SCIENCE & TECHNOLOGY

TNPSC GROUP 1 MAINS CURRENT AFFAIRS

JULY 2018 TO MAY 31ST 2019

FRESH CLASS FOR GROUP 1 & 2 MAINS START FROM SEPTEMBER

Artificial Intelligence

Indian IT industry apex body NASSCOM (National Association of Software & Services Companies) has opened Centre of Excellence for Data Science and Artificial Intelligence (CoE-DSAI) in Bengaluru, Karnataka.

The Indian Institute of Technology (IIT) Madras has inaugurated the Robert Bosch Center for Data Science and Artificial Intelligence

Seven-point strategy on Artificial Intelligence

The government has recently drawn up a seven-point strategy that would form the framework for India's strategic plan to use AI.

- developing methods for human machine interactions;
- ensuring safety and security of AI systems; 3
- creating a competent workforce in line with AI and R&D needs
- understanding and addressing the ethical,
- legal and societal implications of AI,
- Measuring and evaluating AI technologies through standards and benchmarks, among others.

Internet of things

The internet of things (IoT) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices.

Blockchain

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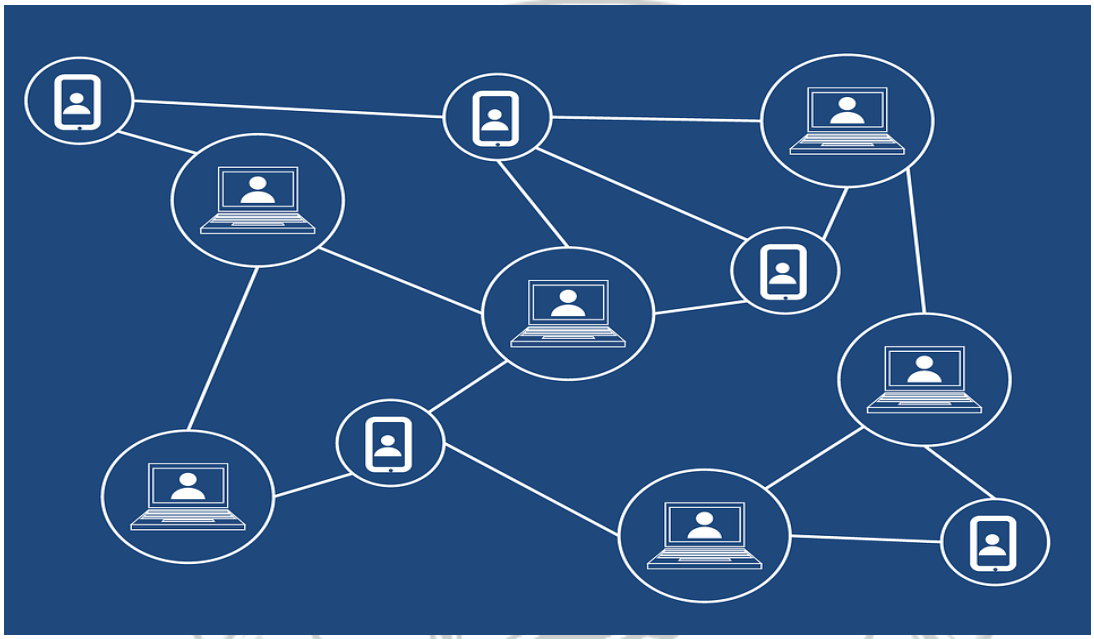
Blockchain is a decentralized and distributed ledger, where, blocks containing a set of transactions are chained together by cryptographic hash. Transactions originating from a node are validated by participating nodes and a set of transactions are added into a block by a "mining" node. Any mining node with sufficient compute power that solves a cryptographic puzzle can generate and broadcast a new block containing the set of validated transactions. Blockchain uses peer-to-peer (P2P) network overlay on the Internet



Artificial Intelligence Pushing the Frontiers / செய்ற்கை நுண்ணறிவு

Artificial Intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that works and reacts like humans. It is the ability of machines to learn and reason through analogy, analyse, interpret information, recognize speech, visual perception and take decisions. In other words, AI is application of human intelligence by the machines.

- Computers with AI are designed for speech recognition, learning, planning and problem solving.
- The subfields of AI include machine learning, autonomous systems, natural language processing, robotics and artificial creativity.

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- They are of two types: Strong or full AI and weak AI.
- A full AI means a machine becoming capable of performing all intellectual tasks that a human being can perform.
- Weak AI or applied AI is a subset of strong AI as it involves machines being able to solve selective actions that a human can perform.

Application of AI / பயன்பாடுகள்

- **Driverless Car: டிரைவர் இல்லாத கார்** Robots can perform human tasks without errors like autonomous, driverless cars that can prevent accidents due to human errors. As they don't require breaks like humans, they provide higher levels of productivity in lesser time than humans.
- **Medical Science :** மருத்துவ அறிவியல் Robots can perform complex surgeries with precision, record huge amount of information that can be used for individualized treatments, evolved research works etc.
- **Developing Countries: வளர்ந்து வரும் நாடுகள் பயன்படுத்தலாம்.** Developing countries like India can creatively use the technology to find unique solutions for problems related to sanitation, education, agriculture etc. AI can make things easier by weather predictions and can efficiently help in disaster management. The use of automation in the banking sector has already received positive reviews.
- **Other:** மற்றவை Other than efficiency, machines have advantages over negative effects of human emotions as well. They can take more rational and logical decisions than those based on various human sentiments.

Concerns/கவனத்தில் கொள்ளக்கூடியவை

- **Loss of employment: வேலைவாய்ப்பு இழப்பு** One of the major concerns is the possibility of human beings losing out on employment opportunities due to machines ability to perform same tasks more

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efficiently. Automation has already rendered a huge number of people jobless all around the world.

- **Risk from unemployment வேலைவாய்ப்பின்மை இடர்:** Unemployment due to AI could have serious impact in a country like India that will have largest working age population by 2020. IT sector, with large number of skilled and unskilled labours, is particularly being considered to be vulnerable in this context.
- **Regulations:** கட்டுப்பாடுகள் Another major concern is about difficulties in regulation of machines in the human society. For example how can self driven cars that crash be held accountable for their actions?
- **Machines without ethics:** நெறி இல்லாத இயந்திரங்கள் Along with the human sentiments, basic human values like morality and ethics would not exist in a machine dominated world. Such a society can lose out on factors like belongingness, warmth, brotherhood etc.

Way forward:

- There are endless possibilities for the application of artificial intelligence but the ethical and moral concern emanating from it cannot be brushed aside. There shall be a larger public discourse where all the stakeholders of the society can discuss and understand the possibilities that AI as a scientific innovation holds.
- The speculations about job losses because of AI can be turned around by learning from history wherein revolutionary concepts have usually led to the creation of new set of jobs. Ten years ago nobody had even imagined that one can earn thousands by sharing videos.
- Machines cannot mimic the human brains's ability to think uniquely and come up with new solutions to problems every time. In the future, also this human ability to make sense of novel situations and experiences would help in regulating AI.

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- To preserve the significant values of humanity, a regulated application of the new technology is needed to prevent its transformation into a destructive agency that cannot be controlled.

Formalin

Formalin, a derivative of formaldehyde is a carcinogenic substance used to prolong the shelf life of fish. It is harmful when consumed by humans. Once ingested, formalin releases toxins into the body, and the sustained ingestion of formalin can eventually lead to cancer.

Project- RAMA (Reconstituting Asteroids into Mechanical Automata)

NASA has announced it would give funds to Made In Space's project- RAMA (Reconstituting Asteroids into Mechanical Automata), for finding ways to turn asteroids into giant, autonomous spacecraft's, which could fly to outposts in space

CERN

CERN, the European Organization for Nuclear Research, is one of the world's largest and most respected centres for scientific research. LHC

Why is the Higgs particle called the "God particle"?

The nickname is pure invention. There's nothing in the mathematical equations, in the interpretation of the physics, in any philosophy, or in any religious text or tradition that connects the Higgs particle or the Higgs field with any notion of religion or divinity. Professor and Nobel Prize Winner Leon Lederman, allowed his book on the Higgs particle to be assigned this attention-getting title, and thus the name!

LEAP

The Indian Institute of Technology (IIT)-Madras has commissioned remotely operable Local Electrode Atom Probe (LEAP) microscope. It is claimed to be world's first remotely operable LEAP microscope, as it can be remotely operated through special terminal by researchers divided geographically

AGNI – V

- The Agni series (I to V) missiles constitute the backbone of India's nuclear weapons delivery and part of nuclear triad.
- Agni-V is India's longest-range ballistic missile which will be inducted into the nuclear arsenal soon.

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- Earlier variants of the Agni family of long-range missiles have already been deployed.
- Agni – V is an Inter-Continental Ballistic Missile (ICBM) with a range of over 5,000 km and can reach most parts of China.
- I
- \.t is powered by three stage solid fuelled missiles.
- It can carry a payload of 1.5 tonnes.
- It is a part of Integrated Guided Missile Development Program (IGMDP).

Crew Escape System

ISRO carried out a major technology demonstration ,the first in a series of tests to qualify a Crew Escape System, which is a critical technology relevant for human spaceflight. The Crew Escape System is an emergency escape measure designed to quickly pull the crew module along with the astronauts to a safe distance from the launch vehicle in the event of a launch abort. The first test (Pad Abort Test) demonstrated the safe recovery of the crew module in case of any exigency at the launch pad.

