

You & Technology -Jan 2019



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GOOD MORNING TIMES S&T (JANUARY-2019)

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General Studies Paper-3 – S&T – Jan 2019

1) INTERNATIONAL YEAR OF THE PERIODIC TABLE

To celebrate the 150th anniversary of the organisation of the periodic table, UNESCO has launched the International Year Of The Periodic Table.

- Russian scientist Dmitry Mendeleev published the first periodic such table in 1869.
- The table organizes all chemical elements by the number of protons in a given atom and other properties.
- There are seven rows, called periods, and 18 columns, called groups, in the table.
- Elements in the same group share similar properties. Those in the same period have the same number of atomic orbitals.
- Most elements on the table are metals divided into six broad categories – alkali metals, alkaline earths, basic metals, transition metals, lanthanides and actinides. They are located on the left, separated from the non-metals on the right by a zig-zag line.
- Lanthanides and actinides, often called “inner transition metals”, are commonly hived off as a separate section under the main table as including all 30 – including Uranium – would make the table too wide.
- The table is a useful tool for people to derive relationships between the different properties of the elements. It can also help predict the properties of new elements that have yet to be discovered or created.

Who maintains periodic table?

The International Union of Pure Applied Chemistry (IUPAC) is responsible for maintaining the periodic table.

- IUPAC is an international federation of National Adhering Organizations that represents chemists in individual countries. It is a member of the International Council for Science (ICSU).
- Headquarters of IUPAC is in Zürich, Switzerland.
- Established in 1919 as the successor of the International Congress of Applied Chemistry for the advancement of chemistry.
- Its members, the National Adhering Organizations, can be national chemistry societies, national academies of sciences, or other bodies representing chemists.
- The IUPAC's Inter-divisional Committee on Nomenclature and Symbols (IUPAC nomenclature) is the recognized world authority in developing standards for the naming of the chemical elements and compounds.

1001 Inventions:

- UNESCO has also launched its educational initiative, 1001 Inventions: Journeys from Alchemy to Chemistry.
- Consisting of educational material and science experiments to help young people improve their understanding of chemistry and its numerous uses, the initiative will be brought to schools around the world during 2019.

2) NASA NEW HORIZONS

On January 1, NASA's New Horizons spacecraft became the first explorer to fly past the

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mysterious object- Ultima Thule, located some 4 billion miles from Earth.

- This is a historic flyby of the farthest, and quite possibly the oldest, cosmic body ever explored by humankind.

Key facts- Ultima Thule:

- Ultima Thule is located in the Kuiper belt in the outermost regions of the Solar System, beyond the orbit of Neptune.
- It measures approximately 30 km in diameter, and is irregularly shaped.
- Ultima Thule has a reddish color, probably caused by exposure of hydrocarbons to sunlight over billions of years.
- Ultima Thule belongs to a class of Kuiper belt objects called the "cold classicals", which have nearly circular orbits with low inclinations to the solar plane.

Background:

- New Horizons was launched on 19 January 2006, and has been travelling through space for the past nine years. New Horizon's core science mission is to map the surfaces of Pluto and Charon, to study Pluto's atmosphere and to take temperature readings.

3) NASA'S OSIRIS-REX

NASA's OSIRIS-Rex spacecraft has set a new milestone in cosmic exploration by entering orbit around an asteroid, Bennu, the smallest object ever to be circled by a human-made spaceship.

Significance:

- OSIRIS-Rex is the first-ever US mission designed to visit an asteroid and return a sample of its dust back to Earth. The \$800 million (roughly Rs. 5,600 crores) unmanned spaceship launched two years ago from Cape Canaveral, Florida and arrived

December 3 at its destination, some 70 million miles (110 million kilometres) away.

What next?

- The plan is for OSIRIS-REx to orbit Bennu through mid-February, using a suite of five scientific instruments to map the asteroid in high resolution to help scientists decide precisely where to sample from.
- Then, in 2020, it will reach out with its robotic arm and touch the asteroid in a maneuver Rich Kuhns, OSIRIS-REx program manager with Lockheed Martin Space Systems in Denver, described as a "gentle high-five."
- Using a circular device much like a car's air filter, and a reverse vacuum to stir up and collect dust, the device aims to grab about two ounces (60 grams) of material from the asteroid's surface, and return it to Earth in 2023.

About the mission:

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

Why was Bennu chosen?

