does not completely rule out lack of infection.
- Therefore, quarantine/isolation of these people (who were in proximity with patient) is essential.
- On the other hand, the vast majority (by some estimates 70-80%) would have sub-clinical infection (they have never shown any symptoms).
- So, in this case, the antibody test will give data on how many people are exposed to the virus at some point of time.
- This would be essential to estimate the extent of virus spread in the community and to respond appropriately.

4.6 Rapid Antigen Detection Test

Why in news?

The Indian Council of Medical Research (ICMR) approved the rapid antigen detection test for diagnosis of Covid-19.

What is the rapid antigen detection test?

- It is a **point-of-care test**, performed outside the laboratory setting.
- It is a quick diagnostic test on swabbed nasal samples. It detects antigens that are found on or within the SARS-CoV-2 virus.
- [Antigens are foreign substances that induce an immune response in the body.]
- In India, the ICMR has allowed the use of antigen detection kits developed by the South Korean company S D Biosensor.
- SD Biosensor has a manufacturing unit in Manesar.
- The kit is commercially called Standard Q COVID-19 Ag detection kit.
- It comes with an inbuilt Covid antigen test device, viral extraction tube with viral lysis buffer and sterile swab for sample collection.

How is rapid antigen detection test different from RT-PCR test?

- RT-PCR is currently the gold standard frontline test for the diagnosis of Covid-19.
- Like RT-PCR, the rapid antigen detection test too seeks to detect the virus rather than the antibodies produced by the body.
- While the mechanism is different, the most significant difference between the two is **time**.
- As the ICMR has pointed out, the RT-PCR test takes a minimum of **2-5 hours** including the time taken for sample transportation.
- These specifications limit the widespread use of the RT-PCR test.
- It also impedes quick augmentation of testing capacity in various containment zones and hospital settings.
- In a reliable rapid antigen detection test, the maximum duration for interpreting a positive or negative test is **30 minutes**.

Why has been only the kit by the company SD Biosensor allowed?

- Very few reliable antigen detection kits for Covid-19 diagnosis are available worldwide.
- The US FDA authorised the first antigen test, with US-based Quidel's antigen kit called the Sofia 2 SARS Antigen FIA.
- In India, the ICMR conducted an independent **two-site evaluation** of the SD Biosensor kit, at ICMR and AIIMS.
- The results revealed that the kit had a very high specificity, or the ability to detect true negatives, ranging between 99.3% and 100%.
- The sensitivity of the test, or its ability to detect true positives, ranged between 50.6% and 84%, depending upon the viral load of the patient.
- The higher the ability to detect true negatives, the more reliable is any positive result.
- Having allowed SD Biosensor to market its kit commercially, ICMR has also asked other manufacturers/developers who have antigen detection assays to come forward for validation.

Where will the test be used?

- As of now, the kit will be used in containment zones or hotspots and healthcare settings.
- Test will be performed onsite under strict medical supervision and maintaining the kit temperature between 2° and 30°C.
- **In containment zones** - The test can be conducted on all symptomatic influenza-like illnesses.
- Asymptomatic direct and high-risk contacts with co-morbidities of a confirmed case are to be tested once between day 5 and 10 of coming into contact.
- **In healthcare settings** - It can be used in three categories.
 1. In all persons presenting influenza-like symptoms in a healthcare setting and suspected of having Covid-19 infection;
 2. In asymptomatic patients who are hospitalised or seeking hospitalisation, in the high-risk groups and
 3. In asymptomatic patients undergoing aerosol-generating surgical procedures /non-surgical interventions.

Is the test a confirmatory one for diagnosis of Covid-19?

- According to the ICMR guidelines, if the test shows a positive result, it should be considered as true positive, and does not need reconfirmation.

- However, those who test negative in the rapid antigen test should then be tested by RT-PCR to rule out infection.

What are the limitations of an antigen test's results?

- When it gave emergency authorisation for the first antigen kit, the US FDA pointed out that antigen tests are **very specific for the virus**.
- But it also said that they are **not** as **sensitive** as molecular PCR tests.
- Also, the ICMR has said that once the sample is collected in the extraction buffer, it is **stable only for one hour**.
- Therefore, the antigen test needs to be conducted at the site of sample collection in the healthcare setting.
- A negative test result may occur if the level of an extracted antigen in a specimen is below the sensitivity of the test or if a poor quality specimen is obtained.
- A negative result may occur if the concentration of antigen in a specimen is below the detection limit of the test or if the specimen.
- Also, children tend to shed the virus for longer periods than adults, which may result in differences in sensitivity.

4.7 Covid-19 Vaccine

Why in news?

The Indian Council of Medical Research (ICMR) wants the Covid-19 vaccine to be ready for public use way sooner.

What is the vaccine?

- 'Covaxin' is the indigenous Covid-19 vaccine developed by Hyderabad-based Bharat Biotech.
- It was developed from a strain of SARS-CoV-2 isolated at the National Institute of Virology.

How this decision is viewed?

- The agency's head wrote a letter to the doctors preparing to test the indigenous vaccine for human trials.
- This appeared to be pressurizing the doctors into getting a vaccine ready by August 15, 2020.
- After a **public uproar**, the agency clarified that, its intent was to infuse a sense of urgency given the pandemic.
- It also clarified that there were no plans to deviate from the rulebook on vaccine development.

What are the steps in vaccine approval?

- The basic philosophy of all vaccines involves **introducing the weakened form of the virus** into healthy volunteers.
- Therefore, the first checkpoint is that the vaccine candidate should not sicken a healthy person.
- Next hurdle is that a vaccine must **stimulate the immune system** just enough to get it to produce protective antibodies.
- Finally, only if all were to go well, it must be tested on many people in real world conditions.
- Over time, they must be shown over to be better protected than those who were unvaccinated.
- Each one of these steps cannot be rushed.
- Each step is necessary to ensure that the vaccine can be released for public use.

What is the conclusion?

- Bharat Biotech has experience and credibility in vaccine manufacture.
- However, Covaxin is one of hundreds of potential vaccines being tested.
- Experts' consensus is that no vaccine could be readied for public use until next year.
- It is perplexing why the ICMR would want to cut corners with a basic premise of research that: Science does not progress in a hurry.
- The best strategy is to maintain **absolute transparency**, and proceed surely, even if slowly.

4.8 Research on Coronavirus' Proteins

Why in news?

Research shows that the spike protein of SARS-CoV-2 changes its form after it attaches itself to a human cell.

What is the spike protein?

- A spike protein protrudes from the surface of a coronavirus, like the spikes of a crown or corona.
- In the SARS-CoV-2 coronavirus, the spike protein **initiates the process of infection** in a human cell.
- It attaches itself to a human enzyme (ACE2 receptor) before entering into the cell and makes multiple copies of itself.

What has the new research found?

- Researchers have freeze-framed the spike protein of SARS-CoV-2 in both its shapes - before and after fusion with the cell.
- For doing this, they have used the technique of cryogenic electron microscopy (cryo-EM).
- The images show a dramatic change to the hairpin shape after the spike protein binds with the ACE2 receptor.
- The "after" shape can show itself before fusion without the virus binding to a cell at all.
- The spike can go into its alternative form prematurely.

What does that signify?

- The alternative shape may help keep SARS-CoV-2 from breaking down.
- The rigid shape may explain why the virus remains viable on various surfaces for various periods.
- It is speculated that the post fusion form may protect the SARS-CoV-2 from our immune system.

In what way can it protect the virus from the immune system?

- Post fusion shape can induce antibodies that do not neutralise the virus.
- In effect, the spikes in this form may **act as decoys** that distract the immune system.
- Antibodies specifically targeting the post fusion state would not be able to block viral entry since it would be too late in the process.

Do the two forms share any similarities?

- Both the "before" and "after" forms have sugar molecules, called glycans, at evenly spaced locations on their surface.
- Glycans are another feature that helps the virus avoid immune detection.

How is the knowledge about the alternative shape useful?

- These findings may have implications for **vaccine development**.

- Many vaccines that are currently in development use the spike protein to stimulate the immune system.
- But these may have varying mixes of the prefusion and postfusion forms.
- This may limit their protective efficacy.
- There is a need for stabilising the spike protein in its prefusion structure to block the conformational changes that lead to the postfusion state.
- If the protein is not stable, antibodies may be induced but they will be less effective in terms of blocking the virus.
- Using this research's prefusion structure as a guide should help us in introducing stabilizing mutations to mimic the prefusion state.
- This could be more effective in eliciting neutralizing antibody responses.
- This would be done by the researchers in case the first round of vaccines are not as effective as we all hope.

4.9 ICMR's Trial on Plasma Therapy

Why in news?

ICMR approved a multi centric phase-2 trial to use convalescent plasma on Covid-19 patients with moderate illness.

Why ICMR will conduct a phase-2 trial?

- **Previously** - ICMR conducted three feasibility studies in about 20 severely ill patients.
- These tests have found the therapy to be safe and able to resolve illness or improve the clinical symptoms.
- **Currently** - Safety of convalescent plasma from people who have recovered from Covid-19 illness is not a huge concern.
- Therefore, the first stage of the human clinical trial has been skipped.
- The ICMR will instead study plasma safety and efficacy in a phase-2 trial with 452 patients.

How will the trial be carried out?

- The patients with moderate Covid-19 illness will be randomly assigned to receive either convalescent plasma or only standard of care.
- Plasma will be collected from donors in 21 hospitals, 28 days after they make a complete recovery from illness.
- Or the plasma will be collected from a symptom-free person who have more than the required level of antibodies against the novel coronavirus.
- Molecular and also other routine tests will be done before plasma use.

What will be the outcomes of the new trial?

- The primary outcomes of the trial include,
 1. Preventing the illness from progressing to a severe form, and
 2. Avoiding deaths from all causes at 28 days after plasma infusion.
- Key secondary outcomes will include resolution of symptoms, reduction in hospital stay and respiratory support.

How effective is the CP therapy?

- Convalescent plasma (CP) therapy, about a century old, has shown some benefit in treating measles, chickenpox and rabies.

- Studies have shown faster clearance of virus in the case of MERS and SARS if given early in the course of disease, but not in randomised trials.
- Only 3 studies involving 21 Covid-19 patients have been carried out but not in trials that will demonstrate the efficacy of CP therapy for Covid-19.

Why trials are important?

- In trials, the participants will be selected randomly with a control arm.
- Randomised controlled trials will clearly demonstrate the efficacy of a therapy for any infectious disease, including Covid-19.
- The pandemic provides an opportunity to **ascertain the clinical benefits** of CP therapy through randomised controlled trials.
- The U.S. FDA and India have thus approved the use of plasma from recovered Covid-19 patients only for trial purposes.

4.10 Delhi's Plasma Bank

Why in news?

The Delhi government will set up a plasma bank for coronavirus patients at the Institute of Liver and Biliary Sciences (ILBS).

What is a plasma bank?

- The Plasma banks will extract and store plasma from people who have recovered from Covid-19.
- They will give this plasma to someone suffering from the disease.
- The bank is being started keeping in mind the experiences of many who struggle to arrange plasma for their loved ones.

At what stage is the therapy in Delhi?

- Delhi was among the first few states to get ICMR approval to conduct trials with plasma therapy, which is still at trial stage.
- Once a person contracts the virus, the blood produces antibodies and certain cells remember the antigen.
- These cells will produce antibodies when they come in contact with the same virus again.
- The plasma trial is examining if the plasma containing antibodies from recovered patients is beneficial to others as well.
- The CP therapy is not as effective on critical patients, but those with moderate symptoms appear to be responding well.

What are the results of the trial?

- In a controlled study conducted on patients at Lok Nayak Hospital, administration of the therapy was found to be safe.
- The results have also been shared with ICMR.
- While some patients were administered convalescent plasma (CP), the others were administered fresh frozen plasma (FFP).
- CP is extracted from a Covid patient who has recovered.
- FFP is extracted from a person who has no exposure to the disease.
- During the trial, it was found those who were given CP showed more improvement than those who were administered FFP.

Why is CP better than FFP?

- CP was administered to those whose respiratory rate had soared to 35.36 breaths per minute. [Normal rate is 12 to 20 breaths per minute.]
- Post administering plasma, the respiratory rate improved substantially.
- These results were better than the results seen in patients who were administered regular FFP.
- The duration of stay in the hospital was also reduced in those given CP.

Who can be a donor?

- A healthy person between the age group of 18-60 years with no co-morbidities could be a donor.
- The patient should have recovered at least three weeks before donating and tested negative for Covid-19 twice.

4.11 Withdrawal of Lancet Study

Why in news?

- A study in The Lancet (medical journal) found no benefit from the use of hydroxychloroquine (HCQ) to treat COVID-19 patients.
- The Lancet has now withdrawn this study, after the research paper's authors said they could no longer vouch for its underlying data.

What is hydroxychloroquine?

- It is an anti-malarial drug option.
- It is considered less toxic than chloroquine.
- It is also prescribed for patients of rheumatoid arthritis and lupus.

Who makes this drug in India?

- Hydroxychloroquine had a market size of only around Rs 152.80 crore.
- However, several countries source the drug from India.
- Mumbai based Ipca Laboratories has nearly 82% of the market, with its brands HCQS and HYQ.
- Around 80% of the volumes produced by Ipca are exported.
- Ahmedabad-headquartered Cadila Healthcare has 8% of the market.

Why has hydroxychloroquine gained attention now?