Kepler Space Telescope

The Kepler Space Telescope has been officially retired by NASA. Its successor space telescope, called TESS, has already started collecting data. Launched in 2009, the Kepler mission is specifically designed to survey our region of the Milky Way galaxy to discover hundreds of Earth-sized and smaller planets in or near the habitable zone and determine the fraction of the hundreds of billions of stars in our galaxy that might have such planets.

TESS (Transiting Exoplanet Survey Satellite)

TESS will find the most promising exoplanets orbiting our nearest and brightest stars, giving future researchers a rich set of new targets for more comprehensive follow-up studies

Vikas Engine

Vikas Engine is the workhorse liquid rocket engine powering the second stage of India's Polar Satellite Launch Vehicle (PSLV), second stage and the four strap on stages of Geosynchronous Launch Vehicle (GSLV) and the twin engine core liquid stage (L110) of GSLV Mk-III.

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Cryptocurrency

cryptocurrency is a digital currency built with cryptographic protocols that make transactions secure and difficult to fake. The most important feature of a cryptocurrency is that it is not controlled by any central authority: the decentralized nature of blockchain makes cryptocurrency theoretically immune to the old ways of government control and interference.

Net Neutrality.

Network neutrality—the idea that Internet service providers (ISPs) should treat all data that travels over their networks fairly, without improper discrimination in favor of particular apps, sites or services—is a principle that must be upheld to protect the future of our open Internet.

The IceCube experiment

IceCube is a particle detector at the South Pole that records the interactions of a nearly massless subatomic particle called the neutrino. IceCube searches for neutrinos from the most violent astrophysical sources: events like exploding stars, gamma-ray bursts, and cataclysmic phenomena involving black holes and neutron stars.

Genome Valley 2.0:

Telangana Government has signed Memorandum of Understanding (MoU) with Singapore-based engineering & consulting firm Surbana Jurong for preparing roadmap for Genome Valley 2.0

Fields medal

Akshay Venkatesh, a renowned Indian-Australian mathematician, is one of four winners of mathematics' prestigious Fields medal, known as the Nobel prize for math.

RISECREEK

The initial batch of 300 chips, named RISECREEK and produced under Project Shakti, have been fabricated free at Intel's facility at Oregon, U.S., to run the Linux operating system. RISECREEK can meet the demands of defence and strategic equipment such as NAVIC (Indian Regional Navigation Satellite) and Internet of Things (IoT) electronics, its developers say. "

Thermal battery technology

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A thermal energy battery is used for storing and releasing thermal energy. It allows for available energy to be temporarily stored and be released for use whenever necessary. Standard battery technology is based on charging and discharging cycles mainly operated by electricity. The most commonly used Lithium-ion battery works on electrical energy. However, thermal batteries operate on thermal energy, which can be defined as energy created by temperature differences. World's **first-ever thermal battery plant** was unveiled in Andhra Pradesh

LIGO-India Project

LIGO-India is a planned advanced gravitational-wave observatory to be located in India as part of the worldwide network. The project recently received the in-principle approval from the Indian government. LIGO-India is planned as a collaborative project between a consortium of Indian research institutions and the LIGO Laboratory in the USA, along with its international partners Australia, Germany and the UK. This is an initiative to set up advanced experimental facilities for a multi-institutional observatory project in gravitational-wave astronomy located near Aundha Nagnath, Hingoli District, Maharashtra.

4D printing

4D printing is the process through which a 3D**printed** object transforms itself into another structure over the influence of external energy input as temperature, light or other environmental stimuli. This technology is part of the project of MIT Self-assembly Lab

Parker Solar Probe

NASA's Parker Solar Probe is the mankind's first mission to 'touch' the Sun.Parker Solar probe will perform the closest-ever observations of the Sun's outer atmosphere, called the corona

Gaganyaan

Gaganyaan is an Indian crewed orbital spacecraft that is intended to send 3 astronauts to space for a minimum of seven days by 2022, as part of the Indian Human Spaceflight Programme.

He enumerated the objectives of the Mission as:

- Enhancement of science and technology levels in the country
- A national project involving several institutes, academia and industry

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- Improvement of industrial growth
- Inspiring youth
- Development of technology for social benefits
- Improving international collaboration

Relevance of a Manned Space Mission for India:

1. **Boost to industries**: The Indian industry will find large opportunities through participation in the highly demanding Space missions.Gaganyaan Missionis expected will source nearly 60% of its equipment from the Indian private sector.
2. **Employment:**According to the ISRO chief, the Gaganyaan mission would create 15,000 new employment opportunities, 13,000 of them in private industry and the space organisation would need an additional manpower of 900.
3. **Technological development**: Human Space flights are frontier field in the science and technology. The challenges the Human Space Flights provide to India, and the benefits accruing from taking up those missions will be very high and will lead to further thrust for technological developments in India
4. **Boost to research:** It will boost good research and technology development. With a large number of researchers with proper equipment involved, HSF will thrust significant research in areas such as materials processing, astro-biology, resources mining, planetary chemistry, planetary orbital calculus and many other areas
5. **Motivation:** Human space flight will provide that inspiration to the youth and also the national public mainstream. It would inspire young generation into notable achievements and enable them to play their legitimate role in challenging future activities
6. **Prestige:** India will be the fourth country to launch human space mission. The Gaganyaan will not only bring about prestige to the nation but also establish India's role as a key player in the space industry.

Chang'e-4,

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China has launched Chang'e-4, a first probe ever to explore the dark side of the Moon, marking another milestone in its ambitious space programme.

ICESat-2

ICESat-2, part of NASA's Earth Observing System, is a satellite mission for measuring ice sheet elevation and sea ice thickness, as well as land topography, vegetation characteristics, and clouds.

PM-STIAC

Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC) has been constituted. It will advise the Prime Minister on all matters related to S&T, innovation and monitor the implementation of PM's vision on the same

IMPRINT India

Impacting Research Innovation And Technology (IMPRINT) is the first of its kind, Pan IIT and IISC joint initiative supported by Ministry of HRD. It aims to develop a roadmap for research to solve major engineering and technology challenges in technology domains relevant to India.

APSARA – U

Apsara is the first research reactor in Asia became operational in Trombay campus of Bhabha Atomic Research Centre in 1956 and the reactor was shut down in 2009. Recently a swimming pool type research reactor "Apsara-upgraded", of higher capacity was setup at Trombay. The reactor, made indigenously, uses plate type dispersion fuel elements made of Low Enriched Uranium (LEU). This reactor will increase indigenous production or radio-isotopes for medical application by about fifty percent and would also be extensively used for research in nuclear physics, material science and radiation shielding

Cyclone-30

The country's biggest cyclotron facility that will produce radioisotopes vital for diagnosis and treatment of cancer has become operational. The machine – Cyclone-30 — is housed at the Kolkata-based Variable Energy Cyclotron Centre (VECC) under the Department of Atomic Energy (DAE) and will start regular production by mid-next year after supporting nuclear systems are commissioned and regulatory clearances are obtained.

RemoveDEBRIS

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RemoveDEBRIS was launched aboard the SpaceX Dragon refill spacecraft on 2 April 2018 as part of the CRS-14 (Commercial Resupply Service mission), arriving at the International Space Station on 4 April. Deployment of the satellite from the station's Kibo module via robotic Canadarm-2 took place on 20 June 2018. At approximately 100 kg, RemoveDEBRIS is the largest satellite to have ever been deployed from the International Space Station

IOWave18

Exercise IOWave18 will simulate Indian Ocean countries being put in a tsunami warning situation and require the National Tsunami Warning Centre and the National and/or Local Disaster Management Offices in each country to implement their Standard Operating Procedures. Exercise IOWave18 will comprise two scenarios on successive days: one in the north western Indian Ocean off the coast of Iran, and the other in the eastern Indian Ocean off the west coast of northern Sumatra

PSLV C-42

Polar Satellite Launch Vehicle-C42 of the ISRO has recently launched two earth observation satellites of the United Kingdom

NovaSAR

NovaSAR is a S-band synthetic Aperture radar satellite, intended for forest mapping, land use, and ice cover monitoring as well as flood and disaster monitoring.

S1-4

S1-4 is a high-resolution optical earth observation satellite that will be used for surveying resources, environment monitoring, urban management, and disaster monitoring

Defence Acquisition Council

The objective of the Defence Acquisition Council is to ensure expeditious procurement of the approved requirements of the Armed Forces in terms of capabilities sought and time frame prescribed by optimally utilizing the allocated budgetary resources. Its headed by defence minister

Dickinsonia

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Scientists have discovered an ancient fossil of the earliest animal on geological record -- Dickinsonia -- a strange oval creature with rib like segments running along its body that lived on Earth 558 million years ago.

Hyperloop

Hyperloop is a hi-tech, superfast transport concept that is the brainchild of Tesla and SpaceX chief executive Elon Musk. Musk envisages a train-like vehicle that can pass through near-vacuum tubes while levitating above a magnetic rail, a system referred to as maglev. The lack of friction resulting from the vacuum environment and maglev system means the vehicle can reach far higher speeds than standard trains.

Einstein prize

Abhay Asktekar, an Indian American professor, is the recipient of 2019 Einstein prize awarded for outstanding accomplishments in the field of gravitational physics.

ITER International thermonuclear experimental reactor

ITER ("The Way" in Latin) is one of the most ambitious energy projects in the world today. In southern France, 35 nations are collaborating to build the world's largest tokamak, a magnetic fusion device that has been designed to prove the feasibility of fusion as a large-scale and carbon-free source of energy based on the same principle that powers our Sun and stars.