- Bennu was selected for the OSIRIS-REx mission from over 500,000 known asteroids, due to it fitting a number of key criteria. These include:
 - Proximity to Earth: In order for OSIRIS-REx to reach its destination in a reasonable timeframe, NASA needed to find an asteroid which had a similar orbit to Earth.
 - Size: Small asteroids, those less than 200m in diameter, typically spin much faster than larger

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asteroids, meaning the regolith material can be ejected into space. Bennu is around 500m in diameter, so rotates slowly enough to ensure that the regolith stays on its surface.

- **Composition:** Bennu is a primitive asteroid, meaning it hasn't significantly changed since the beginning of the Solar System (over 4 billion years ago). It is also very carbon-rich, meaning it may contain organic molecules, which could have been precursors to life on Earth.
- Additionally, Bennu is of interest as it is a Potentially Hazardous Asteroid (PHA). Every 6 years, Bennu's orbit brings it within 200,000 miles of the Earth, which means it has a high probability of impacting Earth in the late 22nd Century.

4) TRANSITING EXOPLANET SURVEY SATELLITE (TESS)

Nasa which launched Transiting Exoplanet Survey Satellite (Tess) for searching exoplanets in April, 2018 has discovered a third small planet outside our solar system.

THE NEW PLANET:

- The new planet is named HD 21749b. The newly discovered planet orbits a bright and nearby star which is about 53 light years away in the constellation Reticulum.
- HD 21749b appears to have the longest orbital period of the three planets so far identified by Tess. The surface of the new planet is hotter than 100 degrees Celsius. About TESS mission: • The Transiting Exoplanet Survey Satellite (TESS) is a NASA mission that will look for planets orbiting the brightest stars in Earth's sky. It was led by the

Massachusetts Institute of Technology with seed funding from Google.

- **Mission:** The mission will monitor at least 200,000 stars for signs of exoplanets, ranging from Earth-sized rocky worlds to huge gas giant planets. TESS, however, will focus on stars that are 30 to 100 times brighter than those Kepler examined. This will help astronomers better understand the structure of solar systems outside of our Earth, and provide insights into how our own solar system formed.

- **Orbit:** TESS will occupy a never-before-used orbit high above Earth. The elliptical orbit, called P/2, is exactly half of the moon's orbital period; this means that TESS will orbit Earth every 13.7 days. Its closest point to Earth (67,000 miles or 108,000 kilometers) is about triple the distance of geosynchronous orbit, where most communications satellites operate.

- **How it works?** It will use transit method to detect exoplanets. It watches distant stars for small dips in brightness, which can indicate that planet has passed in front of them. Repeated dips will indicate planet passing in front of its star. This data has to be validated by repeated observations and verified by scientists.

Significance of the mission:

- TESS is designed to build on the work of its predecessor, the Kepler space telescope, which discovered the bulk of some 3,700 exoplanets documented during the past 20 years and is running out of fuel.
- Nasa expects to pinpoint thousands more previously unknown worlds, perhaps hundreds of them Earthsized or "super-Earth" sized – no larger than twice as big as our home planet.

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- Those are believed the most likely to feature rocky surfaces or oceans and are thus considered the best candidates for life to evolve. Scientists have said they hope TESS will ultimately help catalog at least 100 more rocky exoplanets for further study in what has become one of astronomy's newest fields of exploration.

5) YUTU 2

China has named the lunar rover, successfully deployed to carry out a string of experiments on the far side of the moon, as 'Yutu-2'. **The rover's touchdown is part of China Chang'e-4 lunar probe.**

Key facts:

- It follows the BeiDou Navigation Satellite System — China's homegrown Global Positioning System that started worldwide service last month.
- The rover has been programmed to launch ground penetration radar that would help map the moon's inner structures.
- It would also analyse soil and rock samples for minerals, apart from activating a radio telescope to search for possible signals from deep space.

6) KYASANUR FOREST DISEASE

Karnataka is currently reeling under an outbreak of monkey fever or Kyasanur forest disease (KFD). Authorities are taking measures, including vaccination to combat the disease and spread of it in the state.

About the Disease:

- KFD is caused by the Kyasanur Forest Disease Virus (KFDV). The virus was identified in 1957 when it was isolated from a sick monkey from the

Kyasanur Forest. Since then, between 400-500 humans cases per year have been reported.