- The International Journal of Antimicrobial Agents (IJAA), reported that Azithromycin (antibiotic) added to hydroxychloroquine was significantly more efficient for COVID-19 elimination.
- However, the study was flagged as being too small to draw a definitive conclusion.
- However, by late March 2020, Trump had begun to call the drug a “game changer”, and has since been pushing it.
- At the end of March 2020, the Indian Council of Medical Research (ICMR) issued an advisory.
- It recommended the use of hydroxychloroquine in asymptomatic healthcare workers treating COVID-19 patients.
- ICMR also allowed doctors to prescribe it for household contacts of confirmed COVID-19 patients.
- However, the government has stressed that the drug can only be used in COVID-19 treatment on prescription, and that it should not instill a sense of “false security”.

What did the earlier study result in?

- The study relied on a huge dataset of about 96,000 patients.
- They were sourced from 671 hospitals in six continents.
- So, the WHO has now suspended drug trials pending a safety review, citing a 'do no harm' principle.
- This led to some countries in Europe withdrawing the drug from their own trials.

What was the other study withdrawn?

- The Lancet move was soon followed by the withdrawal of another coronavirus paper in the New England Journal of Medicine (NEJM).
- This was not linked to hydroxychloroquine.
- But it relied upon the same healthcare company's patient database and involved some of the same authors.
- This paper sought to answer questions on the associations between -
 - i. cardiovascular disease
 - ii. COVID-19
 - iii. drugs that target the enzymes that play a role in facilitating the virus in attacking a host

What were the shortcomings highlighted?

- The authors (scientists) of the Lancet paper found problems with the methodology and, more importantly, the dataset.
- It emerged that mortality attributed to the disease in Australia did not match with the country's own estimates.
- There was no way to tally patient records and the hospitals they were sourced from.
- There were also problems with the statistics deployed and the conclusions about the potential risk from the drug.
- The bigger concern was that the data was supplied by Surgisphere Corporation.
- This had just a handful of employees with limited scientific expertise.
- It claimed to have aggregated its numbers by compiling electronic health records in less than 2 months.
- But, experienced clinical trial specialists said that this was a labour-intensive process.
- Concerns were raised regarding the data consequently.
- Soon, the company, citing client confidentiality, said it was unable to share its data sources for independent assessment.
- In their retractions, the journals have blamed Surgisphere for being opaque with its primary data.

What is the larger concern?

- The unfolding research scandal threatens to undermine confidence in two of the world's top medical journals in the midst of a pandemic.
- Moreover, it was the independent effort by external scientists that has now brought the errors to light.
- So far, neither journal has introspected on the peer-review process that led to these studies being published in the first place.
- The average peer-review takes weeks and the clinical trial process months.
- But now, in the post-COVID panic-driven world, the expectation is that science delivers its results like magic.

What does this imply?

- It is a mistake to assume the scientific process as one divorced from the influence of power, privilege, finance and politics.
- The scientific process must be protected from those seeking power and riches.
- The means and methods to a scientific result matter more than the results.
- Openness, more than blame game, is what the post-COVID world needs now from the medical arena.

5. HEALTH

5.1 Nutrition & Union Budget

What is the issue?

- There was reference made to the unprecedented scale of developments under the National Nutrition Mission in the 2020 Budget speech.
- This had reflected the urgency around nutrition in India.

What is the nutritional status of India?

- The Global Hunger Index 2019 reported that India suffers from “serious” hunger, ranked 102 out of 117 countries.
- It also reported that just a tenth of children between 6 to 23 months are fed a minimum acceptable diet.

What is the National Nutrition Mission?

- Prime Minister’s Overarching Scheme for Holistic Nutrition (POSHAN Abhiyaan) is the National Nutrition Mission.
- It is a major initiative to address malnutrition.
- (Malnutrition - A condition that results from eating a diet in which one or more nutrients are either not enough or are too much.)
- POSHAN’s focus of the bulk of the funding has been on technology, whereas, actually, it is convergence that is crucial to address nutrition.

What is the plan?

- There are multiple dimensions of malnutrition that include calorific deficiency, protein hunger and micronutrient deficiency.
- An important approach to **address nutrition is through agriculture**.
- The Bharatiya Poshan Krishi Kosh which was launched in 2019 is a recent attempt to bridge this gap.
- Existing schemes can well address India’s malnutrition dilemma but there are gaps in addressing this concern.

Where are the gaps in addressing this concern?

- For understanding this, one needs to analyse the Budgetary allocation and the expenditure in the previous year (2019-20) to understand more.
- **Calorific deficiency** - The Integrated Child Development Services (ICDS) scheme provides a package of services which address community malnutrition and also tackle calorific deficiency.
- The allocation in 2020-2021 is marginally higher, but clearly, the emphasis needs to be on implementation.
- **Protein hunger** - A scheme for State and Union Territories aims to reach pulses into welfare schemes (Mid-Day Meal, ICDS, etc) also shows under utilisation of budgetary allocation in the 2019-20.

- **Micronutrient deficiency** - The Horticulture Mission is one way to address micronutrient deficiency but here too implementation is low.
- In 2018-19, the Government of India launched a national millet mission to promote these nutritious cereals in a campaign mode.
- This could have been further emphasised in the Budget as well as in the National Food Security Mission (NFSM) which includes millets.
- However, the 2019-20 budgetary allocation points to an underutilisation of the resources and low implementation in these above schemes.

What are the impacts of linkage schemes?

- **Under-spending** - With under-spending, allocations for subsequent years will also be affected.
- This will be limiting the possibility of increasing budgets and the focus on nutrition schemes.
- **Agriculture-nutrition link** - While agriculture dominated the initial Budget speech, this link was not explicit.
- This link is important because about 3/5th of rural households are agricultural in India (National Sample Survey Office, 70th round) and malnutrition rates, particularly in rural areas are high.
- Therefore, agriculture-nutrition linkage schemes have potential for greater impact and need greater emphasis.

How can better nutrition be brought into India?

- India needs to hasten to achieve Sustainable Development Goal 2 of 'Zero Hunger' by 2030.
- The convergence component of POSHAN should be intensified, using the platform to bring all departments in one place to address nutrition.
- These should be an announcement to form 10,000 farmer producer organisations with a ₹ 500 crore allocation to nutrition-based activities.
- There should be promotion of youth schemes to be directed to nutrition-agriculture link activities in rural areas.
- There should be an explicit emphasis and fund allocation to agriculture-nutrition linked schemes.
- The early disbursement of funds and an optimum utilisation of schemes linked to nutrition should be ensured.

Why concentrating on nutrition is important?

- Nutrition goes beyond just food, with economic, health, water sanitation, gender perspectives and social norms contributing to better nutrition.
- This is why implementation of multiple schemes can contribute to better nutrition.
- The Economic Survey notes that "Food is not just an end in itself but also an essential ingredient in the growth of human capital and therefore important for national wealth creation".
- Malnutrition affects cognitive ability, workforce days and health, impacting as much as 16% of GDP.
- In that sense, while Budget 2020-21 looks toward an 'Aspirational India', fixing the missing pieces on the plate, can make a difference not just to better nutrition but to build a wealthier nation too.

5.2 Cough Syrup Poisoning

Why in News?

Due to a poisoned cough syrup, 12 children died in Jammu and more are fighting for their life in a hospital.

Why these deaths had occurred?

- The doctors attributed the deaths to the presence of **diethylene glycol** in the cough syrup which was consumed by all the dead children.
- Diethylene glycol is an anti-freezing agent used in medicines.
- But, it causes acute renal failure in the human body followed by paralysis, breathing difficulties and ultimately death.

Is this the first time such a poisoning has occurred?

- This is the fourth mass glycol poisoning event in India that has been caused due to a pharmaceutical drug.
- This kind of poisoning had occurred in Chennai (1973), Mumbai (1986) and New Delhi (1998).
- In all these three cases, the manufacturers of the suspect syrup failed to contain the level of glycol in the syrup due to negligence or human error.

What should be the immediate concern?

- The immediate concern for doctors, pharmacists and the drug regulators should be **to prevent any more deaths**.
- For this, all the poisoned syrup that has ever been sold in the Indian market should be accounted and stopped from reaching the patients.
- Any patient who has consumed even a spoon of the syrup should then immediately be referred to a hospital for treatment.

What public health measures were taken?

- When the US faced a similar poisoning situation, its entire field force of inspectors and chemists were tracking down every single drug bottle.
- This effort was accompanied by publicity blitz over radio and television.
- There are no such public health measures undertaken here.
- The Himachal Pradesh authorities who are responsible for oversight of this syrup manufacturer have made statements that they've ordered the withdrawal of the drug which is sold across the country.
- However, there is no transparency in this recall process.
- There is no public announcement by the Drug Controller General of India (DCGI).
- [DCGI - Responsible for overall regulation of the entire Indian market.]
- The DCGI website, which is supposed to communicate drug alerts and product recalls, has no mention of suspect product as being dangerous.

What is the need for a recall policy?

- Unlike other countries, India has **no binding guidelines or rules on recalling** dangerous drugs from the market.
- This is one of the key reasons why the DCGI and state drug authorities have been so sloppy.
- The 59th report of the Parliamentary Standing Committee on Health as well as the WHO (in its national regulatory assessment) had warned the DCGI on the lack of a national recall framework in India.
- A set of recall guidelines was drafted in 2012 but never notified into law.

What should be done?

- A **national recall** of the adulterated medicine is the immediate need.

- The administration needs to quickly identify which other pharmaceutical companies have received this spurious ingredient by the same trader.
- It is important for regulatory enforcement to raid and seize the records of this trader in question and verify the sales.
- The lackadaisical response of drug regulators in India is the result of a larger lethargy and arrogance of the administrative bureaucracy.
- They are the ones who are responsible for ensuring safety by keeping unethical practices of pharmaceutical companies under control.
- **National level binding guidelines** or rules on recalling dangerous drugs from the market should be notified soon.

5.3 Ending Tuberculosis by 2025

What is the issue?

- At the End TB Summit, 2018, the prime minister of India made a bold commitment to end tuberculosis by 2025, 5 years ahead of the global target.
- In this context, here is a look at the efforts currently underway and the way forward.

What implications does TB have?

- India still has the highest TB burden in the world.
- Despite the disease being fully curable, people still die from it.
- TB usually affects people in their most productive years and drives families into debt.
- It has a direct link to human suffering, discrimination and also poverty.
- Due to its infectious spread, it directly affects the country's economic growth as well.

What should the approach be?

- The first step is the creation of awareness as though TB affects millions, a very few know enough about it.
- People should be empowered with the necessary information to identify and recognise TB symptoms, and seek diagnosis and treatment.
- There is thus a need for multilingual, multi-stakeholder awareness effort.
- The next step is ensuring that all are provided with access to correct diagnosis and treatment for TB, regardless of the ability to pay for it.
- This can only happen if the government works with the private sector as it did in the case of polio.
- Even today, about half a million TB cases go unnotified, especially those seeking care in the private sector.
- These missing cases should be tracked and ensured that those in need of care and treatment are able to access it.
- Agents need to go door to door, identify TB patients, and provide each of them care with compassion.

What are the challenges?

- A key challenge is building a forward-looking plan to address and control drug resistance.
- This is a man-made menace that is a major roadblock in the fight against TB.
- Every TB patient must be tested for drug resistance at the first point of care, whether in the public or private sector.
- Every patient who is diagnosed late and does not receive timely treatment continues to infect others.

- This cycle of transmission should be ended.

What are the measures in place?

- Efforts are already on to create more labs, point of care tests, an assured drug pipeline, access to new drugs, and counseling support for those affected.
- Recognising that medicines are not enough, the Nikshay Poshan Yojana was launched.
- Under this, TB patients receive Rs 500 every month while on treatment.
- This is to ensure that the patients have economic support and nutrition during the required period.
- On September 25, 2019, the 'TB Harega Desh Jeetega Campaign' was launched to accelerate the efforts to end TB by 2025.
- By employing a "multi-sectoral and community-led" approach, the government aims at building a national movement to end TB by 2025.
- The government has accordingly increased resource allocation towards the TB Elimination Programme four-fold.

What should be done?

- The government machinery at the field level should work with communities and provide free diagnosis and treatment to every affected individual.
- There is also a need to look beyond treatment.
- The country should involve all to fight the disease and end the stigma surrounding it.
- Every patient should seek care that is free from discrimination and with dignity.
- The community must act as a source of support for the patient, which could be achieved through education and awareness

5.4 Eliminating Lymphatic Filariasis

What is the issue?

- For a malnourished body, a parasitic infection can deplete the body's nutrients, severely slimming the chances of recovery and rehabilitation.
- A truly integrated control programmes needs nutritional supplements after treating neglected tropical diseases.

What is lymphatic filariasis?

- The neglected tropical disease like lymphatic filariasis (LF) or Elephant Foot is caused due to a mosquito bite injecting microfilariae into blood.
- It causes disfigurement and disability.
- According to the World Health Organisation, LF is stated to be the second leading cause of long-term disability.
- But in this case of neglected tropical disease, **healthy nutritional behaviours** can lead to the elimination of the disease.

What is the challenge?

- A public health challenge for the country is that the LF puts over 650 million Indians living in tropical or subtropical regions at risk.
- The LF is endemic to 256 districts across India.

- About 90% of the LF burden in the country comes from eight states.
- 8 states - Uttar Pradesh, Bihar, Jharkhand, West Bengal, Chhattisgarh, Maharashtra, Odisha, and Madhya Pradesh.
- These states are home to a significant number of the 117 aspirational districts identified by the NITI Aayog.
- Aspirational districts register rampant malnutrition.
- They form major focus areas for POSHAN Abhiyan or the National Nutrition Mission.

What makes it even worse?

- Diseases caused due to infectious organisms tend to occur amongst the **poorest** of the poor and the chronically **undernourished**.
- These people are already at risk of diarrheal diseases, respiratory tract infections, malaria, and HIV.
- Undernutrition increases the risk of infection, the severity of the disease, and the risk of child mortality.

How can the transmission of LF checked?