The experimental campaign that will be carried out at ITER is crucial to advancing fusion science and preparing the way for the fusion power plants of tomorrow.

Train 18

Indian Railways will soon usher in a new era with its first made-in-India engine-less train - named Train 18. Also known as T18, this train is set to hit the tracks for trials on October 29.

- This is the first long-distance train without separate locomotive (engine) and thus self-propelled.
- The 16-coach semi-high speed 'train set' built at a cost of Rs 100 crore per rake.

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- Fitted with CCTV cameras, Train-18 would have two executive compartments in the middle with 52 seats each, whereas trailer coaches would have 78 seats each.
- About 80% of the design, technology and manufacture of Train 18, a predecessor to 'Train 20', is Indian.
- It has been designed for a maximum operating speed of 160 kmph.
- The new train comes fitted with amenities on a par with the best in the world as on-board Wi-Fi to GPS-based passenger information system, 'touch-free' bio-vacuum toilets, LED lighting etc.
- It also has a climate control system that would adjust the temperature according to occupancy and the weather.

Chandra X-Ray Observatory

The Chandra X-Ray Observatory, observing the universe in high-energy light since 1999, has entered a protective 'safe mode', which interrupts scientific observations and puts the spacecraft into a stable configuration.

Chang'e-4,

China has launched Chang'e-4, a first probe ever to explore the dark side of the Moon, marking another milestone in its ambitious space programme.

INS Tarangini

INS Tarangini, a Sail Training Ship of the Indian Navy, departed Kochi for Lokayan, a seven month long voyage to Europe with the theme of 'Sailing through different Oceans and Uniting Nations'.

bisphenol A

Scientists have created tiny spheres that can **catch and destroy bisphenol A (BPA)**, a synthetic chemical used to make plastics that often contaminates water.

2018 Nobel Medicine Prize

Two immunologists, James Allison of the U.S. and Tasuku Honjo of Japan, won the 2018 Nobel Medicine Prize. They won for their work on a new approach to cancer treatment. They figured out how to help the patient's own immune system tackle the cancer more quickly. It contradicts with traditional forms of cancer treatment that directly target cancer cells. The

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discovery led to treatments targeting proteins made by some immune system cells that act as a "brake" on the body's natural defences killing cancer cells. T-cells are a type of white blood cell that play a central role in the body's natural immunity to disease.

Prize in Chemistry

US scientists Frances Arnold and George Smith and British researcher Gregory Winter have won the 2018 Nobel Prize in Chemistry. They were selected for harnessing power of evolution to develop enzymes and antibodies that have led to new pharmaceuticals and biofuels.

Nobel Prize in Physics

Three scientists Arthur Ashkin (USA), Gerard Mourou (France) and Donna Strickland (Canada) have won the 2018 Nobel Prize in Physics. They were selected for ground-breaking inventions in the field of laser physics.

"OneerTM".

CSIR has developed an affordable Water Disinfection System "OneerTM". The device will go a long way in meeting the requirements of potable water in rural and urban areas

Ask Disha

The AI chatbot-- Ask Disha- is powered by artificial intelligence (AI) and it is aimed at facilitating accessibility by answering users' queries pertaining to various services offered by IRCTC.

India's first indigenous microprocessor called 'Shakti'.

Indian Institute of Technology Madras (IIT Madras) researchers have designed India's first indigenous microprocessor called 'Shakti'. It is aimed at developing industrial-grade microprocessors and other components of the microprocessor ecosystem.

CRISPR technology

CRISPR technology is basically a gene-editing technology that can be used for the purpose of altering genetic expression or changing the genome of an organism. The technology can be used for targeting specific stretches of an entire genetic code or editing the DNA at particular locations. CRISPR technology is a simple yet powerful tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function.

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CRISPR-Cas9 technology behaves like a cut-and-paste mechanism on DNA strands that contain genetic information.

SpiNNaker

The world's largest supercomputer designed to work in the same way as the human brain has been switched on for the first time. The newly formed million-processor-core Spiking Neural Network Architecture (SpiNNaker) machine is capable of completing more than 200 million million actions per second, with each of its chips having 100 million transistors.

EAST

China has announced that its Experimental Advanced Superconducting Tokamak (EAST) reactor — an "artificial sun" designed to replicate the process our natural Sun uses to generate energy — just hit a new temperature milestone: 100 million degrees Celsius (180 million degrees Fahrenheit).

HysIS,

HysIS, the country's first hyperspectral imaging satellite for advanced Earth observation, is slated for the launch. About 30 small satellites of foreign customers will be its co-passengers on the PSLV launcher, numbered C-43. The primary goal of HysIS is to study the Earth's surface in visible, near-infrared and shortwave infrared regions of the electromagnetic spectrum.

GROWTH-India telescope

GROWTH-India telescope at the Indian Astronomical Observatory located in Hanle, Ladakh, has made its first science observation which is a follow-up study of a nova explosion. Novae are explosive events involving violent eruptions on the surface of white dwarf stars, leading to temporary increase in brightness of the star.(Global Relay of Observatories Watching Transients Happen')

GSAT-29

GSAT-29 satellite with a lift-off mass of 3423 kg, is a multi-beam, multiband communication satellite of India, configured around the ISRO's enhanced I-3K bus. This is the heaviest satellite launched from India GSAT-29 carries Ka/Ku-band high throughput communication transponders which will bridge the digital divide of users including those in Jammu & Kashmir and North Eastern regions of India. It also carries Q/V-band payload, configured for technology demonstration at higher frequency bands and Geo-stationary

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High Resolution Camera. carried onboard GSAT-29 spacecraft. An optical communication payload, for the first time, will be utilized for data transmission.

Shukrayaan-1

Shukrayaan-1 is a proposed orbiter to Venus by **the Indian** Space Research Organisation (ISRO) to study the surface and atmosphere of Venus.

The India-based Neutrino Observatory (INO) Project is a multi-institutional effort aimed at building a world-class underground laboratory with a rock cover of approx.1200 m for non-accelerator based high energy and nuclear physics research in India.

The project includes

- construction of an underground laboratory and associated surface facilities at Pottipuram in Bodi West hills of Theni District of Tamil Nadu,
- construction of a Iron Calorimeter (ICAL) detector for studying neutrinos, consisting of 50000 tons of magnetized iron plates arranged in stacks with gaps in between where Resistive Plate Chambers (RPCs) would be inserted as active detectors, the total number of 2m X 2m RPCs being around 29000, and

- setting up of National Centre for High Energy Physics at Madurai, for the operation and maintenance of the underground laboratory, human resource development and detector R&D along with its applications. The underground laboratory, consisting of a large cavern of size 132m X 26m X 20m and several smaller caverns, will be accessed by a 2100 m long and 7.5 m wide tunnel.

The initial goal of INO is to study neutrinos. Neutrinos are fundamental particles belonging to the lepton family. They come in three flavours, one associated with electrons and the others with their heavier cousins the muon and the Tau. According to standard model of particle physics, they are mass less. However recent experiments indicate that these charge-neutral fundamental particles, have finite but small mass which is unknown. They oscillate between flavours as they propagate. Determination of neutrino masses and mixing parameters is one of the most important open problems in physics today. The ICAL detector is designed to address some of these key open problems in a unique way. Over the years this underground facility is

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expected to develop into a full-fledged underground science laboratory for other studies in physics, biology, geology, hydrology etc.

SI redefinition

At a meeting today at the General Conference on Weights and Measures (CGPM) in Versailles, France, delegates voted to redefine the International System of Units (SI), changing the world's definition of the kilogram, the ampere, the kelvin and the mole.

The biggest change will be to the kilogram, which is currently set by a 143-year-old platinum alloy cylinder, dubbed "Le Grand K" housed in the International Bureau of Weights and Measures (BIPM) in Paris. The kilogram will now be defined in terms of the Planck constant, *h,* which has been measured with extraordinary precision in recent years.

There's a new dwarf planet in our solar system, and it's the most distant one we've ever discovered. The tiny world, formally known as 2018 VG18 but nicknamed Farout, is about 18 billion kilometres away – roughly 3.5 times the distance to Pluto.

ExseedSAT 1

With the launch of ExseedSAT 1, Exseed Space has become the first Indian privately-funded startup to successfully send a satellite into space.ExseedSAT 1 was launched into space by Space X along with 63 other satellites from 17 countries

BeiDou system

Pakistan has become the first country to use the BeiDou system ending its reliance on the Global Positioning System (GPS). BeiDou-2, also known as COMPASS, is the second generation of the system. It became operational in the year 2011.

Brahmos

- Supersonic cruise missile
- Designed and developed by BrahMos Aerospace, a joint venture of India and Russia
- It has derived its name from the names of two rivers, India's Brahmaputra River and Russia's Moskva River.
- It operates on fire and forget principal

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- Capable of being launched from land, sea, sub-sea and air against sea and land targets
- Carrying capacity : 300 Kg (both conventional and nuclear)
- Speed : Mach 3 (that is, three times the speed of sound)
- Max Range : 290 Km. Its range was extended to **450 km** and plan is to increase it to 600km.
- It is two-stage missile, the first one being solid and the second one ramjet liquid propellant.
- BrahMos missile already has been inducted into the Indian Army and Navy

India To Get High-Performing BullSequana Supercomputers Worth Rs 4,500 Crore From France

National Supercomputing Mission (NSM)

1. The Mission envisages empowering national academic and R&D institutions spread over the country by installing a vast supercomputing grid comprising of more than 70 high-performance computing facilities.
2. These supercomputers will also be networked on the National Supercomputing grid over the National Knowledge Network (NKN).
3. The NKN is another programme of the government which connects academic institutions and R&D labs over a high speed network.
4. The Mission includes development of highly professional High Performance Computing (HPC) aware human resource for meeting challenges of development of these applications.
5. India looks forward to create a cluster of machines for weather forecasting, drug discovery and data mining.