- Hard ticks (*Hemaphysalis spinigera*) are the reservoir of the KFD virus and once infected, remain so for life.
- Rodents, shrews, and monkeys are common hosts for KFDV after being bitten by an infected tick. KFDV can cause epizootics with high fatality in primates.

Transmission:

- Transmission to humans may occur after a tick bite or contact with an infected animal, most importantly a sick or recently dead monkey. No person-to-person transmission has been described.
- The disease as of now is stated to be transmitted through monkeys. Large animals such as goats, cows, and sheep may become infected with KFD but play a limited role in the transmission of the disease.
- These animals provide the blood meals for ticks and it is possible for infected animals with viremia to infect other ticks, but transmission of KFDV to humans from these larger animals is extremely rare. Furthermore, there is no evidence of disease transmission via the unpasteurised milk of any of these animals.

Symptoms:

- After an incubation period of 3-8 days, the symptoms of KFD begin suddenly with chills, fever, and headache. Severe muscle pain with vomiting, gastrointestinal symptoms and bleeding problems may occur 3-4 days after initial symptom onset. Patients may experience abnormally low blood pressure, and low platelet, red blood cell, and white blood cell counts.
- After 1-2 weeks of symptoms, some patients

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recover without complication. However, the illness is biphasic for a subset of patients (10-20 %) who experience a second wave of symptoms at the beginning of the third week. These symptoms include fever and signs of neurological manifestations, such as severe headache, mental disturbances, tremors, and vision deficits.

Vulnerable Group:

- People with recreational or occupational exposure to rural or outdoor settings (e.g., hunters, herders, forest workers, farmers) are potentially at risk for infection by contact with infected ticks.
- Seasonality is another important risk factor as more cases are reported during the dry season, from November through June.

Diagnosis:

- Diagnosis can be made in the early stage of illness by molecular detection by PCR or virus isolation from blood. Later, serologic testing using enzyme-linked immunosorbent serologic assay (ELISA) can be performed.

Prevention:

- Doctors say there is no specific treatment for KFD, but early hospitalisation and supportive therapy is important. Supportive therapy includes the maintenance of hydration and the usual precautions for patients with bleeding disorders.
- A vaccine does exist for KFD and is used in endemic areas of India. Additional preventative measures include insect repellents and wearing protective clothing in areas where ticks are endemic.

7) RARE DISEASES

After withdrawing the **National Policy for Treatment of Rare Diseases (NPTRD)**, the

Minister of Health and Family Welfare has approved a proposal for adding a subcomponent under the umbrella scheme of Rashtriya Arogya Nidhi (RAN) for provision of one-time financial assistance to those below threshold poverty line for specified rare diseases which require one-time treatment.

About Rare Diseases

- There is no universally accepted definition of rare diseases and the definitions usually vary across different countries. However, generally rare diseases are defined as a health condition of low prevalence that affects a small number of people compared with other prevalent diseases in the general population.
- WHO defines rare disease as often debilitating lifelong disease or disorder condition with a prevalence of 1 or less, per 1000 population.
- 80% of rare diseases are genetic in origin and hence disproportionately impact children.
- These are also called 'orphan diseases' because drug companies are not interested in adopting them to develop treatments due to low profitability.
- The most common rare diseases include Haemophilia, Thalassemia, Sickle-cell Anaemia, auto-immune diseases, etc.
- They affect 6%- 8% of the total population in the country. So far about 450 rare diseases have been recorded in India.
- Karnataka is the first state to release a Rare Diseases and Orphan Drugs Policy.
- The Union Health Ministry termed the current policy "untenable" as the policy was to be implemented under the National Health Mission. (The ambit of the NHM is restricted to primary

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and secondary health care but rare diseases come under tertiary care).

- One-time financial assistance is being provided as an interim measure till a new policy is framed. A committee has been set up to frame a new policy.

Criticism of the move: Why India Needs a policy on rare disease?

- Need for Continuous Treatment: Most of the rare diseases for which treatment is available are progressive. They require continuous support and not just one-time assistance as an interim arrangement can never be a substitute for a policy.
- The withdrawn Policy highlighted the measures and steps, both in the short as well as in the long term, that need to be taken to deal comprehensively with rare diseases. The policy sought to strike a balance between access to treatment with health system sustainability.
- Pushes Families in Poverty: Its impact on families is often catastrophic in terms of emotional as well as financial burden. The exorbitant cost of treatment per patient, which ranges anywhere from ₹25 lakh and ₹4 crore per year, is out of reach even for middle-class families.
- Significant Population Impacted: While there is no registry of rare diseases patients in India (the policy provided for one), according to government's own estimates there are between 70-90 million patients.
- Difficulty in R&D: Rare diseases are difficult to research upon as the patient pool is very small and it often results in inadequate clinical experience. The policy envisaged a R&D framework which cannot be attained through one time financial support.