- It can be checked by improvements in the districts' nutritional status, in addition to disability alleviation and mass drug administration (MDA).
- MDA is an annual dosage of anti-filarial drugs given to eligible people in affected areas.
- This triple-drug therapy is being scaled up by the Centre.
- So, it will help achieve India's goal of LF elimination by 2021.

What do studies reveal?

- Studies have shown that malnutrition is closely related to filariasis.
- It has also found that their **compounded effect** can put the affected person at **higher risk**.
- The **nutritional indicators** should be used as the monitoring mechanism for the elimination of LF.
- This will help in effective implementation of the provisions under the national nutrition program.
- The POSHAN Maah in September is a key reminder for all stakeholders to make the fight for filaria elimination into a people's movement.

What is needed?

- **Broad approach** - Mass drug administration can help reduce the parasite load in an affected body, and diminish sources of reinfection.
- But, a collaborative effort in nourishing locals will go a long way in securing health and well-being.
- This approach should include nutritional rehabilitation, behaviour change initiatives, and public health measures to prevent reinfection.
- **Community-based initiatives** - Along with uptake of schemes like take-home ration at the district level, community-based initiatives can help a lot to the mass movement.
- These initiatives may include promoting kitchen gardens and sourcing locally-available foods to diversify food consumption.
- **Rehabilitation** - The infection is usually acquired in childhood and can clinically manifest in one's youth.
- So, rehabilitation of affected persons is required for extensive recovery of deficits in the health, nutrition, and education status of children.
- It will also help in alleviating the symptoms of disease in all age groups.

- **Essentials** - Finally, clean water, environmental health, and sanitation are essential to keep people and their excreta apart.
- This will prevent vectors and flies from breeding, which would pave the way for the elimination of LF.

5.5 National Digital Health Mission

Why in news?

The National Digital Health Mission (NDHM) was announced by the Prime Minister on Independence Day.

What is the NDHM?

- The NDHM is part of the National Digital Health Blueprint (NDHB).
- [NDHB aims to enhance the healthcare delivery by setting up a core e-health database of international standards.
- It allows patients to have control over their health data.]
- The NDHM envisages creating a national health ID for every Indian.
- It wants to make use technology to streamline processes such as record-keeping, sharing of healthcare data and similar healthcare processes.
- This well-timed move will help citizens make informed decisions on treatments.

Is the fund allocated enough?

- The NDHM is supposed to cover all government health programmes to begin with.
- This will be a huge exercise and would require more resources than the currently allocated ₹ 144 crore.
- This will make private participation a necessity given the strained finances of the Centre.

What is the potential of this mission?

- It has the potential to transform the healthcare sector.
- It can make the healthcare sector more technologically advanced, inclusive and delivery-driven.

What is the further kind of data that should be integrated?

- Such centralised data, combined with real-time Big Data analytics, can become a surveillance tool.
- Healthcare **data from wearable devices** are getting mainstreamed.
- This data is used by the healthcare providers, doctors and patients for diagnosis, if not for treatment.
- So, the NDHM should spell out its stand on collecting such data from individuals and integrating it with the unique health ID.

What are the challenges?

- The NDHM gives rise to logistical challenges and privacy concerns.
- It involves government collaboration between hospitals in both public as well as private sectors, labs, insurance firms, pharmacies and telemedicine.
- So, there is a **risk of exposing** individual healthcare data to hacking and commercial misuse.
- Although the NDHM is now a voluntary exercise, it could become mandatory for availing government health services.
- In such a context, ensuring the **safety** of individual health data becomes paramount.

What could be done?

- The government must gain the **confidence of all stakeholders**, including rights groups, before going ahead.
- There should be more **clarity on questions** such as:
 1. Who will maintain and manage the centralised repository of citizen's health data;
 2. Who will own the data — the individual or the state;
 3. Whether individuals can transfer the data between service providers and
 4. Whether the individual has the right to erase irrelevant healthcare data and maintain 'his or her right to be forgotten'.
- Insurance companies should not be allowed to misuse personal data.
- The NDHM must be in **compliance** with the global best practices on data privacy, like the EU's General Data Protection Regulation.
- The potential and pitfalls of digitisation of health data must be appreciated before moving ahead.

5.6 National Health ID

Why in news?

Prime Minister announced a national health ID for every Indian.

What is the national health ID system?

- The national health ID will be a **repository** of all health-related information of a person.
- According to the National Health Authority (NHA), a person who wants their health records available digitally must create a Health ID.
- Each Health ID will be linked to a health data consent manager such as National Digital Health Mission that will be used to seek the patient's consent.
- It will allow for seamless flow of health information from the Personal Health Records module.

How will the Health ID be created?

- It will be created by using a person's basic details and mobile number or Aadhaar number.
- This will make it unique to the person, who will have the option to link all of their health records to this ID.

What was the original proposal for the health ID?

- The National Health Policy 2017 aimed at creating a digital integrated health information system that would serve the needs of all stakeholders.
- This system could improve efficiency, transparency and citizens' experience with linkage across public and private healthcare.

What did the Niti Aayog do?

- Based on this proposal, in 2018, Niti Aayog floated a consultation of a digital backbone for India's health system - National Health Stack.
- In this consultation, a Digital Health ID was proposed to reduce the risk of preventable medical errors and increase the quality of care.
- The system will also enable the users to obtain a longitudinal view of their healthcare records.

What did the Central government do?

- This Niti Aayog proposal was then further taken up by the Central government.

- The Ministry of Health and Family Welfare, the NHA, and the MietY prepared a strategy overview document.
- The document is about making India a digital health nation by enabling digital healthcare for all.

Which systems does the national health ID interact with?

- Various healthcare providers such as hospitals, labs, online pharmacies, insurance companies, etc., will participate in the health ID system.
- While option of digital Health ID will be there, in case a person does not want Health ID, then also treatment should be allowed.

Have there been global instances of such a health record system?

- In 2005, the UK's National Health Service (NHS) started deployment of an electronic health record system.
- The goal was to have all patients with a centralised electronic health record by 2010.
- Many hospitals acquired electronic patient records systems as part of this process.
- But, there was no national healthcare information exchange.
- The project had been plagued by changing specifications, technical challenges and clashes with suppliers.
- This left it years behind schedule and way over cost.
- The program was dismantled after a cost to the UK taxpayer was more than £12 billion.

5.7 Diseases of Animal Origin

What is the issue?

- COVID-19 virus' spread has focused attention on the invisible processes, which help pathogens found in wild animals make the leap to humans.
- Diseases of animal origin such as Ebola, SARS, bird flu, swine flu, etc., have raised alarm over potential pandemics in recent years.

How did the virus spread?

- The Covid-19 infection, thought to have originated in a **wet market** that kept live animals in Wuhan, China, points to many underlying factors:
 1. The destruction of forests and trapping or farming of wild species has brought these animals closer to humans, and
 2. The viruses these animals harbour find ready hosts in domestic animals, moving to humans.
- **Rising economic activity**, such as road building and mining cutting through forests, has brought more people in close contact with animals.
- Another dimension is the **global trade in wild species** and their sale in markets along with domestic animals.

What does the pandemic prove?

- As COVID-19 pandemic has proved, these short-term high growth trajectories can come to an abrupt halt with a pandemic.
- Such a terrible outcome could be witnessed again, potentially caused by reckless exploitation of the environment.
- In spite of repeated warnings of crippling pandemics waiting in the wings, governments paid little attention.

What does the history say?

- The history of the lethal Nipah virus, involving transfer from bats to pigs, underscores the value of maintaining viable ecosystems, and eliminating the need for wild bats to colonise human surroundings.
- Biodiversity in forests harmlessly retains dangerous viruses and other pathogens among a vast pool of wild animals, away from people.
- This phenomenon makes clear that governments should stop viewing undisturbed landscapes as an impediment to economic growth.

What is the warning?

- Novel virus that can move effortlessly from human to human has found a large reservoir of hosts in a globalised world.
- Unlike previous epidemics, the Covid-19 has extracted a staggering toll, killing people, forcing a lockdown and causing economic devastation.
- This should serve as a warning to the government that the hasty permissions granted for new roads, dams, mines and power projects in already enfeebled forests can unleash more scourges.

What could be done?

- The government would do well, if it roll backs its dilution of the environmental clearance system.
- The government could strengthen this with a mandate to the States, and leave protected areas to scientific experts.
- Pristine forests with diverse species keep viruses virtually bottled up, out of man's way. They should be left undisturbed.

5.8 Epidemic Disease Act, 1897

Why in news?

Recently, the Centre amended the Epidemic Disease Act, 1897.

What has changed?

- Through an ordinance, the Cabinet amended the 1897 Act.
- The amendment made commission or abetment of acts of violence against healthcare workers a cognisable, non-bailable offence.
- The offenders will be imprisoned for a term of three months to five years, and with fine of Rs 50,000 to Rs 2 lakh.
- In case of causing grievous hurt, imprisonment shall be for a term of six months to seven years and with fine of Rs1 lakh to Rs 5 lakh.

Why did the Centre invoke the 1897 Act now?

- In March 2020, this Act was invoked to fight the Covid-19 outbreak.
- The Act empowers the state governments to take special measures and prescribe regulations in an epidemic.
- It defines penalties for disobedience of these regulations, and provides for immunity for actions taken under the Act.

Why the Act was enacted?

- In January 1897, Council member J Woodburn tabled the Epidemic Diseases Bill during bubonic plague outbreak in Bombay.

- The Bill was tabled as a measure to contain the plague before it attains large proportions elsewhere in the country.
- It noted that the powers of the municipal bodies and other local governments were inadequate to deal with such situations.
- It called for special powers for governments of Indian provinces and local bodies, including to check passengers of trains and sea routes.
- It said existing laws were insufficient to enable municipal officers to deal with matters related to overcrowded houses, sanitation, etc.

How was it passed?

- The Bill was referred to a Select Committee, which submitted its report on 4th February 1897.
- The Bill was passed the same day, after a brief discussion.
- It was passed amid concerns of the disease spreading, with crowds from Bombay having reached places all over India.
- The government was particularly worried about Calcutta, then the Indian capital.
- Among the members, Rahimtula Muhammad Sayani and Maharaja of Darbhanga said that the Bill was passed hurriedly.

What were the challenges discussed?

- Babu Joy Gobind Law suggested that steps be taken with regard to **Muslims'** pilgrimage to Mecca.
- But Alexander Mackenzie, Lieutenant Governor of Bengal, clarified that his government was unwilling to interfere with religious practices.
- Sayani said that the persons desirous of performing the pilgrimage could be persuaded to put off their intention until the danger has passed.
- It was discussed that isolating **women** was particularly difficult.
- Woodburn told that the whole town could not run the risk of plague infection merely because its source is a woman.

5.9 Emergence of Epidemics

What is the issue?

- Scientists believe that the loss of biodiversity, and wildlife trade, have strong linkages with the emergence of epidemics.
- Pandemic is an opportunity to explore the consequences of its unscientific actions on nature and prepare for behavioural change.

Is there a link between loss of biodiversity and epidemics?

- Dangerous infectious diseases (Ebola, SARS, Nipah, etc.) have been transferred from wild animals to humans.
- In order to clear land for agriculture and development, forests and habitats have been destroyed.
- In the process, several species are lost.
- Human-induced environmental changes reduce biodiversity resulting in new conditions that host vectors and/or pathogens.
- It is not yet fully understood which species have contributed to the transmission of COVID-19 and how.
- However, according to experts, there is strong evidence that it spread from a wildlife market in Wuhan, China.

Is there a link between illegal wildlife trade and epidemics?

- **Organised crime** - Trafficking in wild plants and animals and wildlife products has become one of the largest forms of organised crime.
- By deliberately pursuing and hunting certain species or by establishing monocultures, habitats and ecosystems are being damaged or destroyed.
- **Threat to India** - Illegal wildlife smuggling is an emerging threat to India's unique wildlife heritage.
- India shelters a number of vulnerable and threatened species.
- Body parts of animals like pangolins, rhinos, etc., are being traded illegally to countries such as China, Vietnam, etc,
- Species are being wiped out for manufacturing traditional Chinese medicines by organised trade networks.
- People extensively encroach natural habitats; hence biodiversity is declining significantly.
- By disturbing the delicate balance of nature, ideal conditions for the spread of viruses from animals to humans has been created.

What could be done?

- There is a need to **revisit our relationship with nature** and rebuild an environmentally responsible world.
- Nations should work towards realising the **2050 vision for biodiversity**, 'Living in Harmony with Nature'.
- **One health approach** must be followed, which considers the health of people, wild and domesticated animals, and the environment.
- The high-risk wildlife markets should be strictly regulated.
- There is a need to promote green jobs and work towards achieving carbon-neutral economies.
- India should strictly enforce,
 1. The Wildlife (Protection) Act of 1972, which prohibits the trade of 1,800 species of wild animals/plants and their derivatives;
 2. The Biological Diversity Act of 2002;
 3. Strategies and action plans like the National Biodiversity Targets;
 4. The National Biodiversity Mission.
- The mainstreaming of biodiversity is needed in India's post-COVID-19 development programme.
- Mass biodiversity literacy should be a mission.
- Ecosystem integrity will regulate diseases and restrict the transmission of pathogens from one species to another.

5.10 Initial Infection Points for SARS-CoV2

Why in news?

Scientists have identified two specific types of cells in nose as the likely initial infection points for the novel coronavirus (SARS-CoV2).

Was the infection mechanism not already known?

- Yes, previous studies have shown what happens at the cellular level.

- The entry of the virus takes place by means of a “lock and key” effect.
- SARS-CoV2 has a fatty envelope with a spike protein on the surface.
- The spike (key) unlocks the ACE2 protein (lock) on the human cell, which acts as the receptor for the virus.
- Once inside the cell, the virus uses TMPRSS2 protein to complete its entry.
- TMPRSS2 protein allows the virus to reproduce and transmit itself inside the cell.