Akademik Lomonosov

Akademik Lomonosov is the world's first "floating" nuclear power plant (FNPP). It is coming up in Russia

scramjet engine

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A scramjet engine is an improvement over the ramjet engine as it efficiently operates at hypersonic speeds and allows supersonic combustion. Scramjet engine designed by ISRO uses Hydrogen as fuel and the Oxygen from the atmospheric air as the Oxidizer.

106th 'Indian Science Congress

106th 'Indian Science Congress (ISC)' session is being held at Jalandhar, Punjab. Theme – Future India: Science and Technology. Indian Science Congress is organised by the Indian Science

Blood Moon

During a total lunar eclipse, though the Moon gets shadowed by the Earth, sunlight passing through the Earth's atmosphere, break down in its constituent colours and the red part gets scattered by the atmosphere and falls on the Moon's surface, thereby making it take on a reddish copper hue. For this reason since antiquity, a totally eclipsed Moon is called a "Blood Moon". It has no other special relevance other than the fact that the colour of the Moon looks blackish-red.

Blue Moon

This full Moon occurs twice in a calendar month, the last one being on January 2. The next one, on January 31, is termed a "Blue Moon". The Moon does not turn blue but historically the second full Moon of an English calendar month is termed as a Blue Moon. Hence the oft-quoted phrase of a rare occurrence of any event as "once in a Blue Moon".

PSLV C44

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.

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.

UNNATI

National space agency, the Indian Space Research Organisation (ISRO) has launched the UNNATI (UNispace Nano-satellite Assembly and Training by

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ISRO) programme at the U R Rao Satellite Centre, Bengaluru. UNNATI is a capacity building programme on nanosatellite development.

DNA Technology (Use and Application) Regulation Bill, 2018.

Cabinet approves DNA Technology (Use and Application) Regulation Bill, 2018.

Need and its significance:

- The utility of DNA based technologies for solving crimes, and to identify missing persons, is well recognized across the world.
- Therefore, the new bill aims to expand the application of DNA-based forensic technologies to support and strengthen the justice delivery system of the country.

Highlights of the Bill:

- As per the Bill, national and regional DNA data banks will be set up for maintaining a national database for identification of victims, suspects in cases, undertrials, missing persons and unidentified human remains.
- According to it, those leaking the DNA profile information to people or entities who are not entitled to have it, will be punished with a jail term of up to three years and a fine of up to Rs. 1 lakh. Similar, punishment has also been provided for those who seek the information on DNA profiles illegally.
- As per the bill, all DNA data, including DNA profiles, DNA samples and records, will only be used for identification of the person and not for "any other purpose".
- The bill's provisions will enable the cross-matching between persons who have been reported missing on the one hand and unidentified dead bodies found in various parts of the country on the other, and also for establishing the identity of victims in mass disasters.

Benefits of the Bill:

- By providing for the mandatory accreditation and regulation of DNA laboratories, the Bill seeks to ensure that with the proposed expanded use of this technology in the country.

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- There is also the assurance that the DNA test results are reliable and the data remain protected from misuse or abuse in terms of the privacy rights of our citizens.

- It has provisions that will enable the cross-matching between persons who have been reported missing on the one hand and unidentified dead bodies found in various parts of the country on the other, and also for establishing the identity of victims in mass disasters

GSAT-31

The Indian Space Research Organisation is all set to launch its 40th communication satellite GSAT-31 on February 6 from the spaceport in French Guiana.

The satellite will also provide wide beam coverage to facilitate communication over large oceanic region comprising large part of the Arabian Sea, the Bay of Bengal and the Indian Ocean using wide band transponder,

LOFAR telescope

The LOFAR telescope is made up of a network of radio antenna across seven countries, forming the equivalent of a 1,300-km diameter satellite dish. The scientists have published a **new map of the night sky** and discovered hundreds of thousands of galaxies which were previously unknown.The discovery was made using the **Low-frequency Array (LOFAR) telescope.**

Param Shivaay Super-Computer

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

- Under this project, the Center for Development of Advanced Computing (C-DAC) has developed the first supercomputer 'Param Shivay' of 833 teraflop capacities.

- The supercomputer will help in simulation and modeling which will be applied in many areas like climate assessment, weather forecasting, space engineering, seismic analysis, finance, disaster simulation and management, search astrophysics, macro-data analytics, information collection

Yuva Vigyani Karyakram or Young Scientist Programme.

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1. The programme aims at imparting basic knowledge on space technology, space science and space applications to the younger ones with the intent of arousing their interest in the emerging areas of space activities.

2. Under the programme, three students each will be selected to participate in it every year from each state and union territory, covering CBSE, ICSE and state syllabus.

3. The eligibility for being chosen for the programme includes those students who have finished 8th standard and are currently studying in the 9th standard.

4. The selection will be based on the academic performance and extracurricular activities of the students, as per the selection criteria already circulated to the chief secretaries of the states and administrators of Union Territories.

5. The students belonging to rural areas have been given special weightage under the selection criteria set by ISRO.

HELINA

HELINA is an acronym for "Helicopter Launched Nag" missile. Nag is a third generation Anti-Tank guided missile indigenously developed under "Integrated Guided Missile Development Programme (IGMDP)" of DRDO

CAR-T

CAR-T cell therapy works by helping the patient's own immune system to fight cancer. **CAR** stands for "chimeric antigen receptor" engineered receptors that are grafted on to the patient's '**T cells**'

Project 75(I)

Project 75(I) will provide a major boost to the existing submarine design and manufacturing eco-system in India through transfer of design and equipment technology as well as necessary skill sets.

Atmospheric Waves Experiment mission

The Atmospheric Waves Experiment (AWE) mission will cost $42 million and is planned to launch in August 2022, attached to the exterior of the Earth-orbiting International Space Station (ISS).

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To help unravel that connection, AWE will investigate how waves in the lower atmosphere, caused by variations in the densities of different packets of air, impact the upper atmosphere. This proposed mission would investigate how giant space weather storms from the Sun, called solar particle storms, are accelerated and released into planetary space.

GRAPES-3

The GRAPES-3 experiment (or Gamma Ray Astronomy PeV EnergieS phase-3) located at Ooty in India started as a collaboration of the Indian Tata Institute of Fundamental Research and the Japanese Osaka City University, and now also includes the Japanese Nagoya Women's University. GRAPES-3 is designed to study cosmic rays with an array of air shower detectors and a large area muon detector.

PSLV-C45

India's Polar Satellite Launch Vehicle (PSLV-C45) successfully launched EMISAT and 28 international customer satellites from Satish Dhawan Space Centre (SDSC) SHAR in Sriharikota. This flight marked the first mission of PSLV-QL, a new variant of PSLV with four strap-on motors.

EMISAT

EMISAT is a satellite built around ISRO's Mini Satellite-2 bus weighing about 436 kg. The satellite is intended for electromagnetic spectrum measurement.

FASER,

FASER, or the Forward Search Experiment, will complement CERN's ongoing physics programme, extending its discovery potential to several new particles

National Aids Control Program

- The National AIDS Control Organization, Ministry of Health and Family Welfare launched the first phase **of National AIDS Control Programme in 1992.**
- Over time, the focus has shifted from raising awareness to behavior change, from a national response to a more decentralized response and to increasing involvement of NGOs and networks of Person Living with HIV/AIDS (PLHIV).

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- Subsequently, second, third and fourth phases have been launched in 1999, 2007 and 2014 with better implementation and improved strategy.

National Strategic Plan for HIV/AIDS and Sexually Transmitted Infection (STI) 2017 – 2024

- The National AIDS Control Organization (NACO) has now revised the national approach to reach **'the last mile'** – in order to ensure a more effective, sustained and comprehensive coverage of AIDS related services.
- This approach is being implemented by the NACO through a seven-year National Strategic Plan on HIV/AIDS and STI, 2017-24.
- By 2020, the focus of the national programme will be on achieving the following fast track targets:

1. 75% reduction in new HIV infections,
2. 90-90-90: 90% of those who are HIV positive in the country know their status, 90% of those who know their status are on treatment and 90% of those who are on treatment experience effective viral load suppression
3. Elimination of mother-to-child transmission of HIV and Syphilis
4. Elimination of stigma and discrimination

Project Varshadhare

- It is a cloud seeding project flagged off by the Karnataka government to enhance the amount of precipitation from the clouds to generate more rain.
- Special aircraft will disperse the chemical silver iodide as they fly through rain-bearing clouds that will trigger and enhance the precipitation.

Event Horizon Telescope

The scientists at Event Horizon Telescope Project have released the first-ever image of a Black Hole (more precisely, of its shadow).

What is a black hole?

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- The term 'black hole' was coined in the mid-1960s by American Physicist John Archibald Wheeler.
- Black hole refers to a point in space where matter is so compressed as to create a gravity field from which even light cannot escape.
- Black-holes were theorized by Albert Einstein in 1915.

Event Horizon

- There is a region of space beyond the black hole called the event horizon. This is a "point of no return", beyond which it is impossible to escape the gravitational effects of the black hole.

Event Horizon Telescope Project

- EHT is a group of 8 radio telescopes (used to detect radio waves from space) located in different parts of the world.