- Not covered under Health Insurance: Private insurance companies treat genetic disorders as pre-existing conditions and, on that ground, exclude them from coverage. Since most rare diseases are genetic, patients are routinely denied insurance cover.

Rashtriya Arogya Nidhi

- The RAN was set up to provide financial assistance to patients, living below poverty line and who are suffering from major life threatening diseases, to receive medical treatment at any of the super speciality Hospitals/Institutes or other Government hospitals.
- The financial assistance to such patients is released in the form of 'one-time grant', which is released to the Medical Superintendent of the Hospital in which the treatment has been/is being received.
- It has been set up as society registered under the Societies Registration Act, 1860.

8) LEPROSY IN INDIA

Initial reports of Leprosy Case Detection Campaign of the National Leprosy Eradication Programme (NLEP) indicated an all-time high of nearly 50,000 new leprosy cases in Bihar.

Current scenario

- India was officially declared to have eliminated leprosy in 2005 when new cases fell to less than 1 per 10,000, yet India still accounts for the largest number of leprosy affected people in the world (58 per cent).
- Indian research contributed to the development of Multi-Drug Therapy or MDT, now recommended by WHO, which led to the shortening of treatment and higher cure rates.

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- In recent years, along with other countries, India has repealed legislation that discriminates against persons affected by leprosy. o In 2016, it repealed the draconian colonial-era Lepers Act and in January 2019 Lok Sabha passed a bill seeking to remove leprosy as a ground for divorce.

Challenges in eradicating leprosy

- Antimicrobial resistance in leprosy: Global data shows that a total of 8% of the Mycobacterium leprae bacterial strains studied showed gene mutations conferring resistance towards drugs such as rifampicin, dapson and ofloxacin.
- Non-adherence to drugs: Due to various reasons a significant number of patients become irregular and default from MDT.
- Issues with 2005 declaration of Leprosy elimination: o It led to the diversion of focus as both funding as well as resources declined and the frontline workers stopped making household visits to identify undetected cases, shifting instead to voluntary patient registration. o The dermatologists didn't send patients for treatment, as the strong rhetoric of elimination made them believe leprosy is a disease of the past. o Neither funders nor young researchers are attracted to an officially eliminated disease, even if it is still ubiquitous.
- Stigma about leprosy: Fear of stigma, and the resulting discrimination, discourages individuals and their families from seeking the help they need.
- Lack of funding: Financial crunch in leprosy research and awareness campaigns leads to a shortfall in human reserves and trained medical

professionals who can diagnose the disease correctly in its nascent stage.

What is Leprosy?

- Leprosy is a chronic infectious disease caused by Mycobacterium leprae and is highly contagious.
- The bacteria has a long incubation period. Once a person is infected, it can take 6-10 years or even 20 years for the first symptoms to surface.
- The disease mainly affects the skin, the peripheral nerves, the mucosa of the upper respiratory tract and the eyes.
- It is curable and treatment provided in the early stages averts disability. Mycobacterium Indicus Pranii (MIP)
- It is an indigenous vaccine for leprosy developed by National Institute of Immunology.
- It is now being introduced into the National Leprosy Elimination Programme (NLEP). It will boost the immune system against the bacterial disease.

Measures taken to eradicate Leprosy International

- Multidrug therapy, made available by WHO free of charge to all patients worldwide since 1995, provides a simple yet highly effective cure for all types of leprosy.
- In 2016, WHO launched The Global Leprosy Strategy 2016–2020: accelerating towards a leprosy-free world which aims to reinvigorate leprosy control efforts and avert disabilities, especially among children affected by the disease in endemic countries. Government of India Initiatives
- National Health Mission aims to reduce prevalence of Leprosy to <1/10000 population and incidence to zero in all districts.