What has the new study found?

- The new study has identified the specific cells where the mechanism of entry most likely comes into play when the virus begins its attack.
- These are the goblet cells and ciliated cells in the nose.
- **Goblet cells** are mucus-producing cells on the surface of organs.
- They are found along the surface of the respiratory tract, intestinal tract, in the upper eyelid, etc.
- **Ciliated cells** are hair-like cells that occur on the surface of organs.
- They help sweep mucus, dust, etc to the throat, where it can be swallowed.

How did the study identify these cells?

- The researchers looked for areas where the two key proteins, ACE2 and TMPRSS2, express themselves most prominently.
- For this, they turned to the Human Cell Atlas.
- [Human Cell Atlas - An international consortium that aims to create comprehensive reference maps of all human cells]
- They looked at multiple datasets of cells from more than 20 different tissues of non-infected people.

What did the data show?

- Both the proteins were found in multiple organs.
- However, ACE2 expression was generally low while TMPRSS2 was highly expressed with a broader distribution.
- This suggests that ACE2 (rather than TMPRSS2) may be a limiting factor for viral entry at the initial infection stage.
- Goblet cells and ciliated cells in the nose had the highest levels of both these COVID-19 virus proteins, of all cells in the airways.
- This makes these cells the most likely initial infection route for the virus.

Does this rule out other entry points?

- The other two entry proteins were also found in cells in the **cornea** of the eye and in the **lining of the intestine**.
- This suggests another possible route of infection via the eye and tears ducts, and possible oral-faecal transmission.
- However, they note that:
 1. The two cell types in the nose are located at a place that is highly accessible for the virus.
 2. ACE2 is produced in the nose cells at the same time as various immune genes that would be activated when the cells are fighting the infection.
 3. The virus is thought to be spread through respiratory droplets produced when an infected person coughs or sneezes.

How does the knowledge help?

- This is the first time that these two cell types have been pinpointed as the likely points of initial entry.
- Their identification could help **explain the high transmission rate** of Covid-19.
- Knowing which cell types are important for virus transmission provides a basis for **developing treatments** to reduce its spread.

5.11 Covid-19 - Importance of Testing

Why in news?

A common concern across the world during this COVID-19 pandemic is the lack of enough testing by many countries.

Why is lack of testing a big concern?

- The positivity rates, as seen now, underestimate the true infection.
- Because, what is reported are those that 'test' positive and negative.
- There are many others who might have mild symptoms but are not being tested.
- Similarly, the mortality rate is overstated because the denominator includes just those tested.
- Also, because collection is not perfect, there are some people with the infection who may have a negative RT-PCR test.

How all does testing help?

- Testing, in this context, is generally driven by the need for data.
- Data is key to make public health determinations.
- It also provides some guidance to individuals doubting on their immunity level.
- Enough 'testing as communities' is crucial to understand, with certainty, how many people are acutely infected.
- It also provides information on whether or not, and how many people, show symptoms.
- Since people without symptoms can spread the infection, it is important to have this insight.
- It does not mean everybody should be tested all the time.
- But having a big enough sample is important to have a reasonable degree of certainty that the numbers are correct.
- Knowing who is infected will give better information on -
 - i. the Ro (rate of spread)
 - ii. understanding the risk at present
 - iii. looking at infection as efforts are made to ease social restrictions

How does it help with the immunity factor?

- There is notable variation among countries in the nature of spread and the number of cases.
- Given this variation by location, having the data by geographic area is important.
- It is essential to know how many people have antibodies, and presumed immunity.

Herd Immunity

- Herd immunity happens when so many people in a community become immune to an infectious disease that it stops the disease from spreading.
- This can happen in two ways:
 1. many people contract the disease and in time build up an immune response to it (natural immunity)
 2. many people are vaccinated against the disease to achieve immunity
- But, it is hard to predict things in a pandemic.
- So, in the case of COVID-19, herd immunity without a vaccine is by definition not much a preventative measure.

- This is important to determine when “herd immunity” exists and how far countries are from that goal.
- That number needs to be informed by the Ro and rate of transmission.
- This is because, greater number of people should be immune if the Ro is higher.
- However, despite this, in the case of COVID-19, a country could not ensure herd immunity until there is an effective vaccine.

Is lifting lockdown dependent on number of tests?

- Not the number per se, but the extent to which the number informs on the reduced risk of continuing spread of the virus is important.
- The number of tests per day would be determined by ascertaining statistically the number of people with active infection in a region.
- In areas where there is more social crowding, there is a greater risk of transmission of disease due to proximity to others.
- So, the number of people with active infection in such areas will have to be lowered.
- However, the requisite number of tests per day for a country like India cannot be the same.
- The numbers would be different in Mumbai, Delhi, and other large cities.
- It could probably be fewer in smaller areas, and those with less risk.

What is the concern with antibody test kits?

- There is a certain level of unreliability on the antibody test kits.
- Normally when a test method is brought to the market, there are strict evaluations that come first.
- But because of the emergency, there was a relaxation of those requirements.
- A reasonable amount of oversight in this regard is in the best interest of the public to protect all from dangerous tests, the same as for drugs and medical devices.
- Purchasers should make sure that their vendors have recognised good manufacturing practices.

5.12 Rapid Testing Kits

Why in news?

Rapid testing kits used to detect antibodies to the novel coronavirus have proved unreliable.

Why such kits are needed?

- Governments around the world are looking for an accurate blood test that can tell people if they have immunity through past Covid-19.
- The diagnostic **RT-PCR test** to confirm the presence of the virus using a nasal swab in a laboratory setting is considered **reliable**.
- The attempts to design a **rapid test** that uses a blood sample to find antibodies after past infection have been proved **unreliable**.
- They have missed about 30% of positive cases, showing low sensitivity.

What concerns many countries?

- The **low sensitivity** of the kit is the phenomenon that is worrying India.
- Many Indian States have already imported several hundred thousand rapid testing kits, mainly from China.
- India’s experience is shared by the US, UK, Spain and other countries.

- ICMR has advised States to use these kits for surveillance testing rather than to make medically important decisions.

What is the challenge now?

- Narrowing down the test to reliable methods is the challenge.
- The WHO is working to identify them and the results will be crucial.
- All countries are looking at sero-surveillance as a process that may determine the status of population on Covid-19.
- An exit from lockdown and other public health measures depend on such testing.

What should India focus on?

- India should remain focused on **identifying tests** that work well.
- This requires close integration with efforts launched by diagnostics regulators in the U.S., Europe and China.
- These countries have allowed early use of these kits, which themselves are under evaluation.
- Some vendors of rapid testing devices in China have run afoul of regulators since they have no prior expertise in the field.
- Therefore, making purchase decisions calls for **rigorous review**.

What should be done?

- In the immediate context, the message should go out to States that rapid tests cannot substitute for RT-PCR to diagnose infection.
- It is by no means clear that antibodies developed in response to COVID-19 provide long-term protection against re-infection.
- A good reliable test to certify that a large section of the population have developed immunity against Covid-19 is needed.
- These tests would be a promising tool to reopen the economy with confidence.

5.13 Kasaragod Model

Why in News?

The Centre showcased the contact tracing and containment model of Kerala's Kasaragod as a successful containment exercise.

Why showcase Kasaragod?

- Kasaragod reported the third case of COVID-19 in the country - a student airlifted from Wuhan on February 3.
- The district administration mounted a **massive exercise to trace** the 150-odd contacts of that one student.
- Kasaragod had 169 cases and zero deaths until April 19.
- Of these, 123 people had already **recovered**.
- Most of the cases were of those who had caught the virus during their travels abroad and those who returned from the Middle East.

What is the Kasaragod model?

- The **district administration** relied on aggressive testing, technology, foolproof contact tracing, etc., to achieve the results it can now show.
- The state government appointed a **special officer** to,

1. Coordinate functioning of the district administration.
 2. Coordinate between departments at field and secretariat levels.
- **Section 144** was imposed in the entire district, with 7 drones employed for surveillance.
 - Under the **Care for Kasaragod** initiative, a common coordinated action plan was drawn up for combating COVID-19.

What was this action plan?

- All quarantined people were tracked using GPS.
- All essentials were home-delivered in the containment zones.
- A campaign on social distancing called “Break the Chain” was carried out to deliver the message of social distancing.
- Core teams were formed with incident commanders to rush to various areas and take quick action.
- The plan was carried out with a very strong social welfare component, which included free food kits for the poor and migrant workers.
- Health checkup was carried out on alternate days for migrants or the destitute. There is a 709-bed COVID-19 care centre.
- ASHAs and health inspectors carried out household surveys.

What are the other successful models?

- **Agra Model:** The district administration identified epicentres.
- They delineated the impact of positive confirmed cases on the map.
- A special task force was deployed as per a micro plan made by the district administration.
- The hotspot area was identified within a 3 km radius from the epicentre.
- They were managed through an active survey and containment plan.
- A 5 km buffer zone was identified as the containment zone.
- **Bhilwara Model:** This entailed complete isolation of Bhilwara city with Section 144 CrPC being imposed.
- The shutdown was total with the city and district borders sealed and checkposts at every entry and exit point.
- **Pathanamthitta Model:** Every person who had entered the district was screened.
- A database was created so that they could be reached at short notice.
- Graphics were created showing the travel route of the positive cases and publicised. This led to self-reporting.

5.14 Handling of COVID-19 - Kerala's Strategy

What is the issue?

- Kerala has made global headlines for its handling of Covid-19, and K K Shailaja, Kerala Health Minister, has gained global attention too.
- Here is an account by her on how Kerala kept the numbers down and the challenges ahead.

What all contributed to Kerala's success model?

- **Panchayati Raj and healthcare systems** - In Kerala, the Panchayati Raj is implemented in a truly democratic way.
- The local self-governments are fully charged with power.

- The distribution of money also follows the same proportion.
- The Primary Health Centres (PHCs) are under the local-level panchayat, ensuring people-centric measures.
- **Planning** - Planning preparedness is one of the most important aspect in COVID-19 handling.
- Kerala started its planning well before in January 2020 itself.
- This was when reports on virus spread in Wuhan came out and WHO was yet to declare it a pandemic.
- Notably, many Keralites were in Wuhan.
- A Rapid Response Team meeting was held, and Kerala opened a control room at the state level.
- The Health department informed all 14 districts, district medical officers (DMOs).
- They also started district-level control rooms with expert groups in each.
- Additional health officials had different responsibilities.
- These included contact tracing, making isolation rooms and Covid hospitals, logistics collection, and even mental health.
- The State ensured that the surveillance team was at the airport to examine.
- The State then followed a rigorous strategy of trace, quarantine, test, isolate and treat.
- **Testing** - Testing is important, but Kerala did not follow the slogan, "Test, test, test, nothing else".
- Testing everybody is not necessary, as that might result in running out of testing kits etc.
- Instead, Kerala did testing in a strategic way.
- The priority is tracing first and testing the symptomatic cases first.
- Efficient and scientific quarantining is so far keeping the spread under control.
- With the help of local self-government, anganwadi workers and helpers, ASHA workers, there is a thorough watching of quarantined people.
- Every day, there is inquiry over phone or in person to check on symptoms if any.
- If detected, at once, the health department sends ambulance to the house and shifts that person to hospital and takes samples and tests.
- When new people are coming from the epicentres, there is increased testing among the highest contacts and also secondary contacts.
- Random testing is being done and sentinel surveillance testing is also there.
- **Recent resurgence of cases** - The situation changed when the lockdown was relaxed, air travel reinstated, and surface travel restarted.
- People again started to come back from other countries and also from other parts of India.
- But the State anticipated this and was well prepared for the second wave.
- It follows the same strategy of containment, tracing, testing and treating.
- Surveillance and tracing teams are deployed at airports, seaports, railway stations and checkpoints at road.
- Notably, more than 1.5 lakh people returned from the Gulf countries; a number of people tested positive.
- Population from other states included those from Chennai, Maharashtra Mumbai and Gujarat primarily.
- Not only were they positive, but also some of the people who returned from these epicentres were in a pathetic condition (advanced stages).
- This is another reason why the positive cases and deaths were increasing.

- **Strain on health systems** - The pressure on health care systems was high due to increasing cases.
- Nevertheless, the State went with Plan A, Plan B, Plan C etc.
- In Plan A, there were 3 COVID-19 hospitals in every district and nearly 1,500 beds for COVID-19 patients in each hospital.
- In Plan B, there were even more hospitals.
- Many hospitals were changed to COVID-19 hospitals with higher capacity.
- In Plan C, Kerala planned for arranging some hotels, hostels and some auditoriums.
- This is under consideration, and there is a good list of institutions under the plan.
- The State is also keeping track of human resources, not only in the government sector, but also in the private sector.
- The State is also giving training to medical resource personnel to handle the situation if many positive cases occur.
- **Community transmission** - As of now, there is no community transmission in Kerala.
- The cases are largely traceable at present.
- Some augmented samples from all parts of the society are also being tested, at a time 3,000 etc.
- Out of this, there were not many positive cases, which again shows that the virus has not entered the community.
- But the possibility of a community transmission cannot be ruled out altogether either.
- **Approach** - The overall approach in Kerala was towards breaking the chain of spread.
- Every individual is responsible. That is the slogan in Kerala: "My health is my responsibility".
- So ensuring health behaviours and habits among people was one of the key aspects in breaking the chain.

5.15 COVID-19 Treatment

Why in News?

Experiments are conducted to find a treatment for COVID-19 disease.

How does the coronavirus infect someone?