Three-parent baby

A "three-parent baby" is born after faulty bits of the mother's DNA are replaced by those taken from a healthy donor. The DNA thus replaced is the mitochondrial DNA that a baby inherits entirely from its mother.

Mission Shakti.

India has tested the Anti-Satellite System(A-SAT) from Dr A P J Abdul Kalam Island, formerly known as Wheeler Island, an island off the coast of Odisha.

- The test was named as Mission Shakti.
- It has successfully destroyed a live satellite in the Low Earth Orbit(an altitude of 300 km).
- With this test India is now in the league of three countries after the U.S., Russia, and China to have such technology.

Anti-satellite (ASAT) System

- It is missile-based system to attack moving satellites.
- It is of 2 kinds— based on launching from the ground or from planes.
- Defence Research and Development Organisation (DRDO) has - developed Anti-satellite (ASAT)completely indigenously.

Low Earth orbit

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- A Low Earth Orbit is an Earth-centered orbit with an altitude of 2,000 km or less.
- Most of the manmade objects in space are in LEO.

Raavana-1

Sri Lanka has launched its first satellite _Raavana-1' into space from the Mid-Atlantic Regional Spaceport at NASA's Wallops Flight Facility on Virginia's East Shore. _Raavana 1' weights around 1.05 kg. The lifespan of the satellite is around one and a half years

Square Kilometre Array

Scientists at Cambridge have finished designing the _brain' of the Square Kilometre Array (SKA), the world's largest radio telescope. It consists of a supercomputer that will process the enormous amounts of data produced by the SKA's telescopes.

Energy

Energy affects every part and every field of our life. We need energy to do all sorts of physical and physiological activities like moving writing, running, cooking, thinking or doing any work. We need energy for transportation, communication, lighting, industries and agriculture. We also need energy to extract minerals from ores and to manufacture 1 fertilizers, pesticides and all other products. We need energy for space travel and all scientific activities.

The energy sources can be broadly categorized into renewable and nonrenewable resources. While renewable resources like biomass energy, solar energy, tidal energy, wind energy, hydel power energy etc. can be regenerated, the non-renewable energy resources like coal, petroleum and natural gas are fossil fuels which took millions of years to be formed and cannot be renewed during our life span.

"Conventional " energy sources of energy refers to enegy sources we have been using for years now, almost a century — whether for grid or household supply or for vehicles, on large commercial scale. These therefore include all oils based on petroleum products— gasoline, diesel, natural gas , coal as also hydropower.

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So hydropower, though green energy, is a conventional source of energy. This is the reason this is often shown separately from renewable energy in most statistics.

Any newer technology used for generation of electricity is thus non-conventional. This term therefore covers solar, wind, bio fuel, bio diesel, energy from garbage / waste, agriculture / horticulture, sea waves, geo thermal, ice and any other source.

What is Conventional Source of Energy

The energy sources which cannot be compensated, once these are used (after their exploitation) are termed as conventional energy sources.

CONVENTIONAL ENERGY

Fossil Fuels

Fossil fuels, such as coal, oil and natural gas, are important non-renewable sources of energy. Since the beginning of mankind, we have been using fossil fuels to generate heat, light and electricity for various purposes. These are the primary sources for generating electrical energy in the world today. Over 85% of our energy demands are met by the combustion of fossil fuels. Carbon is the main constituent of these fossil fuels. Fossil fuels are excellent sources of energy for our transportation needs. You may be surprised to know that approximately 1.9 billion tons of coal is burnt in a year to generate electricity in the world. A large amount of chemical energy is stored in the fossil fuels. This stored chemical energy is converted into various other forms of energy such as heat, light and mechanical energy

Coal

Coal is formed in a way similar to the other fossil fuels, though it goes through a different process called “coalification”. Coal is made of decomposed plant matter in conditions of high temperature and pressure, though it takes a relatively shorter amount of time to form. Coal is not a uniform substance either; its composition varies from deposit to deposit. Factors that cause this deviation are the types of original plant matter, and the extent to which the plant matter decomposed.

here are different types of coal such as peat, lignite, sub-bituminous and bituminous. The first kind of coal is peat which is merely a mass of dead and decomposing plant matter. Peat has been used as fuel in the past, as an alternative to wood. Next, the peat becomes lignite, a brownish rock that

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contains recognizable plant matter and has a relatively low calorific value. Lignite is basically the halfway point from peat to coal. The next phase is sub-bituminous which is a shade of dull black with very little visible plant matter. This type of coal has a less than ideal calorific value. Bituminous coal is the best quality of coal. It. is jet black, very dense and brittle. This type of coal has high calorific value.

Natural Gas Natural gas is another major source of the energy in our country. Oil and gas fields have been found everywhere on the planet except on the continent of Antarctica. These fields always contain some gas, but this natural gas (methane) does not take nearly as long to form. Natural gas is also found in independent deposits within the ground as well as from others sources too. Methane is a common gas found in swamps and is also the byproduct of animals' digestive system.

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Advantages and Disadvantages of Energy from Fossil Fuels

- Generation of energy from the fossil fuels technology-wise is easy and relatively cost effective,
- Fossil fuels have a very high calorific value
- Fossil fuels can generate huge amounts of electricity in just a single location.
- Transportation of fossil fuels like oil and gas to the power stations can be made through the use of pipe-lines, making it an easy task.
- Power plants that utilize gas are very efficient.

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- Construction of power plants that work on fossil fuels is relatively easy technology-wise and they can be constructed in almost any location.

Disadvantages of Fossil Fuels

- Pollution is a major disadvantage of using fossil fuels as source of energy. During the process of combustion of fossil fuels a lot of toxic gases (and fly-ash in case of coal) are generated which cause pollution of the atmosphere. These gases include carbon dioxide, which traps the Sun's heat and may be causing global warming. Besides carbon dioxide, coal also gives off sulphur dioxide which may cause acid rain.
- The supply of fossil fuels is limited and cannot be replenished. The rate at which they are being consumed, their reservoirs are sure to run out soon.
- Extraction of fossil fuels including coal has resulted in the destruction of wide areas of land and has endangered the environmental balance in some areas
- Mining of fossil fuels including coal is difficult and rated as one of the most dangerous jobs. Many a times, it endangers the lives of miners
- Use of natural gas can cause unpleasant smell in the area

Hydropower:

Energy obtainable from water flow or water falling from a higher potential to lower potential, is known is hydro- power. It is a conventional and renewable form of energy which can be transmitted to long distance through cables and wires.

In India, hydroelectric power is generated by a number of multipurpose river valley projects e.g. Hydro-power project Hirakud, Bhakra Mangal project, Narmada valley project, Nagarjun Sagar project, Sardar Sarovar project etc.

Nuclear energy:

A small amount of radioactive substance (U^{235}) can produce a lot of energy through the process of nuclear fission. For example, one ton of uranium can provide energy which is much higher than three million tons of coal or 12 million barrels of oil. In order to obtain nuclear energy, nuclear reactors are required. There are around 300 nuclear reactors all over the world. India has only four nuclear power stations

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The nuclear energy can be used in production of electrical energy, as a fuel for marine vessel and space crafts and for the generation of heat in chemical processing plants. In India, Uranium deposits are found at different parts of Rajasthan and Singhbum of Jharkhand.

Thorium is recovered from monazite sand found in the state of Kerala. Due to the higher energy releasing tendency of these radioactive substances, these can be used in nuclear reactors to release energy crisis. But the radioactive substances are exhaustible and can be used to develop nuclear weapons of mass destruction. In addition, dumping or radioactive wastes cause serious environmental hazards.

Non-Conventional Energy

Solar Energy:

Energy produced through the sunlight is called solar energy. Under this programme, solar photovoltaic cells are exposed to sunlight and in the form of electricity is produced. Photovoltaic cells are those which convert sun light energy into electricity. In year 1999-2000, 975 villages were illuminated through solar energy. Under Solar Thermal Programme, solar energy is directly obtained. Sunlight is converted into thermal power. Solar energy is used for cooking, hot water and distillation of water etc.

Wind Energy:

This type of energy can be produced by harnessing wind power. It is used for operating water pumps for irrigation purposes. Approximately 2756 wind pumps were set up for this purpose. In seven states, wind power operated power houses were installed and their installed capacity was 1000 MW. India has second position in wind power energy generation.

3. Tidal Energy:

Energy produced by exploiting the tidal waves of the sea is called tidal energy. Due to the absence of cost effective technology, this source has not yet been tapped.

Bio Energy:

This type of energy is obtained from organic matter.

It is of two kinds:

(i) Bio Gas:

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Bio Gas is obtained from Gobar Gas Plant by putting cow dung into the plant. Besides producing gas this plant converts gobar into manure. It can be used for cooking, lighting and generation of electricity. 26.5 lakh bio gas plants had been established by the year 2003-04. They produce more than 225 lakh tonnes of manure. About 1828 large community bio gas plants have been established in the country.

(ii) Bio Mass:

It is also of a source of producing energy through plants and trees. The purpose of bio mass programme is to encourage afforestation for energy. So that fuel for the generation of energy based on gas technique and fodder for the cattle could be obtained, 56 MW capacity for the generation of bio mass energy has been installed.

Energy from Urban Waste:

Urban waste poses a big problem for its disposal. Now it can be used for generation of power. In Timarpur (Delhi) a power Ration of 3.75 capacity has been set up to generate energy from the garbage.In Chennai also the setup was established

Hydrogen energy

Hydrogen is a clean fuel. It is an energy carrier that can be used for a broad range of applications. Also it could serve as a possible substitute to liquid and fossil fuels.Its physical properties could be stated as following. At standard temperature and pressure, hydrogen is a nontoxic, nonmetallic, odorless, tasteless, colorless, and highly combustible diatomic gas with the molecular formula H_2.