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- Ayushman Bharat's 1,50,000 Health and Wellness Centres across the country plan to screen all Indians for leprosy.
- Sparsh Leprosy Awareness Campaign aims at communicating the importance of early detection and treatment of leprosy.
- New preventive approaches like chemoprophylaxis and immuno-prophylaxis are being considered to prevent transmission.
- 30th of January (Martyrdom Day of Mahatma Gandhi) was celebrated all over India as Anti Leprosy Day to spread public awareness about the disease.
- A Leprosy Case Detection Campaign was launched in 2016, involving house-to-house screening and referral of patients for diagnosis.
- 12th Five year plan had set out to achieve elimination of leprosy at the district level by 2017. India's National Leprosy Eradication Programme
- It is a centrally sponsored Health Scheme of the Ministry of Health and Family Welfare which aims to eradicate leprosy from India.
- **Strategies for Leprosy elimination:**
 - o Decentralized integrated leprosy services through General Health Care system.
 - o Early detection & complete treatment of new leprosy cases.
 - o Carrying out house hold contact survey in detection of Multibacillary (MB) & child cases.
 - o Early diagnosis & prompt MDT, through routine and special efforts
 - o Involvement of Accredited Social Health Activists (ASHAs) in the detection & complete treatment of Leprosy cases for leprosy work
 - o Strengthening of Disability Prevention & Medical Rehabilitation (DPMR) services.

- o Information, Education & Communication (IEC) activities in the community to improve self-reporting to Primary Health Centre (PHC) and reduction of stigma.
- o Intensive monitoring and supervision at Primary Health Centre/Community Health Centre.

Way forward

- Avoid shallow declarations: India remains a long way away from elimination at the state or district levels, let alone eradication. It is necessary to learn lessons and avoid creating an environment of complacency.
- Speedy implementation of the Health and Wellness Centres (HWC) initiative in the true spirit of comprehensive primary healthcare approach.
- Enhancing training of health-care providers: in communication and behaviour change skills, and by improving the patients' access to quality care and friendly services.
- Adherence to MDT: can be improved by multiple initiatives that target the views and actions of patients, health-care workers, and society.
- Removal of stigma: Leprosy program managers should design positive health messages and use innovative media to appeal to and reach target groups to motivate leprosy patients to seek early treatment and the community to accept leprosy patients.
- Creating Livelihood Opportunities: Those who have been cured at an early stage and can work, should be given opportunities to learn skills and trades that would enable them to work.

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9) GAS HYDRATES

Researchers at Indian Institute of Technology (IIT) Madras have experimentally shown that methane and carbon dioxide (CO₂) can exist as gas hydrates.

What are gas hydrates?

- They are formed when a gas such as methane gets trapped in well-defined cages of water molecules forming crystalline solids. It is a solid ice-like form of water that contains gas molecules in its molecular cavities.
- Natural gas hydrates occur on continental margins and shelves worldwide from Polar Regions to the tropics.
- Gas hydrate reservoirs are generally associated with biologically rich cold seep ecosystems at the seafloor. Cold seeps are locations where hydrocarbon-rich fluid seeps up from below the sea floor, often as methane or hydrogen sulfide.
- It is estimated that total amount of carbon in the form of methane hydrates, far exceeds the carbon content in all the fossil fuel reserves put together and hence these are supposed to be the future potential energy resource.
- Combustion of methane, is more CO₂ efficient than that of any other hydrocarbon. Hence, using methane from gas hydrate compared to other hydrocarbons is relatively climate friendly.
- According to the latest estimates of the US Geological Survey, India has the second largest gas hydrate reserves after America. The Krishna-Godavari (KG), Cauvery and Kerala basins alone have 100130 trillion cubic feet of estimated reserves.
- The carbon dioxide hydrate produced in the lab by the IIT team raises the possibility of

sequestering or storing carbon dioxide as hydrates under the sea bed.

Extraction of gas hydrates: The natural gas from gas hydrate can be produced via:

- Depressurization: Drilling of hole into the layer of hydrate and reducing the pressure beneath. This technique is implemented for hydrates only in polar regions beneath the permafrost.
- Thermal stimulation: via steam injection, hot brine solution etc. that raises the temperature of the local reservoir outside the hydrate region to cause the dissociation of the hydrate, thus releasing free gas which can be collected. However, no country in the world has so far developed the technology to produce gas hydrates commercially and economically.

Issues with extraction: Gas hydrates are also important for seafloor stability studies, because "melting" gas hydrate may cause seafloor "land" slides. Methane released from gas hydrate may therefore play a significant role in climate change.