- A coronavirus is surrounded by a fatty outer layer (envelope).
- On this envelope, there is the corona (crown) of spikes made of protein.
- On the surface of human cells, there is an enzyme called ACE2.
- The spike protein of the virus binds to the ACE2 that acts as receptor.
- It then fuses with the cell surface, and releases its genetic material (RNA) into the cell.
- Once inside, the virus replicates itself by using the cell's molecular mechanism.

How should the treatment be?

- All the above stages involve various interactions between virus proteins and human proteins.
- Any treatment being developed or researched will look to **inhibit these activities** at one stage or the other.
- In order to repurpose the existing drugs or to develop new drugs,
 1. Research institutions are studying the **functioning** of the virus
 2. Some studies are looking at the **structure** of the virus and

3. Some studies are investigating the **behaviour** of the virus.

What are the Solidarity experiments?

- **Solidarity trials** are the World Health Organization (WHO) initiative that includes India.
- They are investigating four lines of treatment using existing drugs.
- They are carrying trials by inhibiting the virus' activity at the various stages like at reception, cell entry, replication stage, etc.,

What are the experiments trying to find out at reception stage?

- The trials are carried out by inhibiting the virus' activity at the reception stage using **chloroquine-hydroxychloroquine** drug combination.
- A 2005 study found that chloroquine prevented the ability of the SARS virus to attach itself to the ACE2 receptors.
- As chloroquine causes severe side effects, the current trials are being done with a combination with hydroxychloroquine.

What are they trying to find out at cell entry stage?

- The aim of these trials is to hinder the virus at the cell entry stage.
- Many viruses enter a cell by acidifying compartments within the membrane at the cell surface.
- When **chloroquine-hydroxychloroquine** enter the compartment, it loses part of its acidity.

What are they trying to find out at replication stage?

- During replication stage, the virus uses enzymes to break down proteins, leading to a chain of new viruses.
- Many trials are looking at obstructing the virus at this stage.
- One set of Solidarity trials is looking at the combination of anti-HIV drugs i.e. **lopinavir-ritonavir**.
- Another is investigating **lopinavir-ritonavir** combined with **interferon-beta**, a molecule that regulates inflammation in the body.
- Another trial is done with the drug **remdesivir** that will inhibit the coronavirus by targeting the enzyme that facilitates its replication.

Why are some studies looking at the virus's structure?

- Antibodies can recognise the spike protein, bind to it, and mark it as a target for immune cells.
- However, the virus also has a sugar coat that hides parts of its spike proteins from the immune cells.
- Therefore, the researchers are analysing the sugar shield.
- They are trying to calculate how the spike proteins move on the virus's surface and how they change their shape.
- They hope to identify binding sites for antibodies, and plan to compare these with the binding properties of existing drugs.
- By this, they can identify ingredients that can block the spike protein.

Why are some studies looking at the virus's behaviour?

- In a study, Italian researchers mapped the interactions between virus proteins and human proteins.
- When the virus attacks, the body responds by activating certain proteins and deactivating others to hinder it.
- At the same time, the body has other mechanisms that the virus exploits.
- These were what the researchers mapped, identifying specific proteins in order to develop drug therapies.

Beyond the Solidarity trials, are there studies on specific drugs?

- In Nature Journal, an international collaboration of researchers reported six possible drug candidates.
- The project targeted SARS-CoV2's main enzyme for splitting proteins, Mpro (plays a key role in mediating viral replication).

5.16 Covid-19 Containment Strategies

Why in news?

As India is nearing the end of its extended lockdown, it must learn from other countries in devising strategies to contain the epidemic.

What happened in China?

- It took 94 days to reach one million Covid-19 cases on April 3, 2020 after China reported the first cluster of 41 cases on December 31, 2019.
- Within 12 days, the cases doubled to two million.
- It again took just 12 more days to cross three million cases globally.

What is the rate of spread globally?

- **Spread** - The virus has now spread to 188 countries/regions.
- The true number of infections will be several-fold higher as most countries have not been testing people who have mild or no symptoms.
- While new cases have declined in Europe, there is an uptick in Africa and South America.
- The virus is still spreading quickly in the U.S., which has the most number of cases globally.
- **Deaths** - There have been over 2.1 lakh deaths worldwide.
- With the U.S. accounting for over 56,600 deaths, which is double that of Italy, which is over 27,000.

What is the rate of spread in India?

- India has reported over 30,300 cases and 973 deaths.
- The number of cases has multiplied several-fold from over 600 since the national lockdown from March 25.
- At nearly 8,600 cases, Maharashtra has the maximum in the country.
- Dharavi, a slum in Maharashtra alone has 330 cases and 18 deaths.
- Nearly 3,000 people might need institutional quarantine in the absence of effective containment in Dharavi.

What could India learn from the Singapore's experience?

- Singapore almost contained the spread of the virus early on.
- But, the city-state has seen numbers rising since late March, 2020.
- **Dormitories** - Fresh cases have been reported from dormitories that house over 0.2 million migrant workers from other countries.
- The crowding in the dormitories has provided an ideal setting for easy infection spread.
- These dormitories are akin to what is seen in the slums in India.
- **Efforts** - Singapore has shut down educational institutions and workplaces on April 3, when the number of cases was 1,114.
- Though it took many other measures to contain the spread, it has not been able to contain the spread of the virus.

- Nearly 15,000 cases have been reported as on April 28, 2020.
- As India nears the end of its extended lockdown, it needs to **learn from the successes and failures** of other countries.

5.17 World Health Assembly Session

Why in news?

The 73rd session of the World Health Assembly (WHA) took place virtually from May 18-19, 2020.

What is the WHA?

- The WHA is the decision-making body of the WHO.
- The Assembly is held annually in Geneva, Switzerland and attended by member states of WHO.
- During the Assembly, the WHO's 194 member states discuss health agendas set by the body's Executive Board.
- They also set new goals and assign tasks to fulfil these goals.
- Due to Covid-19, the Assembly was held virtually this year, and has been fit into a two-day schedule from a three-week schedule.

What was the resolution at the meet?

- A resolution was brought forward by the European Union (EU) and was endorsed at the Assembly.
- During the session, countries including India, Japan, Indonesia, New Zealand, UK and Canada accepted the resolution.
- Reportedly, 116 of the 194 member states were in favour of the resolution.
- It asked for an "impartial, independent and comprehensive evaluation" of the WHO's response to the COVID-19 pandemic.
- The resolution also called for identification of the "zoonotic" source of the coronavirus.
- The origin of the virus is currently believed to be a wet market in Wuhan, China.
- Apart from this, the Assembly also addressed a global vaccine action plan with the "Immunisation Agenda 2030".
- This aims to ensure immunisation for all age groups to prevent the spread of preventable diseases and sustaining vaccine supplies.

What does the resolution demand?

- The resolution does not mention China.
- It, however, says the Director General of the WHO, Tedros Adhanom Ghebreyesus should continue to work closely with the -
 1. World Organisation for Animal Health (OIE)
 2. the Food and Agriculture Organization of the UN (UN FAO)
 3. countries
- This is as part of the One-Health Approach to 'identify the zoonotic source of the virus'.
- Also, the route of introduction to the human population, including the possible role of intermediate hosts
- The call includes efforts such as scientific and collaborative field missions.
- This will enable targeted interventions and a research agenda to reduce the risk of similar events.

- It will also help provide guidance on how to prevent SARS-COV2 infection in animals and humans and prevent the establishment of new zoonotic reservoirs.

Why is the resolution important?

- Since the pandemic, there has been an increasing pressure on China.
- China has so far opposed suggestions for inquiry into the origins of the virus.
- Meanwhile, the US has repeatedly blamed the WHO.
- It claims that the WHO had failed to obtain timely information and share it in a transparent fashion.
- The US President Donald Trump said that WHO's response was "China-centric".
- In this backdrop, he threatened to permanently cut funding to the WHO.
- At present, the US is the WHO's biggest contributor and makes up over 14.67% of the total funding, at \$553.1 million.
- Given all these, the resolution gains importance.

What does this mean for China?

- While the resolution has been endorsed, it remains to be seen how the probe will be carried out and to what degree of independence.
- Significantly, the timeline of the probe is also not clear.
- So far, China has opposed demands calling for an international investigation into the virus.
- Recently, China's premier Xi Jinping announced a \$2 billion donation to the United Nations.
- This is over twice the amount the US contributed before Trump cut off funding.
- It also offered to set up hospitals and health infrastructure in Africa.
- At the WHA, Xi said China "supports" the idea of a comprehensive review of the global response towards Covid-19 after it was brought under control.
- The Trump administration however sees China's announcement as a way to escape scrutiny.

5.18 Taiwan's COVID-19 Strategy and WHO

What is the issue?

- With nations having a tough fight against the COVID-19 pandemic, here is how Taiwan has appreciably contained the spread and handled the outbreak.
- [Notably, Taiwan is not a member of the World Health Organisation (WHO).]

What was Taiwan's COVID-19 strategy?

- It is 17 years since Taiwan was hit hard by the Severe Acute Respiratory Syndrome (SARS) outbreak of 2003.
- Given this history, Taiwan has been in a state of constant readiness to the threat of emerging infectious diseases.
- When information on COVID-19 outbreak was first confirmed on December 31, 2019, Taiwan began implementing onboard quarantine of direct flights from Wuhan that very same day.
- On January 2, 2020, Taiwan established a response team for the disease.
- It activated the Central Epidemic Command Center (CECC) on January 20 as a level 3 government entity.
- This was upgraded to level 2 and level 1 on January 23 and February 27, respectively.

- The CECC effectively integrates resources from various ministries and invest itself fully in the containment of the epidemic.
- Taiwan undertook rigorous testing. As of April 9, it had tested a total of 42,315 persons showing 380 confirmed cases.
- Despite its proximity to China, Taiwan ranked 123 among 183 countries in terms of confirmed cases per million people.

What were the specific measures?

- **Quarantine** - Taiwan has implemented dynamic plans concerning border quarantine measures.
- These included onboard quarantine, fever screening, health declarations.
- A 14-day home quarantine for passengers arriving from nations it has listed under the Level 3 Warning was part of the plan.
- **Monitoring and Support** - Taiwan has established an electronic system for entry quarantine.
- This allows passengers with a local mobile phone number to fill in health information using a mobile phone.
- A health declaration pass will then be sent to them as a text message.
- This is connected to the community care support management system.
- The system, in turn, allows government agencies to provide care services and medical assistance.
- The travel history of individuals is now stored on the National Health Insurance (NHI) card to alert physicians to possible cases and prevent community transmission.
- For those undergoing home quarantine or isolation, the government is working with telecom operators to allow GPS tracking of their locations.
- Quarantine offenders are subject to fines or mandatory placement according to relevant laws and regulations.
- **Testing** - Taiwan has increased its laboratory testing capacity.
- It expanded the scope of its surveillance and inspections based on trends of the disease.
- It also retested people with higher risk who had already tested negative.
- Meanwhile, it has designated 50 regional hospitals and medical centres and 167 community hospitals and clinics to create a tiered system for testing.
- **Precaution** - The above hospitals and clinics are also required to set up special wards or areas.
- In principle, COVID-19 patients are isolated and treated individually in these wards and areas to prevent nosocomial infections.
- [A nosocomial infection refers to a hospital-acquired infection (HAI).]
- Moreover, Taiwan has banned the export of surgical masks since January 24, 2020.
- It arranged for masks, and expanded domestic mask production to more effectively allocate masks.
- It launched a name-based rationing system for mask purchases at NHI-contracted pharmacies and local public health agencies.
- An ordering system for masks was brought in which allows people to order online and pick up masks at convenience stores.

Why is a connected global effort crucial?

- Infectious diseases know no borders.
- Pandemics can spread rapidly around the world because of the ease of international transportation.

- Among the most salient examples are:
 - i. the Spanish flu of 1918
 - ii. the Severe Acute Respiratory Syndrome (SARS) outbreak of 2003
 - iii. the H1N1 influenza of 2009
- Intermittently, serious regional epidemics have also occurred.
- These include the Middle East Respiratory Syndrome (MERS) in 2012, Ebola in West Africa in 2014, and the Zika virus in Central and South America in 2015-16.
- Certainly, global health security requires the efforts of every person to ensure an optimal response to public health threats and challenges.
- Taiwan, though not a member of WHO, cannot stand alone and must be included in the fight against such threats and challenges.

Can Taiwan rightfully claim this?

- Taiwan has long been excluded from WHO due to political considerations.
- But Taiwan has fulfilled its responsibilities as a global citizen.
- It has abided by the International Health Regulations 2005 (IHR 2005) in notifying WHO of confirmed COVID-19 cases.
- It has also communicated with other countries on confirmed cases, travel and contact histories, and border control measures.
- Taiwan has uploaded the genetic sequence of COVID-19 to the Global Initiative on Sharing All Influenza Data (GISAID) Initiative.

How will Taiwan's inclusion help?

- Taiwan could now share much with the world given its renowned public health experience and system, the NHI, etc.
- Its ability to perform rapid testing as well as research and manufacture vaccines and drugs against COVID-19 has much to offer.
- It can also share its methods for analysing the virus.
- If WHO's mission is to ensure the highest attainable standard of health for every person, then WHO needs Taiwan just as Taiwan needs WHO.

5.19 Vaccine Development

What is the issue?

- The development of vaccine for the Covid-19 is a need of the time.
- However, the governments should continue with routine immunisation as well as robust health measures for Covid-19.

How far are we from developing a COVID-19 vaccine?

- Developing vaccines is a time-consuming and resource intensive process.
- It takes up to 10-15 years from the discovery of a novel way to produce a vaccine to the licensure of a vaccine for commercial use.
- There are unprecedented levels of data sharing and global collaboration for the development of a coronavirus vaccine.

- Therefore, with a full push, a coronavirus vaccine (at least an investigational one) can be developed within 18 months to 2 years.