Related Current Affairs

National Policy on biofuels -2018

salient features:

Categorization: The Policy categorises biofuels as “Basic Biofuels” viz. First Generation (1G) bioethanol & biodiesel and “Advanced Biofuels” – Second Generation (2G) ethanol, Municipal Solid Waste (MSW) to drop-in fuels, Third Generation (3G) biofuels, bio-CNG etc. to enable extension of appropriate financial and fiscal incentives under each category.

Scope of raw materials:

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The Policy expands the scope of raw material for ethanol production by allowing use of Sugarcane Juice, Sugar containing materials like Sugar Beet, Sweet Sorghum, Starch containing materials like Corn, Cassava, Damaged food grains like wheat, broken rice, Rotten Potatoes, unfit for human consumption for ethanol production.

Protection to farmers: Farmers are at a risk of not getting appropriate price for their produce during the surplus production phase. Taking this into account, the Policy allows use of surplus food grains for production of ethanol for blending with petrol with the approval of National Biofuel Coordination Committee.

Viability gap funding:

With a thrust on Advanced Biofuels, the Policy indicates a viability gap funding scheme for 2G ethanol Bio refineries of Rs.5000 crore in 6 years in addition to additional tax incentives, higher purchase price as compared to 1G biofuels.

Boost to biodiesel production:

The Policy encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, Used Cooking Oil, short gestation crops.

Expected benefits:

Import dependency: The policy aims at reducing import dependency

Cleaner environment: By reducing crop burning & conversion of agricultural residues/wastes to biofuels there will be further reduction in Green House Gas emissions.

Health benefits: Prolonged reuse of Cooking Oil for preparing food, particularly in deep-frying is a potential health hazard and can lead to many diseases. Used Cooking Oil is a potential feedstock for biodiesel and its use for making biodiesel will prevent diversion of used cooking oil in the food industry.

Employment Generation: One 100klpd 2G bio refinery can contribute 1200 jobs in Plant Operations, Village Level Entrepreneurs and Supply Chain Management.

Additional Income to Farmers: By adopting 2G technologies, agricultural residues/waste which otherwise are burnt by the farmers can be converted

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to ethanol and can fetch a price for these waste if a market is developed for the same.

Classification of Biofuels:

1st generation biofuels are also called conventional biofuels. They are made from things like sugar, starch, or vegetable oil. Note that these are all food products. Any biofuel made from a feedstock that can also be consumed as a human food is considered a first generation biofuel.

2nd generation biofuels are produced from sustainable feedstock. The sustainability of a feedstock is defined by its availability, its impact on greenhouse gas emissions, its impact on land use, and by its potential to threaten the food supply. No second generation biofuel is also a food crop, though certain food products can become second generation fuels when they are no longer useful for consumption. Second generation biofuels are often called "advanced biofuels."

3rd generation biofuels are biofuel derived from algae. These biofuels are given their own separate class because of their unique production mechanism and their potential to mitigate most of the drawbacks of 1st and 2nd generation biofuels

Hydrocarbon Exploration Licensing Policy, HELP

- There will be a uniform licensing system which will cover all hydrocarbons, i.e. oil, gas, coal bed methane etc. under a single license and policy framework.
- Contracts will be based on "biddable revenue sharing". Bidders will be required to quote revenue sharein their bids and this will be a key parameter for selecting the winning bid. They will quote a different share at two levels of revenue called "lower revenue point" and "higher revenue point". Revenue share for intermediate points will be calculated by linear interpolation. The bidder giving the highest net present value of revenue share to the Government, as per transparent methodology, will get the maximum marks under this parameter.
- An Open Acreage Licensing Policy will be implemented whereby a bidder may apply to the Government seeking exploration of any block not already covered by exploration. The Government will examine the Expression of Interest and justification. If it is suitable for award, Govt. will call for competitive bids after obtaining necessary

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environmental and other clearances. This will enable a faster coverage of the available geographical area

- A concessional royalty regime will be implemented for deep water and ultra-deep water areas. These areas shall not have any royalty for the first seven years, and thereafter shall have a concessional royalty of 5% (in deep water areas) and 2% (in ultra-deep water areas).
- In shallow water areas, the royalty rates shall be reduced from 10% to 7.5%. The contractor will have freedom for pricing and marketing of gas produced in the domestic market on arms length basis. To safeguard the Government revenue, the Government's share of profit will be calculated based on the higher of prevailing international crude price or actual price.

Smart Grid

A smart grid is the integration of information and communications technology into electric transmission and distribution networks.

- Self-healing and resilient
- Asset optimization and operational efficiency
- Enable demand response
- Integration of advanced and low-carbon technologies
- Improved Power quality
- Market empowerment
- Customer inclusion
- Clean & Green

Rural Electrification Policy, 2005

Rural Electrification Policy, 2005 Initially, when announced in 2005, Rural Electrification Policy (REP) aimed at providing access to electricity to all households by year 2009, quality and reliable power supply at reasonable rates and minimum lifeline consumption of 1 unit per household per day as a merit good by year 2012.However, as can be seen from the data, these targets are yet to be achieved. Rural Electrification Policy also changed the definition of electrified villages. According to the REP, a village would be classified as electrified based on a Certificate issued by the Gram Panchayat,

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certifying that basic infrastructure such as distribution transformer and distribution lines are provided in the inhabited locality as well as a minimum of one Dalit Basti / hamlet where it exists; and electricity is provided to public places like schools, panchayat office, health centres, dispensaries, community centres etc., and the number of households electrified are at least 10 per cent of the total number of households in the village. This definition when applied in 2005 suddenly increased the number of unelectrified villages.

Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)

In line with the goal set in Electricity Act (EA) 2003 and Rural Electrification Policy of 2005 to provide connection to all households by 2009, the "Rajiv Gandhi Grameen Vidyutikaran Yojana" (RGGVY) was launched in April 2005 to electrify all un-electrified villages / habitations and to provide access to electricity to all rural households in un-electrified and electrified villages in the entire country. The scheme was implemented through the Rural Electrification Corporation (REC) which was the designated Nodal Agency of the Ministry of Power.

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

The scope of RGGVY was further expanded and the new Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY)5 was launched in December 2014. This programme is one of the flagship programmes of the Government of India and also aims to facilitate 24x7 supply of power to all. The scope of the programme includes the following

- Separation of agriculture and nonagriculture feeders facilitating judicious rostering of supply to agricultural and non- agricultural consumers in the rural areas;
- Strengthening and augmentation of sub-transmission & distribution (ST&D) infrastructure in rural areas, including metering at distribution transformers, feeders and consumers end;
- Rural electrification, as per CCEA approval dated 01.08.2013 for completion of the targets laid down under RGGVY for 12th and 13th Plans by subsuming RGGVY in DDUGJY and carrying forward the approved outlay for RGGVY to DDUGJY.
- Specifically, the DDUGJY has two major components i.e. feeder separation and Power for All by 2019, that were not there in the RGGVY. The government is working towards providing power to the

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last mile standing in the country and has commenced taking various measures for the same. The target is to complete all village electrification by 2019. The DDUGJY scheme also aims to improve the power supply in rural households as well as reduction of the peak loads.

Ujwal DISCOM Assurance Yojna (UDAY):

To make the electricity distribution sector better equipped and efficient, the Government of India has initiated the Ujwal DISCOM Assurance Yojna (UDAY)7 . The UDAY is a path breaking reform and is aimed to restructure the way state-owned discoms operate, currently reeling under a mountain of debt and mounting operational losses every year. The bulk of the restructuring focus has been around the financial plan with the state governments to take over their DISCOM's debts in a pre-defined fashion – 50 per cent of the debt outstanding as of September 2015 by the last quarter of the financial year 2015-16, and 25 per cent by June 2016. It thus, empowers the DISCOMs with the opportunity to break even in the next 2-3 years through four initiatives, namely.

- Improving operational efficiencies of DISCOMs
- Reduction of cost of power;
- Reduction in interest cost of DISCOMs
- Enforcing financial discipline on DISCOMs through alignment with State finances.

Unnat Jyoti by Affordable LEDs for All (UJALA):

The Government of India has also launched the National Programme for LED-based Home and Street Lighting for energy conservation by reducing energy consumption. Along with this programme, Energy Efficiency Services Ltd (EESL), a Government of India organisation, has launched the scheme for Light Emitting Diode (LED) bulb distribution under the Domestic Efficient Lighting Programme (DELP) in March 2015. On March 2016, National Led LED Bulbs Scheme got a New Face in 'UJALA' (UnnatJyoti by Affordable LEDs for All). The main objective is to promote efficient lighting, enhance awareness on using efficient equipment which reduces electricity bills and help preserve environment. Under this programme, LED bulbs are being distributed in a phased manner from March 2015 onwards. Currently, the DELP scheme is on-going in nine states—Himachal Pradesh, Uttarakhand, Delhi, Rajasthan, Uttar Pradesh, Maharashtra, Karnataka,

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Andhra Pradesh and Jharkhand. As on June 28, 2016, a total of around 123 million LED bulbs had been distributed that is equivalent to saving of around 43 million kWh/day of energy and avoiding 3205 MW of peak demand

Hydrocarbons Vision – 2025

- To assure energy security by achieving self-reliance through increased indigenous production and investment in equity oil abroad.
- To enhance quality of life by progressively improving product standards to ensure a cleaner and greener India.
- To develop hydrocarbon sector as a globally competitive industry which could be benchmarked against the best in the world through technology upgradation and capacity building in all facets of the industry.
- To have a free market and promote healthy competition among players and improve the customer service.
- To. ensure oil security for the country keeping in view strategic and defence considerations.