Indian Initiative

- The National Gas Hydrate Programme (NGHP) is of national importance considering India's phenomenal growing energy demand. The programme was initiated in 1997. It first conducted studies in 2006.
- India has entered into an agreement with Canada to develop technology in this regard.
- IIT Madras, in collaboration with GAIL, is working to recover methane from methane hydrate from the Krishna-Godavari Basin and sequester CO₂ simultaneously.

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10) EAT RIGHT INDIA MOVEMENT

The Food Safety and Standards Authority of India (FSSAI) recently organised the Swasth Bharat Yatra, a key element of the 'Eat Right India Movement'.

Eat Right India movement

- It is multi-sectoral effort with primary focus on daily intake of salt, sugar, fat, phasing-out trans-fats from diets and promoting healthier food options.
- It is built on two broad pillars of Eat Healthy and Eat Safe.
- It brings together three ongoing initiatives of FSSAI that target citizens:
 - o The Safe and Nutritious Food (SNF) Initiative, focused on social and behavioral change around food safety and nutrition at home, school, workplace and on-the-go.
 - o The Eat Healthy Campaign focused on daily intake of salt, sugar, fat, phasing-out trans-fats.
 - o Food fortification, focused on promoting five staple foods- wheat flour, rice, oil, milk and salt, with key vitamins and minerals added to improve their nutritional content.
- It has seven broad areas of action—
 - o to increase demand for healthier food by influencing each other as role models, caregivers and peers,
 - o set standards in schools, promote healthy eating habits and use food as a pedagogical tool,
 - o have appropriate consumer friendly nutrition labelling and restriction on marketing to children through a suitable regulation,
 - o have higher taxation for unhealthy food through differential GST rates,
 - o ensure

availability of healthier food options and guide consumers through appropriate menu labelling, o redesign choices available at points of sale with increased availability and prominent display of healthier options,

o encourage food processing industry to formulate their food products by reducing unhealthy ingredients.

- Under the movement, "Aaj se thoda kam campaign" was launched to encourage citizens to adopt healthy food habits through social media and mass media.

11) YOUNG SCIENTIST PROGRAMME

Indian Space Research Organization (ISRO) has recently launched Young Scientist Programme for school students.

About the Young Scientist Programme

- It aims to inculcate and nurture space research fervor in young minds
- Under this 1-month program, 3 students from each of the 29 States and 7 UTs will be selected.
- Students mostly from class VIII will be given lectures and access to R&D labs and practical experience of building a small satellite.
- It is conceptualized after the similar Programme run by the American Space Agency NASA.
- All the expenses of travelling and boarding will be funded entirely by ISRO.
- Under this, six incubation centres will be established in various parts of the country - North, South, East, West, Centre and North-East, and the first such centre has been established in Agartala in Tripura.

Samvad with Students

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- ISRO recently launched a student outreach programme called Samvad with Students where ISRO chairman meets the students during his outstation visits and address their queries and quench the scientific thrust. ISRO-Student Collaborations

- ANUSAT: ANUSAT (Anna University Satellite) is the first satellite built by an Indian University under the overall guidance of ISRO and will demonstrate the technologies related to message store and forward operations.

- STUDSAT: Student Satellite (STUDSAT) is the first pico-satellite developed in the country by a consortium of seven engineering colleges from Karnataka and Andhra Pradesh.

- YOUTHSAT: A joint Indo-Russian stellar and atmospheric satellite mission with the participation of students. to investigate the relationship between solar variability and thermosphere-Ionosphere changes.

- SRMSat: A nanosatellite weighing 10.9 kg, developed by SRM University, which attempts to address the problem of Global warming and pollution levels in the atmosphere by monitoring CO2 and water vapour.

- Jugnu: A nanosatellite weighing 3 kg, developed by IIT Kanpur under the guidance of ISRO. The satellite is intended to prove the indigenously developed camera system for imaging the Earth in the near infrared region and test image processing algorithms.

12) UNISPACE NANOSATELLITE ASSEMBLY & TRAINING PROGRAMME (UNNATI)

Recently ISRO launched a capacity building programme on Nanosatellite development named UNNATI.

More about UNNATI

- It is an initiative to commemorate the 50th anniversary of the first United Nations conference on the exploration and peaceful uses of outer space (UNISPACE+50).

- It would provide opportunities to the participating developing countries to strengthen in assembling, integrating and testing of Nanosatellite.

About Nanosatellite

- In mass classification a Nanosatellite is any satellite with mass from 1kg to 10kg.