Will discovering a vaccine end the Covid-19 fight?

- With more than 100 candidate vaccines already in development, the response from the scientific community and industry is unprecedented.
- But, vaccine development on its own isn't enough.
- There is no global system to oversee the allocation of vaccine supply.
- Many countries with the capacity to manufacture at the required scale will face pressure to supply them first to their own population.
- Before a vaccine is developed, **global access agreements** are needed.
- There will need to be some type of **agreement on priority use**.
- The health workers should probably be the most important, followed by high risk and finally, the general population.

Will the Covid-19 fight disrupt routine immunisation programmes?

- The Covid-19 outbreak is a reminder that infectious diseases know no borders.
- The importance of **preparedness** and **early detection** cannot be overemphasized.
- Investing in **strong primary healthcare** and **immunisation systems** is the first line of defence against threats to global health security.
- The number of people missing out vaccines is likely to rise substantially.

How can countries mitigate such risks?

- The governments should continue with their **routine immunisation** as well as robust public **health measures for Covid-19**.
- Without routine immunisation, the outbreaks of vaccine-preventable diseases will overwhelm the health system on top of Covid-19 challenge.
- Strong routine immunisation ensures people are protected against the spread of infectious disease.
- Beyond routine immunisation, **procuring emergency stockpiles** are an important aspect of global epidemic preparedness.
- These stockpiles are a last-resort insurance policy that guarantees vaccines will always be available for rapid delivery when needed.

5.20 Air-Conditioners

Why in news?

There is a question whether people should be careful about using air-conditioners (AC) in the time of Covid-19.

What are some research predictions?

- A number of researchers have predicted that the novel coronavirus is unlikely to survive high temperatures.
- Additionally, a study by Chinese researchers has concluded that droplet transmission was prompted by air-conditioned ventilation.
- Not many other studies have associated AC use with coronavirus spread.

What are the guidelines?

- The government has issued general guidelines on the use of ACs.

- The Indian Society of Heating Refrigeration and Air Conditioner Engineers (ISHRAE) compiled the guidelines.
- These guidelines are limited to temperature and high relative humidity (RH) in the context of the virus.
- The guidelines say that a **temperature between 24-30°C** should be maintained while operating ACs at home.
- It also says that **relative humidity** levels in the range of **40%-70%** are considered most suitable.
- Recirculation of cool air by ACs must be accompanied by outdoor air intake and exhaust by natural exfiltration.

What is the ISHRAE-cited study?

- ISHRAE cited a study that examined the transmission of the coronavirus in 100 cities of China.
- The study indicated that **high temperature and high humidity reduce the transmission** of influenza significantly.
- ISHRAE states that the studies conducted at various Relative humidity levels using viral culture methods have shown that,
 1. Low temperature (7–8°C) - Optimal for airborne influenza survival
 2. Moderate Temperatures (20.5–24°C) - The survival rate of the virus decreases progressively
 3. Higher temperatures (greater than 30°C) - The survival rate of the virus decreases further progressively

What is the significance of the humidity range stipulated?

- The RH is believed to affect infectivity of the coronavirus.
- Moisture in the air plays a primary role in providing protection against respiratory infection.
- Humidity levels of 40-70% are considered the most ideal range for humans to fight pathogens.
- The guidelines state that in dry climate, RH should not fall below 40%.
- ISHRAE notes that 80% RH tend to neutralise the Covid-19 virus.
- Water evaporating from a pan should be kept in the room; this will increase humidity if it falls below 40%.
- Fresh Air intake through a fan filter unit will prevent outdoor dust entry.
- The exhaust through kitchen and toilet exhaust fans should be kept operational.

What is the study that linked COVID-19 with air-conditioning?

- The China-based study was conducted in an air-conditioned restaurant involving 10 positive patients from three family clusters.
- It concluded that droplet transmission was prompted by air-conditioned ventilation.
- It said that the key factor for infection was the direction of the airflow.
- It strongly recommended increasing the distance between tables and improving ventilation.

5.21 Covid-19 Treatment: Remdesivir

Why in news?

The US Food and Drug Administration (FDA) gave emergency approval to use the drug remdesivir for critical Covid-19 patients.

What is Remdesivir?

- It was manufactured in 2014 to treat for Ebola, by US-based biotechnology firm Gilead Sciences.
- It has since been used to treat for MERS and SERS, both caused by members of the coronavirus family.
- Current research is looking at whether the drug's antiviral properties work against SARS-CoV2, the coronavirus that causes Covid-19 disease.

What does the Remdesivir do?

- The drug remdesivir is designed to obstruct the novel coronavirus SARS-CoV2 at the stage of replication.
- At this stage, the virus creates copies of itself, followed endlessly by the copies creating copies of themselves.
- Researchers have described the exact mechanism of interaction between the virus and the drug.

How does replication take place?

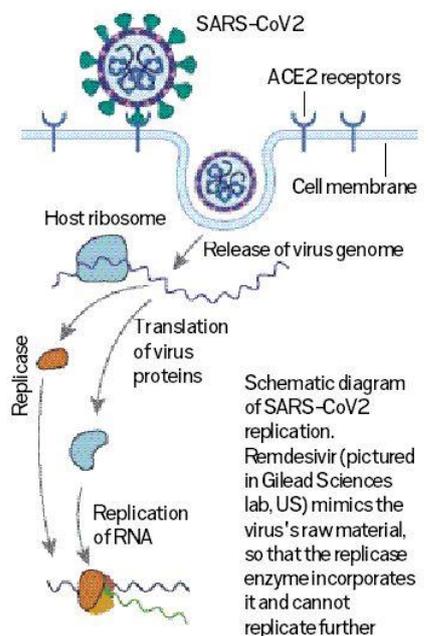
- Once the virus enters the human cell, it releases its genetic material, which is then copied using the body's existing mechanism.
- At every stage of infection, various human proteins, virus proteins, and their interactions come into play.
- At the replication stage, the key protein of the virus at play is an enzyme called RdRp.
- RdRp makes copies by processing components of the RNA of the virus.
- Scientifically, such an enzyme is called a polymerase or a replicase.
- In any case, RdRp is the enzyme that is targeted by remdesivir.

How does remdesivir target the RdRp enzyme?

- In order to replicate, RdRp processes raw material from the RNA of the virus, broken down by another enzyme with that specific function.
- When a patient is given remdesivir, it mimics some of this material, and gets incorporated in the replication site.
- With remdesivir replacing the material it needs, the virus fails to replicate further.

What are some new findings?

- As far as SARS-CoV2 is concerned, a Chinese research paper has added to the emerging knowledge about the action of remdesivir.
- They have **imaged the high-resolution structure** of the SARS-CoV-2 replicase complex, with remdesivir bound to it.
- The structure shows where the RNA template of the virus enters the replication spot.
- It also shows where the remdesivir is incorporated, and where the process of replication is terminated.



5.22 Homoeopathic Drug Arsenicum Album

What is the issue?

- The Ministry of AYUSH listed a homoeopathic drug, Arsenicum album 30 among prophylactic (preventive) medicine against Covid-19.
- On several states recommending it, concerns are being raised from various circles.

What is Arsenicum album?

- Arsenicum album is considered to correct inflammation in body.
- It takes care of diarrhoea, cough and cold.
- It is used commonly by homeopaths to treat anxiety, restlessness, cold, ulcerations, burning pains, etc.
- Arsenicum album is made by heating arsenic with distilled water.
- The process is repeated several times over 3 days.
- Arsenicum album is taken in powder form or as a tablet.
- A small bottle with one course costs Rs 20-30.

What was the recommendation made?

- In January 2020, the Scientific Advisory Board of the Central Council for Research in Homoeopathy (CCRH) opined on the drug.
- Accordingly, Arsenicum album 30 could be taken as prophylactic medicine against Coronavirus infections.
- The CCRH released a fact sheet stating this medicine is only a “possible prevention” against flu.
- Soon, the AYUSH Ministry recommended taking the medicine for 3 days on an empty stomach.
- The dose is advised to be repeated after a month if COVID-19 outbreak continues locally.
- Recently, the Ministry released another notification with “preventive and prophylactic simple remedies” against Covid-19-like illness.
- Among them, it listed Arsenicum album 30 as a homeopathic solution.
- Homeopathy has reportedly been used for prevention during the epidemic of cholera, Spanish influenza, yellow fever, scarlet fever, diphtheria, typhoid, etc.

How prevalent is its use now?

- Arsenicum album 30 has been recommended by some state governments.
- These include Rajasthan, Karnataka, Tamil Nadu, Andhra Pradesh and Kerala.
- The Maharashtra government is yet to take a formal decision.
- But the Mumbai civic authorities have been distributing the drug to high-risk populations in at least two wards.
- The Haryana prisons department and Mumbai police too are also distributing the drug to prisoners and officers respectively.
- Even in states that have no protocol for using the drug against Covid-19, people are reportedly getting to homeopathic clinics to buy the drug.
- Even local chemists have started stocking this medicine.
- The Central Drug Standard Control Organisation recently issued a notification in this regard.
- It allowed private practitioners to try alternative remedies like Ayurveda and homoeopathy to treat Covid-19.

What are the concerns?

- It is said that Arsenicum album has less than 1% arsenic.
- But the health hazards of arsenic contamination in water are well known.
- Long-term exposure to the metal can cause skin cancer, pulmonary and cardiovascular diseases.
- There is no scientific evidence that the drug works against Covid-19.

- The Ayush Ministry has based its recommendation on existing use of the medicine for respiratory illness and influenza.
- Several homeopaths themselves point out that each individual reacts differently to homeopathic medicines.
- Certainly, one medicine cannot be universally held as a prophylactic for all; it can only be a part of the treatment, if at all.
- **Maharashtra** - The Maharashtra government has set up a task-force in this regard.
- This is to evaluate the homoeopathic drug and decide whether it should be used against Covid-19.
- The members however remain undecided yet.
- But, Maharashtra is allowing the drug's use as an immunity booster, like vitamin C tablets.
- It was not encouraging it as a prophylactic.
- There is no scientific evidence that it works as prophylactic, and it is not being encouraged universally for everyone.

Is it rightful to use an untested drug?

- A recommendation made by an expert committee in the WHO during the 2014 Ebola outbreak is worth mentioning here.
- It said that it was 'ethical' to offer unproven interventions with as yet unknown efficacy and adverse effects, as potential preventive treatment.
- This was keeping in view that no vaccine or anti-virals were available.
- But the WHO has no guidelines on using Arsenicum album as a Covid-19 treatment either.
- Notably, the ICMR too has not issued any guidelines regarding the medicine.
- In all, the AYUSH Ministry could have conducted trials to assess the efficacy of the drug before recommending it.

5.23 Caps on Fee by Private Hospitals

Why in news?

Few States in India have stepped in to regulate the charges for COVID-19 care in private hospitals.

What was the need?

- For the initial part of the epidemic, the State was the primary testing agent and care giver for all COVID-19 cases.
- At that stage, few private hospitals, if any, were in the front line of the battle.
- Anyone who tested positive was shifted to a government hospital for isolation and treatment.
- However, increased number of cases necessitated a significant involvement of the private sector.
- But soon there were numerous reports about exorbitant bills being raised in private hospitals for care of COVID-19 patients.
- Costs were upwards of Rs. 7 lakh for a minimum 14-day period of hospitalisation even for mildly symptomatic or asymptomatic patients.
- If ICU (intensive care unit) care is warranted then the rates would be much higher.
- In some instances, the Indian Medical Association demanded for government intervention to regulate this.
- The Central government earlier capped the price of tests for COVID-19 at Rs. 4,500 in private labs, but not hospital charges.

What are the recent regulations by the States?

- Some of the states have now set a cap on the tariff that can be charged by private hospitals for COVID-19 care.
- Maharashtra was the first to fix a tariff, followed by Gujarat and Tamil Nadu.
- Hospitals have been graded into categories, depending on facilities provided.
- So, reasonable rates are fixed per day for each category.
- ICU rates are naturally higher.
- But States have specified that private hospitals should follow the tariff for beds.
- If not complied, the States could be charged for violations.
- Making it a participatory process, the private sector was also co-opted into discussions on tariff.
- **Tamil Nadu** has also fixed a separate tariff for beneficiaries under the Chief Minister's Comprehensive Health Insurance Scheme.
- [It is now subsumed under the Central Insurance scheme.]
- This would make it easy for patients from lower income groups to access private care treatments for COVID-19.
- Tamil Nadu has also re-fixed the rate for testing in a private lab at Rs. 3,000 per test.

What is the way forward?

- It is on part of the governments to ensure that harsh times are further not exacerbated by profiteering.
- While issuing the new fee-cap, the Tamil Nadu Government has not provided a helpline number to report defaulting hospitals.
- What is needed now is further watchfulness on part of the States and mechanisms for redressal.

5.24 Serological Survey in Delhi

What is the issue?

- A recent serological survey in Delhi found the presence of coronavirus-specific antibodies in about 23% of the samples tested.
- Here is a look on the purpose of the survey and the link with "herd immunity."

What is a serological survey?

- The serological survey is meant to detect whether the person being tested had developed antibodies against a virus/bacterium.
- The antibodies are proteins produced by the immune system to fight external organisms like viruses that try to enter the body.
- These are produced only after the infection has happened.
- So, these are specific to the attacking virus or bacterium.
- The presence of antibodies, therefore, is an indication that an infection by that particular virus or bacterium has already occurred.
- Subsequent attempts to infect the body can be thwarted by these antibodies.
- **Vaccine principle** - Vaccines work in a similar manner.
- They inject harmless doses of a virus or a bacterium inside the human body.
- This triggers the production of antibodies by the immune system.

- These antibodies can then fight off an actual attack by those viruses or bacteria.

What is the purpose in Covid-19 case?