INSPIRE

"Innovation in Science Pursuit for Inspired Research (INSPIRE)" is an innovative programme sponsored and managed by the Department of Science & Technology for attraction of talent to Science.

- The basic objective of INSPIRE is to communicate to the youth of the country the excitements of creative pursuit of science, attract talent to the study of science at an early age.
- It helps in building the required critical human resource pool for strengthening and expanding the Science & Technology system and R&D base.
- A striking feature of the programme is that it does not believe in conducting competitive exams for identification of talent at any level.

National Centre for Polar and Ocean Research"

Indian Government has recently renamed National Centre for Antarctic and Ocean Research (NCAOR) as "National Centre for Polar and Ocean

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Research". NCAOR was formed in 1998 with an objective to conduct expedition to India's base stations in Antarctica.

NCAOR is under the Ministry of Earth Sciences. The intent behind the name change is to show that government is refocusing its priorities to Arctic. It is because of the opportunities and challenges posed by climate change in Arctic. Now, India only has one Arctic observation station near Norway. India is already an observer at the Arctic Council.

LiDAR

Light Detection and Ranging (LiDAR) is a remote sensing instrument. It is used as a monitoring system for mapping and modelling in -micro-topography, forestry, agriculture, meteorology and environmental pollution.LiDAR has been recently deployed at Gulf of Khambat, off the Gujarat Coast by National Institute of Wind Energy (NIWE).

Scientific Research Infrastructure Management and Networks (SRIMAN)

The government has proposed a new policy "SRIMAN" that plans to hire out to researchers all lab equipment that cost more than Rs. 10 lakh.

- It is expected to transform scientific instruments in government labs into lucrative assets generating a steady rental income.
- It would also reduce the amount of time such expensive instruments remain idle.
- Currently, the practice of researchers bidding for time-slots to use lab instruments is typically seen more with very expensive equipment, such as radio telescopes and particle-accelerators, which cost crores of rupees.

Solar Park Scheme:

Ministry of New and renewable Energy (MNRE) has drawn a scheme to set up number of solar parks across various states in the country, each with a capacity of Solar Projects generally above 500 MW

What is a solar park

A solar park is a concentrated zone of development of solar power generation projects and provides developers an area that is well characterized, with

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proper infrastructure and access to amenities and where the risk of the projects can be minimized.

Sagittarius A

It is believed to be a super massive black hole in the Milky Way Galaxy. It is 4 million times heavier than sun. The gravity produced by it is so intense that stars many times more massive than our sun orbit around it at incredible speeds

ICANN

The Internet Corporation of Assigned Names and Numbers (ICANN) is a non profit organization that was set up in 1998 to oversee the administration of domain names. ICANN coordinates and ensures the smooth and secure functioning of the cybernetic framework.

Blockchain district

Tech Mahindra and the Telangana government have signed an agreement to establish a Blockchain district in Hyderabad, a first-ofits-kind Centre of Excellence for Blockchain in India.

UMANG (Unified Mobile Application for New-age Governance)

Umang is an initiative to promote Digital India program. The term — Umang stands for Unified Mobile Application for New-age Governance and is envisaged to make e-governance. The application is developed by the Ministry of Electronics and Information Technology (MeitY) and National e-Governance Division (NeGD) in order to drive Mobile Governance in India

O-SMART

The Cabinet Committee on Economic Affairs has given its approval for the umbrella scheme "Ocean Services, Technology, Observations, Resources Modelling and Science (O-SMART)".The services rendered under the O-SMART will provide economic benefits to a number of user communities in the coastal and ocean sectors, namely, fisheries, offshore industry, coastal states, Defence, Shipping, and Ports etc

Bedaquiline

According to the WHO guidelines, all injectables are to be replaced with a fully oral regimen with Bedaquiline to treat MDR-TB patients. Bedaquiline is the powerful anti-TB drug used to treat MDR-TB

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HOPE

UAE has started its preparations for the upcoming Mars Mission named-HOPE

Comprehensive Nuclear-Test-Ban Treaty (CTBT)

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is the Treaty banning all nuclear explosions – everywhere, by everyone. The Treaty was negotiated at the Conference on Disarmament in Geneva and adopted by the United Nations General Assembly. It opened for signature on 24 September 1996. India is not a signed the treaty

EyeROV TUNA

India's first underwater robotic drone EyeROV TUNA was recently handed over to Naval Physical and Oceanographic Laboratory (NPOL) of Defence Research and Development Organisation (DRDO)

C-FLOWS

C-FLOWS (Chennai FLOod Warning System) is developed by National Centre for Coastal Research (NCCR) and IIT Madras. It is a flood warning system customised for use in Chennai and soon going to be developed for other cities

'Main Nahin Hum'

The government has launched 'Main Nahin Hum' portal for IT professionals. The portal, which works on the theme 'Self4Society', will enable IT professionals and organisations to bring together their efforts towards social causes on one platform. The platform has been developed by MyGov.

Space Technology

Space.

space is everything in the universe beyond the top of the Earth's atmosphere – the Moon, where the GPS satellites orbit, Mars, other stars, the Milky Way, black holes, and distant quasars. Space also means what's between planets, moons, stars, etc – it's the near-vacuum otherwise known as the interplanetary medium, the interstellar medium, the inter-galactic medium, the intra-cluster medium, etc;

What is Satellite?

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A satellite is a body at orbits around another body in space. There are two different types of satellites – natural and man-made. Examples of natural satellites are the Earth and Moon. The Earth rotates around the Sun and the Moon rotates around the Earth.

What Are the Parts of a Satellite?

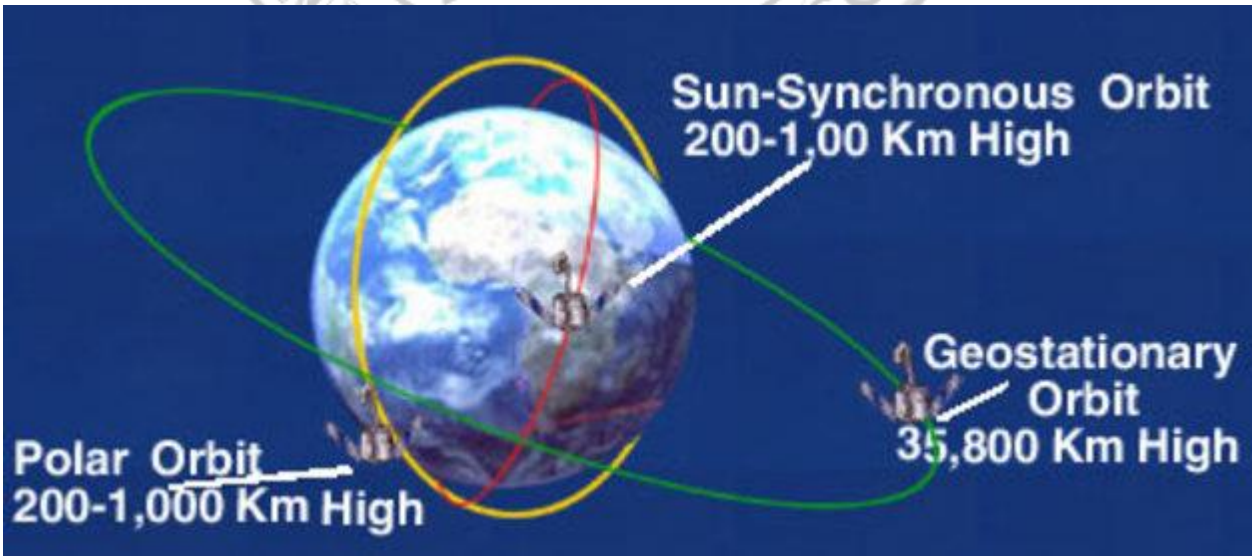
Satellites come in many shapes and sizes. But most have at least two parts in common - an antenna and a power source. The antenna sends and receives information, often to and from Earth. The power source can be a solar panel or battery. Solar panels make power by turning sunlight into electricity.

Low Earth Orbits

Satellites in low Earth orbits are normally military reconnaissance satellites that can pick out tanks from 160 km above the Earth. They orbit the earth very quickly, one complete orbit normally taking 90 minutes. However, these orbits have very short lifetimes in the order of weeks compared with decades for geostationary satellites. Simple launch vehicles can be used to place these satellites of large masses into orbit.

Sun-Synchronous orbits

Meteorological satellites are often placed in a sun-synchronous or heliosynchronous orbit. These satellites are in polar orbits. The orbits are designed so that the satellite's orientation is fixed relative to the Sun throughout the year, allowing very accurate weather predictions to be made. Most meteorological satellites orbit the Earth 15 to 16 times per day.



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Geosynchronous satellites

Earth-synchronous or geosynchronous satellites are placed into orbit so that their period of rotation exactly matches the Earth's rotation. They take 24 hours to make one rotation. The satellites are placed in highly elliptical orbits which enable them to appear to hover above one point on the Earth for most of the day. In twenty four hours they move over the Earth in a figure of eight pattern centred on a fixed longitude, moving slowly where they can be useful and quickly where they are of little use.