- These satellites can reduce the cost of launching because weight is the most important (and most expensive) aspect of launching an object into space.

- Many Nanosatellites are deployed together in network of satellites (satellite constellation) that operates as a single entity which can capture minute details.

- This system can provide people in poor, rural or low population density areas around the world with affordable, high-speed internet access which is currently underserved due to high cost of traditional satellites.

13) PT POINTERS

ISRO'S FIRST MISSION OF 2019

- Context: India has successfully launched Microsat-R, a military satellite and Kalamsat onboard its Polar rocket PSLV C44, in the first mission for the ISRO in 2019.

- Microsat-R is meant for military use.

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• Kalamsat is a communication satellite with a life span of two months. The nanosatellite is a 10cm cube weighing 1.2 kg. It was the first to use the rocket's fourth stage as an orbital platform. It is the world's lightest and first ever 3D-printed satellite.

HUMAN SPACE FLIGHT CENTRE (HSFC)

1. The HSFC, the hub of ISRO's future manned missions, was inaugurated at ISRO headquarters in Bengaluru.

2. HSFC shall be responsible for the implementation of Gaganyaan project — which involves mission planning, development of engineering systems for crew survival in space, crew selection and training and also pursue activities for sustained human space flight missions.

B.TECH COURSE IN AI BY IIT HYDERABAD

• Context: IIT Hyderabad has announced the launch of a full-fledged bachelor's programme in Artificial Intelligence (AI) technology. IIT Hyderabad has become the first institute in the country to launch fullfledged Bachelor's programme in AI technology. IIT Hyderabad will be the third institute to globally to offer the B.Tech course in AI.

14) DNA Technology Regulation Bill

- The Lok Sabha has passed the DNA Technology (Use and Application) Regulation Bill.
- The bill allows regulated use of DNA technology to establish the identity of certain defined

categories of persons, including offenders, suspects, and under trials.

About DNA

- Deoxyribonucleic Acid (DNA) is a set of instructions found in a cell. These instructions are used for the growth and development of an organism.
- The DNA of a person is unique, and variation in the sequence of DNA can be used to match individuals and identify them. DNA technology, therefore allows for accurate establishment of an individual's identity.
- In addition, DNA-based technology helps in identification of victims in the event of terrorist attacks or natural disasters such as earthquakes.
- For example, DNA technology has been used to identify victims of terrorist attacks on the World Trade Centre in 2001, and disasters such as the Asian tsunami in 2004.
- Further, DNA profiling can be used in civil matters, such as parentage related disputes.

Highlights Of The Bill

- The Bill regulates DNA testing for identification of persons, in respect of matters listed in the Schedule.
- This includes offences under the Indian Penal Code, 1860, as well as offences under other laws such as the Immoral Traffic (Prevention) Act, 1956, the Medical Termination of Pregnancy Act, 1971, the Protection of Civil Rights Act, 1955, and the Motor Vehicles Act, 1988.
- The Schedule also allows for DNA testing in certain civil matters. This includes matters such as parentage disputes, issues related to pedigree, immigration or emigration, assisted reproductive technologies, transplantation of human organs, and for the establishment of individual identity.

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- The central government will establish a National DNA Data Bank and Regional DNA Data Banks for each state, or two or more states, as it may deem necessary.

- Every DNA Data Bank is required to maintain the following indices based on DNA testing conducted by a DNA laboratory:

- (i) crime scene index,
- (ii) suspects' or undertrials' index,
- (iii) offenders' index,
- (iv) missing persons' index, and
- (v) unknown deceased persons' index.

- All DNA laboratories will share DNA data prepared by them with the National and Regional DNA Data Banks.

- The Bill provides for a DNA Regulatory Board, which will supervise DNA Data Banks and DNA laboratories. The Secretary in the Department of Biotechnology, will be the ex-officio Chairperson of the Board.

- The Board will make recommendations to the central government on privacy protection in relation to the use and analysis of DNA samples.

- The Board is required to ensure that all information relating to DNA profiles with Data Banks, DNA laboratories, and other persons are kept confidential.

- In case of a person arrested for an offence which carries punishment upto seven years, the authorities are required to obtain his written consent.

- If consent is not given, the authorities may approach a Magistrate who may order the taking of bodily substances from the individual.

- If the offence carries a punishment of more than seven years of imprisonment or death, consent is not required.