- Information about the extent of spread is very important for authorities to make decisions and plan containment measures.
- But in the context of the Covid-19 pandemic, it is not possible to test everyone.
- It is not clear how many people in the population are infected.
- This is especially because most of the patients do not show any symptoms of the disease.
- So, the serological survey was carried out to assess how widespread Covid-19 could have become.
- Detecting antibodies in random sets of people is an indirect way of estimating the extent of disease spread in a community.

What were the results?

- The survey found coronavirus-specific antibodies in about 23% of the roughly 21,000 people who were tested.
- This means that these many people had, at some point or the other, been infected.
- Since random people were tested, it indicated that the spread of the disease was much wider than what diagnostic tests suggest.
- [In Delhi, about 14% of those who have been tested for the virus have turned out positive.]
- The results are being interpreted to suggest that about 46 lakh people in Delhi could so far have been infected, and that “herd immunity” could be approaching.

What is the need for caution?

- Serological surveys are quite useful for the limited purpose of assessing the spread of infection.
- However, scientists caution against drawing such broad conclusions (as herd immunity).
- **Antibodies and Immunity** - The mere presence of antibodies does not mean that the person is protected against the disease.
- The amount of antibodies present, and whether it includes what are known as “neutralising antibodies” are also important.
- These are the ones that actually fight the disease.
- Serological surveys are not designed to assess either the quantity of antibodies or detect the presence of neutralising antibodies.
- Also, studies have indicated that the “neutralising antibodies” could lose their effect after 4 months.
- **Herd immunity** - Clearly, the presence of antibodies and protection against the disease are very different questions.
- So, any talk of “herd immunity” at this stage is not only premature but also misplaced.
- The coronavirus is still evolving and can undergo several mutations.
- Given this too, it is too early to talk about permanent protection.

What then is herd immunity?

- Herd immunity is a stage of an epidemic in which some members of a population group remain protected from infection.
- This comes as a result of a majority of those around them having already developed immunity, either through vaccination or because they have been infected earlier.

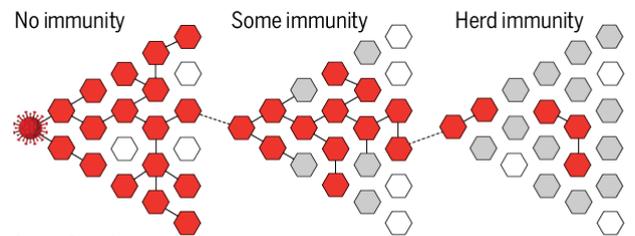
- So, everyone in the population group does not need to get infected before the epidemic is over.
- Once a certain proportion of population gets infected, and thus builds immunity, the epidemic begins to slow down and eventually stop.

What is the challenge here though?

- **Proportion** - The problem is that no one clearly knows what percentage of the population needs to be infected before herd immunity kicks in.
- It is different for different diseases, and different population groups.
- In general, herd immunity is unlikely to happen before at least half the population is infected.
- E.g. in the case of measles, herd immunity is reached only when 85% to 90% of the population attains immunity.
- In some other diseases, the threshold could be lower.
- For Covid-19, different studies have suggested that between 55-70% of the population would need to be infected before herd immunity would develop.
- But it is extremely difficult to determine the level of disease spread necessary for herd immunity when the epidemic is still raging.
- **Understanding** - Herd immunity is mentioned in very loose terms these days.
- This concept can be applied in very specific situations only.
- For example, herd immunity would apply only in closed population groups, those that are cut off from neighbouring societies.
- Thus, talk of herd immunity in Delhi is pointless if there is a free movement of people in and out of the city.
- Every parameter in this calculation is dynamic and evolving; so only after the epidemic is over, it is possible to reliably estimate at what point herd immunity took over.

The journey to herd immunity

1. A novel pathogen is introduced to a community. Because it's new, no one has immunity and it begins to spread.
2. Those who recover and those who receive a vaccine (if there is one) develop immunity, at least for a period of time. With the coronavirus, it's not known how long. So far, there is no proven vaccine.
3. Herd immunity takes hold when the pathogen can't find new hosts and stops spreading. That happens once a sufficient portion of the community is immune. For this virus, estimates range from 55% to 82%.



5.25 COVID-19 & Consumer Behaviour

What is the issue?

- The consumer during and post-COVID is showing remarkable flexibility, bringing about a paradigm shift in her consumption pattern.
- The manufacturers, brand builders and the government should note that the new consumer is following the "Wait and Watch" curve.

What is the current situation?

- Some state governments are demanding the opening up of the economy.
- Before that, there is a need to generate urgent basic demand.
- Here is where consumer behaviour needs to be closely watched.
- Since the lockdown, the priorities of consumers have shifted drastically.

What are the changes?

- The economy has been affected by a reduction in the purchasing power of many.

- Hence, the availability of money to buy products needs to be addressed.
- The current scenario has made all of us go back to the basics, with food, shelter and safety being of prime importance.
- Luxury products hold little value and will see a fall in demand.
- But renting will increase.
- The emphasis will be on saving for a rainy day.
- Banks will have more money and cash will also be kept at home for emergencies.
- Aviation, tourism and hospitality sectors have been hit.
- Even if the lockdown restrictions are relaxed, people will be wary of traveling and only doing so when absolutely necessary.
- E-commerce has shown exponential growth and will continue to do so.
- Consumers would prefer making purchases online and opting for home deliveries rather than venturing out.
- With “Vocal for Local” gaining momentum, there is a huge increase in local apps, local kirana stores, local artisans and brands.
- Offices and factories will re-open, but with less staff/working hours/alternate days.
- Schools and colleges have taken a hit as e-learning and online courses are being preferred.
- The entertainment industry has been drastically hit.
- Apart from the obvious products, financial and medical insurance will play an important role.
- Real estate will suffer as no long-term, high investment purchases will be favoured, but renting will increase.

What are the concerns for the government?

- The government is already taking care of basic essentials of the people, but money also needs to be given.
- People need jobs through development of infrastructure projects.
- Farmers need to have insurance for their crops and the infrastructure to sell at the right price.
- Migrant workers who have faced extreme hardships with their livelihoods being disrupted are looking for support.
- Most are still unemployed, and many are focusing on agriculture as a means of income.

5.26 Pandemic Modelling

Why in news?

A committee of experts' forecast on the course of the pandemic in India has brought good tidings.

Who are the committee members?

- The seven-member committee consisted of well-regarded mathematicians and infectious disease experts.
- They were appointed by the Department of Science and Technology.
- The committee made the forecast using **mathematical modelling**.

What was the forecast?

- By their estimate, India passed its Covid-19 peak in September, 2020.
- The decline in the overall caseload is being observed for nearly a month now and is to continue.
- Active cases, about 7.5 lakh now, are expected to drop below 50,000 by December.

- By February, 2021, the pandemic is likely to extinguish itself with only 'minimal' (not zero) infections.

What are the assumptions?

- It is reasonable to assume that the committee has been scrupulous.
- But, the warning is that this is still a forecast based on mathematical modelling. There are some strong assumptions.
- The decline will continue only if there are no major mutations during winter, antibodies are durable, and current restrictions are maintained.
- There would be no significant gains from a strict lockdown beyond the district level.
- The current containment measures would suffice, except if there are local outbreaks that threaten to overwhelm health-care facilities there.
- Their calculation showed a peak by July latest, with anything from 6 to 15 times the existing infections had there been no or delayed lockdown.

What is the purpose?

- The purpose of the pandemic modelling is to generate a probabilistic overview of the future.
- Mathematical modelling has become a creative exercise, with several models and forecasts being made available on pre-print servers and pending peer-review.

What was the model used?

- The datasets on which the latest model relied on are publicly available and the modelling employs a category of models called **SEIR**.
- SEIR, within a population, estimates those Susceptible, Exposed, Infected and Recovered.
- It is extremely dependent on the quality of data that is used as an input and relies as much on simplifying assumptions that sacrifice complexity for comprehension.
- But there is nothing to suggest, from what is known about the exercise, that it is more likely to be true than similar estimates from scores of models the world over that subscribe to a certain degree of rigour.

What do the experts say?

- Experts associated with the pandemic have reiterated many times that mathematical modelling ought not to be taken literally.
- The latest assessment too should then be used not to critique or justify past decisions but dwell more on the future.
- To be useful, mathematical models must induce policy or behavioural change to avoid their own worst-case scenarios.
- This latest assessment must be seen - no more, no less - as a tool to this end.

5.27 Solidarity Trial

Why in news?

The World Health Organization (WHO) made available interim results from the Solidarity Therapeutics Trial.

What is the Solidarity Trial?

- Initiated by WHO and its partners, the Solidarity Trial is the world's largest multinational human trials on Covid-19 therapeutics.
- The trial covers four repurposed drugs or drug combinations.

- This includes remdesivir, hydroxychloroquine, lopinavir/ritonavir and interferon (in combination with rotonavir and lopinavir).

What is the aim?

- The study spans over more than 30 countries involving 11,300 participants in the trial.
- It included 26 trials in parts of India with a high burden of cases.
- The study looks into the effects of these treatments on various indicators, including their ability to prevent deaths and shorten hospital stays.
- The aim was to help determine whether any of these drugs could at least moderately affect in-hospital mortality, and whether any effects differed between moderate and severe disease.

What have the trials found?

- None of the drugs was able to prove benefits across the parameters studied, especially in reducing mortality among hospitalised patients.
- The interim results said these drugs had little or no effect on hospitalised Covid-19 patients as indicated by overall mortality, initiation of ventilation and duration of hospital stay.
- Drugs like hydroxychloroquine and lopinavir had already been dropped over the course of the last six months for not showing much promise.

What are the other findings?

- The mortality findings contain most of the randomized evidence on Remdesivir and Interferon.
- The findings are consistent with meta-analyses of mortality in all major trials.
- Interferon was also dropped from the trial.
- The findings struck a nerve with American biopharmaceutical firm Gilead Sciences, which developed and patented remdesivir.

To what extent have these drugs been used in India?

- India stopped use of combinations like lopinavir/ritonavir early into the pandemic.
- But, remdesivir, hydroxychloroquine and interferon combinations are still used as part of the Covid-19 treatment regimen.
- Remdesivir, especially, has been heavily sought after.
- The size of India's remdesivir market was pegged at around Rs 121.29 crore in the 12 months ended September.
- These calculations were based on data available for only four of the several remdesivir brands. This means the market may be even larger.

How much of a blow are these findings to those prescribing these drugs?

- The **governments** will take a call on whether the evidence is convincing enough to remove these therapies from their clinical management protocols.
- **Doctors** who feel the drugs should be part of treatment may also take a call on how they will be used on a case-by-case basis.

What about remdesivir?

- The data on remdesivir is disappointing, and it will be under pressure to perform.
- Remdesivir's indiscriminate use will stop, but it still might have a place in individualised care.

5.28 Masks Are Helpful

Why in news?

Studies say that the Covid-19 spread can be contained significantly if many people begin to use masks.

What does the New York study reveal?

- A study using mathematical models for population in New York was conducted by popular universities.
- It shows that if 70% of people wore a professional mask every time they ventured outdoors, the pandemic could be eliminated from the city.
- The same result could be achieved in the entire US, if at least 80% of the population regularly used masks.
- Even low-quality home-made masks could lead to significant reduction in the disease spread, along with other interventions to eliminate it.

Will usage of masks, shorten the lockdown period?

- Another study said that for preventing **community transmission** of the disease, **home-made masks were adequate**.
- These are adequate, even if these were about thrice less effective than professional masks in blocking transmission of smaller particles.
- It said mask usage by a large proportion of the population could help in reducing the lockdown period as well.
- However, these masks should be used in conjunction with quarantining, testing, contact tracing, hand washing and physical distancing.
- Using a mask is a **two-way protection**. It protects the person wearing it and prevents the possibility of infecting others.
- If people stop wearing masks, the probability of a second wave in winter may be greatly increased.

What does an Indian study reveal?

- A study by Indian researchers from government and private institutions simulated the aerodynamic flow of particles from the mouth.
- This showed how masks could block airborne transmission of the virus.
- **Simulation** - Without a mask, a turbulent jet forms (during cough or sneeze), and droplets with a broad size distribution are ejected.
- Large droplets (greater than about 125 microns in diameter) fall to the ground within about 2 metres.
- However, the turbulent clouds transport a mist of small aerosolized droplets over significant distances (approx. 5 m).
- **Without mask** - Within a minute of sneezing, around 37% of potential viral load in the ejecta was found deposited within 2 m on the floor.
- The remaining 63% are suspended in the air, between 2 m and 5 m from the individual.
- **With mask** - 70% of virus-laden droplets were deposited on the mask.
- While those droplets that escaped could potentially take the virus no farther than 1.5 m but it falls off sharply after that distance.
- **Conclusion** - A loosely fitted simple cotton cloth mask qualitatively changes the propagation of the high velocity jet.
- It also largely eliminates the turbulent cloud downstream of the mask.

- Airborne transmission of virus could be reduced by wearing a simple mask and maintaining a strict physical distancing of 2 m.

5.29 Regulation of Indian Pharmacy Market

What is the issue?

- Earlier, large investors shied away from investing in the online pharmacy sector due to lack of proper regulations.
- But now, there is a sudden increase in activities in the sector.

What are the recent activities?

- India's online pharmacy market recently saw two significant merger and acquisition deals.
- Also, the e-commerce giant Amazon has launched its online drug delivery services.

Is the activity in the online pharma space a result of Covid-19?

- Covid-19 and the subsequent behavioural shift towards e-commerce may have catalysed growth for online pharmacies.
- But, the sector was already poised to grow 7-fold by 2023 to \$2.7 billion.
- This was mainly due to the challenges faced by physical pharmacies that gave their online counterparts a problem to solve.
- Experts believe that e-pharmacies will be able to solve the problems that traditional pharmacies couldn't.
- But for this, they need to have a large-scale presence that calls for either huge investments or consolidation.

How the Indian pharmacy market is currently shaped?

- India has a fragmented market with over 8 lakh pharmacies.
- This gives online pharmacies an opportunity to capture their space without opposing large traditional retailers.
- Currently, companies in the Indian e-pharmacy space mainly operate three business models:
 1. Marketplace,
 2. Inventory-led hybrid (offline/online) and
 3. Franchise-led hybrid (offline/online).
- These models are dependent on the way the supply chain is structured.

What are the rules governing the pharmacy sector?

- The government had floated draft regulations for e-pharmacies but these guidelines never saw light of the day.
- The lack of proper rules governing the online pharmacy space has kept large investments at bay.
- But, it has allowed the existing players in the market to grow and overcome the challenges faced by traditional retailers.
- For pharmacies overall, India's drug regulations require retailers to get a licence to dispense medicines from the state in which they are being sold.

What are the rules governing the e-pharmacy sector?

- As the e-pharmacies are not regulated currently, their operations are mostly met with opposition from brick and mortar chemists.
- In the absence of clear regulations, online pharmacies currently operate as marketplaces.

- They cater to patients as a platform for ordering medicines from sellers that adhere to the Drugs and Cosmetics Act and Rules of India.
- Other regulations, like the Information Technology Act and the Narcotic Drugs and Psychotropic Substances Act, also apply.
- Works on regulations specifically for e-pharmacies have been in progress for several years now.

What do the draft e-pharmacy regulations propose?

- **Definitions** - Draft rules sought to define the online sale of medicines.
- It also defined what an e-prescription is and what type of licences online firms would need to get from regulators to operate.
- It also proposed to define e-pharmacies in a way that would allow them to distribute, sell and stock medicines.
- The proposed regulations prevent them from selling habit-forming drugs like cough syrups specified in Schedule X of the Indian drug regulations.
- **Licence** - It also proposed to allow e-pharmacies to get a central licence to operate from the country's apex drug regulator.
- This licence could be used to allow them to operate across the country.

What is the status of the regulation?

- Regulations for online pharmacy players have been in the works since 2016 but are yet to come out.
- The last attempt to clear these regulations saw the draft rules being pushed through two expert committees under the CDSCO in 2019.
- [Central Drugs Standard Control Organisation (CDSCO) is India's apex drug regulatory body.]
- That iteration of the proposed regulations suggested the inclusion of provisions for uploading e-prescriptions.
- However, the regulations ended up with a high-level group of ministers said to include certain top ministers.

6. OTHERS

6.1 Government Notification on RO System

Why in News?

The Environment Ministry has released a draft notification to regulate the use of membrane-based water purification systems.

What is the notification about?

- The notification primarily concerns the **manufacturers** of Reverse Osmosis (RO) water filters.
- It also effectively bars domestic **users** from installing RO systems.
- It mainly deals with rules for integration of systems that inform consumers about total dissolved solids (TDS) levels.
- This is envisaged both before water enters filtration systems and after it has been filtered.
- The aim is also to ensure that after 2022, no more than 25% of water being treated is wasted, and for residential complexes to reuse the residual wastewater for other activities, including gardening.

Why this notification was made?

- There was a legal dispute before the National Green Tribunal.
- It banned RO water filter use in Delhi as the purification process wastes water.

- This legal dispute is the reason why this notification was culminated.
- The association of water filter manufacturers challenged this order and this lawsuit has led to this pan-India notification which intent to **conserve water and cut waste**.

How does RO work?

- In RO, the total dissolved solids (TDS) - a major determinant of water quality - in water are reduced to meet potable water standards.
- (TDS comprise inorganic salts like calcium, magnesium, etc and some small amounts of organic matter that are dissolved in water.)
- Home filters waste nearly 80% of the water during treatment.
- The resort to restrict home filters may cause consumer to worry but it is unlikely that they will be taken to task for using such water filters.
- For one, the notification implies, these filters are prohibited only if the home gets water supply that conforms to Bureau of Indian Standards (BIS) for Drinking Water.
- Although several State and city water boards claim BIS standards, the water at homes falls short of the test parameters.

What does the BIS and NITI Aayog say?

- **BIS** - In 2019, the BIS ranked several cities on official water supply quality.
- In the 28 test parameters, Delhi failed 19, Chennai 9, and Kolkata 10, and only Mumbai met all the standards.
- The BIS norms are voluntary for public agencies that supply piped water but are mandatory for bottled water producers.
- Moreover, most of the country does not have the luxury of piped water.
- **CWMI** - The Composite Water Management Index of NITI Aayog says that 70% of water supply is contaminated.
- Thus, the case for restricting people's choices on the means they employ to ensure potable water is weak.

How the notification should be implemented?

- When implemented, the primary aim of the notification should be to persuade authorities to upgrade and supply BIS-standard water at the consumer's end.
- This should be done without additional costs, particularly on millions who now lack access to protected supply.

6.2 Indian Science Congress

Why in news?

The 107th edition of the Indian Science Congress (ISC) was recently held in Bengaluru.

What does the ISC aim at?

- The formation of the congress pre-dates the Indian republic.
- However, it was the intellectual nursery of modern science in the country.
- Early ideas of how science and technology could aid the development of the new nation were initiated at this gathering of scientists.
- It is for this reason that the congress is inaugurated by the Prime Minister.
- It is normally held in the first week of January.

What is the change in trend?

- The nature of the congress where scientists congregated to exchange scientific ideas has changed.
- It is today becoming a 'science mela'.
- The prime purpose of the ISC now is to draw school and science college students to hear Nobel Laureates and Indian-origin scientists from abroad.
- It lectures about their work and the future prospects of science.
- The other draws are science projects and innovations by schoolchildren and stalls showcasing scientific work being done in key national laboratories and institutions.

What is the recent concern?

- In recent years, the congress often makes news for becoming a forum for pseudoscience and less for interesting scientific ideas or demonstrations.
- Speakers have tended to mix mythology and science and publicise far-fetched assertions.
- E.g. the Kauravas were born from stem-cell technology and the Vedas discussed avionics
- This has eroded the congress's public image.
- The exhibits at several scientific laboratories too are re-runs from old congresses, or from similar and past science fairs.
- Many laboratories showcase their work as 'posters' rather than actually showing demonstrations or working inventions.
- Several top personalities of India's science establishments who have represented or at least had their organisation present a dedicated talk or session, were absent this year.

What should be done?

- It is inevitable that traditions change over time and the relative importance accorded to institutions wax and wane.
- However, this must make way for inspiring new ideas, or new models of taking science to the public.
- A rising trend in science displays, at museums or exhibitions in many places, is to mix science and art.
- Making interactive displays that encourage audience engagement is also the trend.
- In this light, the Indian Science Congress too needs new ideas, and not a mix of myth and pseudoscience.

6.3 Draft Pharma Policy

Why in news?

The draft pharma policy was recently released by the Department of Pharmaceuticals (DOP).

What are the highlights of draft pharmaceutical policy?

- The new pharmaceutical policy proposes to balance the need for price control over medicines.
- Union government will gain a greater role in deciding prices of medicines and medical devices.
- Pricing authority will regulate only medicines that are specified by the government in the National List of Essential Medicines.
- The price caps being imposed on patented medicines are reduced.
- Policy allows pharmaceutical manufacturers to sell their medicines under only under generic names and not under differently-priced brands.
- Manufacturing of drugs under WHO standards is made mandatory.

- The policy seeks to bring down the unreasonable trade margins offered by various stockists to hospitals.

What are the issues with the policy?

- The policy fails to lay controls over the chemists, this may facilitates the sale of fake drugs.
- The policy doesn't have any mechanisms to boost production standards.
- Instead of an appellate authority, it seeks to give bureaucrats more powers on drug controls.
- **Direct price control** – Government takes role of fixing the drug price.
- This will affects the quality, innovation, and hurts patients as much as it does companies.
- It opens the door to lobbying and rent-seeking with all the attendant dangers for competition and for corruption.

6.4 Internet shutdowns in India

Why in news?

India topped the world with the highest number of internet shutdowns by government authorities, according to a report by Delhi-based Software Freedom Law Centre(SLFS).

What does the report say?

- Internet shutdown is defined as “disablement of access to internet as a whole within one or more localities for any duration of time”.
- There have been 233 reported instances of suspension of internet services in India in the last seven years.
- However, 73% of these shutdowns have happened only in the last year and a half.
- Internet shutdowns go against the human rights of citizens and should call for further questioning on their purpose in the interest of transparency.
- The researchers also say that centre issues 7000-8000 orders for phone tapping per month in India.
- Also, an US based think tank released the 'Freedom on the Net' report which offers a bleak perspective on the state of internet freedom across the world.
- Out of the 65 countries assessed, 26 countries are said to have experienced a deterioration and almost half of all declines were related to elections.

What are the consequences of Internet shutdowns?

- There may have been even more shutdowns than reported since many states refuse to respond to RTI (Right to Information) applications asking for details of shutdowns.
- These can last anywhere from a day to 72 hours, or even longer than that.
- Every shutdown negates the official policy thrust of promoting greater digitisation by removing the channel for digital communication.
- In states such as Jammu & Kashmir and Manipur, multiple shutdowns make normal online activities almost impossible.
- Quite apart from the disturbing impact on freedom of expression, shutdowns impose huge costs as well.
- The Indian Council for Research on International Economic Relations (Icrier) estimates that there were 16,315 hours of internet shutdowns between 2012 and 2017, costing an equivalent of \$3.04 billion.
- The costs in 2018 alone would have been of the same order, or higher, given both an increase in shutdowns and the increasing volume of online business.

What are the concerns?

- Local governments use the Temporary Suspension of Telecom Services Rules (Public Safety or Public Emergency), which were introduced in August 2017 to order a suspension of internet services.
- In the past, Section 144 of the Indian Penal Code was used for the same purpose.
- This section allows the authorities to lay down guidelines to impose temporary measures to maintain public tranquility.
- Reports suggest shutdowns are often imposed by low-ranking officials, and then retrospectively cleared at higher levels.
- Moreover, news of a shutdown is rarely disseminated directly to the public, which learns about it the hard way.
- This draconian measure seems to have become a default option during election periods, public protests or during the periods of communal tension.
- These are usually related to apprehensions that social media channels such as WhatsApp may be used to instigate mob violence or to coordinate some act of public protest.
- But shutdowns have been ordered for all sorts of other reasons.
- For example, a shutdown was ordered to prevent cheating in police recruitment exams in Rajasthan and many others were ordered in Maharashtra to “prevent rumour-mongering”.
- Thus, India was critiqued for its internet shutdowns as “collective punishment” it imposes on its own people.
- This is undoubtedly true since every shutdown inconveniences millions of ordinary citizens and causes large, quantifiable losses.

6.5 Rising Game Revolution in India

What is the issue?

A gaming revolution has started in India which expects to have over 300 million digital gamers by 2021.

How does the industry fare?

- Gaming, as an industry, has enormous potential that gaming companies, advertisers, retailers and promoters are looking to make the most of.
- The global gaming industry grossed a staggering \$108 billion in 2017.
- The market in India currently forms less than 1% of the global market and it is expected to grow at a quick rate.
- With increasing popularity and adoption of gaming especially amongst the new generation, the opportunity in digital gaming has prompted investors and companies to keep a keen eye on the sector.
- Affordable internet connectivity, smartphone penetration, power of data, emergence of eSports that augments gaming for professional gamers, and better economics for gaming companies are creating new monetisation avenues in gaming.

What is the case with India?

- Investors, marketers, advertisers and gaming companies are aware that digital gaming is a trillion-dollar market in the making.
- According to the 2017 report “India’s Trillion Dollar Digital Opportunity” by McKinsey, India has over 7.7 billion app downloads, second only to China.
- A user base of such size has created and opened ample opportunities, beyond imagination, for all kinds of games and apps.

- By 2021, the average data consumption of Indians will reach 7 GB per person, a quantum jump from the 1 GB per person in 2016.
- Also, the number of gamers is expected to cross 300 million by 2021, helped by the increasing affordability of smartphones.
- In fact, India's digital gaming adoption growth rate of 56% is second only to Indonesia (among 17 major digital economies).
- New gaming technologies like AR, VR and console gaming are not only making an impact in the gaming industry, but also in sectors like education and healthcare.

What are the opportunities?

- Over the last two years, the popularity of gaming has soared, with millions of users watching professional gamers game on large screens.
- eSports has the potential for advertisements to capture the eyeballs of about 2 million eSports viewers in India, a market that is expected to grow five times by 2021.
- Gamers are also taking it up professionally as a career, thus expanding the digital gaming landscape.
- An increased focus on local development of games, large volume of users and rising potential of monetisation means gaming can emerge as a significant sector in the future.
- It can create jobs for thousands of millennials who can join the creative workplace and there are also a variety of courses that have emerged on gaming.
- College students can intern at gaming companies or even organise and conduct game championship tournaments on their campuses.
- This is turning out to be the next avenue for event management firms as well.

What should be done?

- From games as simple as Candy Crush and Ludo to midcore ones like Sachin Saga played on smartphones to PUBG, Dota 2 and Counter-Strike played by hardcore gamers, a gaming revolution is on in India.
- The country had over 198 million mobile gamers in 2015, and this number is expected to grow to 628 million gamers on multiple portable devices by 2020.
- Games like Pokémon GO took Indian gamers by storm even before its launch.
- A delayed release in India might have resulted in a loss of potential revenue considering how the game went viral through off-the-store sources.
- Thus there are immense opportunity for companies to release games in India as part of their launch strategy, to get a wider popularity from a larger gamer base.