- The penalty for various offences is imprisonment up to three years and fine of up to one lakh rupees.

- Further, the penalty for intentional tampering or destruction of biological evidence is imprisonment up to five years as well as fine of up to two lakh rupees.

Grey Areas/Concerns

- DNA testing carried out in medical or research laboratories can be used to identify an individual. It is unclear if the Bill intends to regulate such laboratories.

- The Bill requires consent of the individual when DNA profiling is used in criminal investigations and identifying missing persons. However, consent requirements have not been specified in case of DNA profiling for civil matters.

- It is unclear whether DNA profiles for civil matters will also be stored in the Data Banks. Storage of these profiles in the Data Banks may violate the right to privacy.

- The Bill specifies the process by which DNA profiles may be removed from the Data Banks. However, the Bill does not require DNA laboratories to remove DNA profiles.

- The Bill does not provide any mechanism for redressal of grievances in cases where the DNA profile is not removed from the data banks by the Director of the National DNA Data Bank.

- The Law Commission in its report on the draft Bill of 2017 stated that only the portion of the DNA which provides information on identity will be used for profiling. However, this is not specified in the Bill.

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15) Microsat-R

- ISRO's Polar Satellite Launch Vehicle (PSLV-C44) successfully injected Microsat-R, and Kalamsat-V2 satellites into their designated orbits.
- Microsat-R is a military imaging satellite which was successfully injected into the intended orbit that is much lower than any of its civil Earth observation spacecraft.
- Weighing only 1.26kg, Kalamsat-V2 is the lightest satellite to be ever built and launched into orbit.
- It is also the first to be built by a private Indian firm and launched by Isro.
- PSLV-C44 mission is unique as it is for the first time ISRO has used the last stage of the rocket (i.e 4th stage) as a platform to perform experiments in space.
- Kalamsat-V2, a student payload, is the first to use PS4 (the fourth stage) as an orbital platform.
- This new low cost technology will help students to conduct several inspiring experiments in space by attaching their instruments to the last stage of the rocket.
- The other experiment with the launcher PSLV-C44 vehicle was a new third variant having two strapon boosters.
- Called the PSLV-DL, D standing for demonstration, it ranges between the older two variants.

16) Paper Sensor To Detect Freshness Of Milk

- Scientists at Indian Institute of Technology, Guwahati, have developed a simple paper kit that can test freshness of milk and tell how well it has been pasteurized.

- Aided with a smart phone app, the kit can help ensure that milk is consumed before it turns too sour.

Why We Need Such Sensors

- Milk being a widely consumed food, its safety is of prime concern to consumers. More so because it is highly perishable and prone to action of enzymes and micro organisms inherently present in it.
- Although pasteurization, freezing and preservation using additives are widely used to prevent spoilage, perishability of milk is still a concern.
- There is no easy way to know if milk is fresh or stale or how effective is pasteurization.
- Tests used in dairies and dairy industries are time consuming and need sophisticated equipment like spectrophotometers. The new detection kit can make testing easy and fast. **How**

This Sensor Works

- A milk enzyme, Alkaline Phosphatase or ALP, is considered an indicator of milk quality because its presence even after pasteurization indicates presence of microbes that may not have been rendered inactive with pasteurization.
- Paper discs were soaked in 4-carboxybenzene diazonium solution and then chemically treated to expose-COOH groups on the diazonium.
- The -COOH groups then attach to NH₂ groups on anti-ALP probe molecules. Thus the anti-ALP probes are fixed on paper.
- When a drop of milk is poured on the tiny paper disc, the ALP in milk reacts with probes, resulting in change of colour.
- The colour change on paper discs is then photographed by a smart phone camera and

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images processed to obtain corresponding colour values.

- These values are then compared with standard data stored in the phone. Thus not only the presence of ALP could be detected but the amount of it in milk could also be measured.
- The team also confirmed that colour is due only to ALP and not due to interference of vitamins, other proteins and minerals in the milk.
- The sensor works in both qualitative and quantitative modes. No separate reader is required for qualitative analysis as it works like just like pregnancy test strips.
- Fabrication in the laboratory at present costs around Rs. 80 to Rs 125 per kit and could come down when mass manufactured.
- The kit could come handy in milk bars, large kitchens and at milk collection centres where freshness of milk is a concern.
- It can find other applications too. Since ALP is also tested in various body fluids, the kit can also be utilized in clinics.

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Jai Hind

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