Geostationary satellites

The majority of communications satellites are in fact geostationary satellites. Geostationary satellites like geosynchronous satellites take 24 hours to complete a rotation. However, geostationary satellites are positioned directly over the equator and their path follows the equatorial plane of the Earth. As a result geostationary satellites don't move North or South during the day and are permanently fixed above one point on the equator of the Earth.

Most video or T.V. communications systems use geostationary satellites. Geosynchronous and geostationary satellites are typically orbiting at 35,788 km (22,238 miles) above the surface of the planet (42,000 km from its centre).

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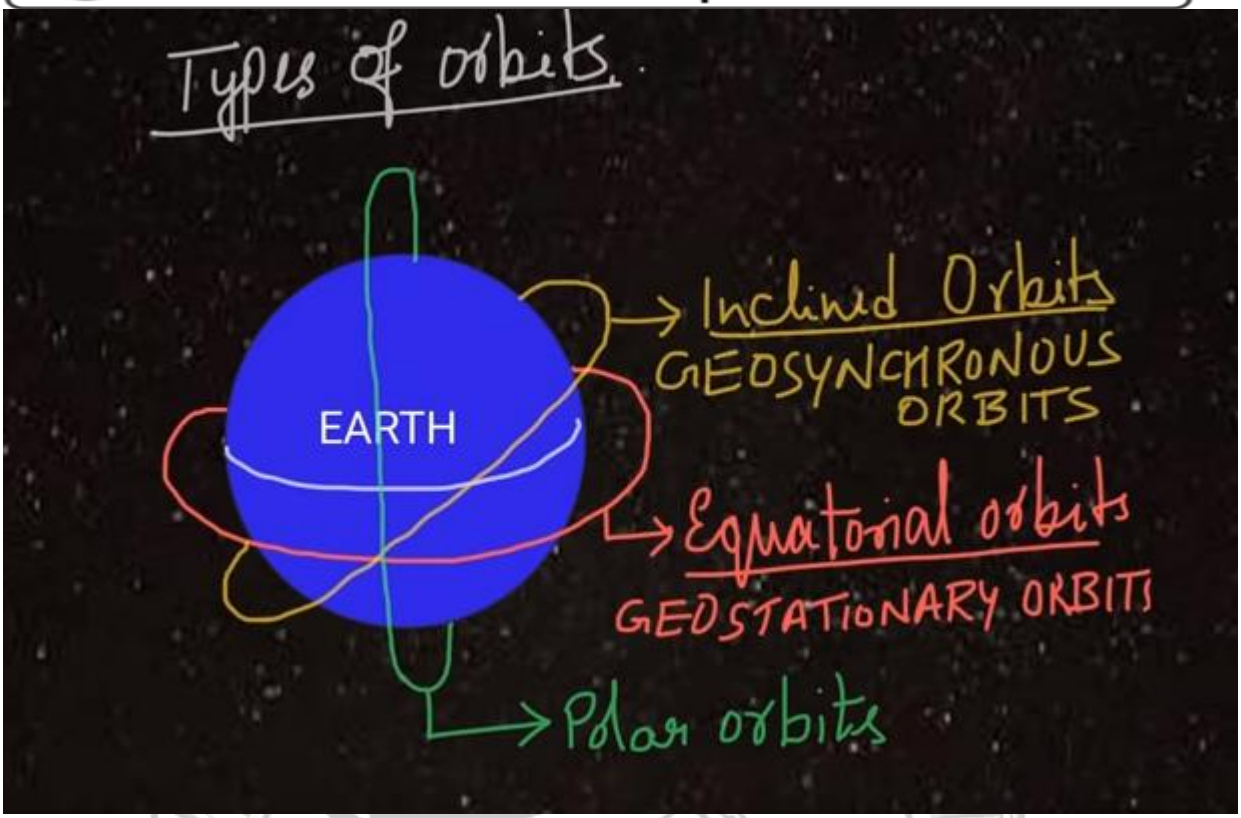

India's Launch Vehicle

Polar Satellite Launch Vehicle (PSLV)

Polar Satellite Launch Vehicle (PSLV) is the third generation launch vehicle of India. It is the first Indian launch vehicle to be equipped with liquid stages. After its first successful launch in October 1994, PSLV emerged as the reliable and versatile workhorse launch vehicle of India with 39 consecutively successful missions by June 2017. During 1994-2017 period, the vehicle has launched 48 Indian satellites and 209 satellites for customers from abroad.

It can take up to 1,750 kg of payload to Sun-Synchronous Polar Orbits of 600 km altitude.

Besides, the vehicle successfully launched two spacecraft – Chandrayaan-1 in 2008 and Mars Orbiter Spacecraft in 2013 – that later traveled to Moon and Mars respectively

Geosynchronous Satellite Launch Vehicle

Geosynchronous Satellite Launch Vehicle Mark II (GSLV Mk II) is the largest launch vehicle developed by India, which is currently in operation. This

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fourth generation launch vehicle is a three stage vehicle with four liquid strap-ons.

GSLV's primary payloads are INSAT class of communication satellites that operate from geostationary orbits and hence are placed in Geosynchronous Transfer Orbits by GSLV.

GSLV's capability of placing up to 5 tonnes in Low Earth Orbits broadens the scope of payloads from heavy satellites to multiple smaller satellites.

INSAT

The Indian National Satellite (INSAT) system is one of the largest domestic communication satellite systems in Asia-Pacific region with nine operational communication satellites placed in Geo-stationary orbit. Established in 1983 with commissioning of INSAT-1B, it initiated a major revolution in India's communications sector and sustained the same later.

India's Space Missions

Indian space programme encompasses research in areas like astronomy, astrophysics, planetary and earth sciences, atmospheric sciences and theoretical physics. Balloons, sounding rockets, space platforms and ground-based facilities support these research efforts. A series of sounding rockets are available for atmospheric experiments. Several scientific instruments have been flown on satellites especially to direct celestial X-ray and gamma-ray bursts

AstroSat

AstroSat is the first dedicated Indian astronomy mission aimed at studying celestial sources in X-ray, optical and UV spectral bands simultaneously. The payloads cover the energy bands of Ultraviolet (Near and Far), limited optical and X-ray regime (0.3 keV to 100keV). One of the unique features of AstroSat mission is that it enables the simultaneous multi-wavelength observations of various astronomical objects with a single satellite.

AstroSat with a lift-off mass of 1515 kg was launched on September 28, 2015 into a 650 km orbit inclined at an angle of 6 deg to the equator by PSLV-C30 from Satish Dhawan Space Centre, Sriharikota. The minimum useful life of the AstroSat mission is expected to be 5 years.

The scientific objectives of AstroSat mission are:

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- To understand high energy processes in binary star systems containing neutron stars and black holes;
- Estimate magnetic fields of neutron stars;
- Study star birth regions and high energy processes in star systems lying beyond our galaxy;
- Detect new briefly bright X-ray sources in the sky;
- Perform a limited deep field survey of the Universe in the Ultraviolet region

Mars Orbiter Mission or Mangalyan.

Mars Orbiter Mission is India's first interplanetary mission to planet Mars with an orbiter craft designed to orbit Mars in an elliptical orbit. The Mission is primarily technological mission considering the critical mission operations and stringent requirements on propulsion and other bus systems of spacecraft. It has been configured to carry out observation of physical features of mars and carry out limited study of Martian atmosphere with following five payloads:

- Mars Colour Camera (MCC)
- Thermal Infrared Imaging Spectrometer (TIS)
- Methane Sensor for Mars (MSM)
- Mars Exospheric Neutral Composition Analyser (MENCA)
- Lyman Alpha Photometer (LAP)

Chandrayaan-1,

India's first mission to Moon, was launched successfully on October 22, 2008 from SDSC SHAR, Sriharikota. The spacecraft was orbiting around the Moon at a height of 100 km from the lunar surface for chemical, mineralogical and photo-geologic mapping of the Moon. The spacecraft carried 11 scientific instruments built in India, USA, UK, Germany, Sweden and Bulgaria.

Aditya-1

The Aditya-1 mission was conceived as a 400kg class satellite carrying one payload, the Visible Emission Line Coronagraph (VELC) and was planned to

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launch in a 800 km low earth orbit. A Satellite placed in the halo orbit around the Lagrangian point 1 (L1) of the Sun-Earth system has the major advantage of continuously viewing the Sun without any occultation/ eclipses. Therefore, the Aditya-1 mission has now been revised to "Aditya-L1 mission" and will be inserted in a halo orbit around the L1, which is 1.5 million km from the Earth.

Antrix

Antrix Corporation Limited (ACL), Bengaluru is a wholly owned Government of India Company under the administrative control of the Department of Space. Antrix Corporation Limited was incorporated as a private limited company owned by Government of India in September 1992 as a Marketing arm of ISRO for promotion and commercial exploitation of space products, technical consultancy services and transfer of technologies developed by ISRO. Another major objective is to facilitate development of space related industrial capabilities in India.

Vikram Sarabhai Space Centre

Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, is the lead centre of ISRO responsible for the design and development of launch vehicle technology. The Centre pursues active research and development in the fields of aeronautics, avionics, materials, mechanisms, vehicle integration, chemicals, propulsion, space ordnance, structures, space physics and systems reliability

India's own GPS System (NaVic)

What is IRNSS?

IRNSS stands for Indian Regional Navigation Satellite System. It is a set of satellites which together can provide India a regional positioning system similar to the GPS. The system is designed to give position accuracy better than 20 metres to users in its primary coverage area. It can also service regions extending up to 1500 km around India's boundary.

ISRO is working jointly with Airport Authority of India (AAI) in establishing the GPS Aided Geo Augmented Navigation (GAGAN) system

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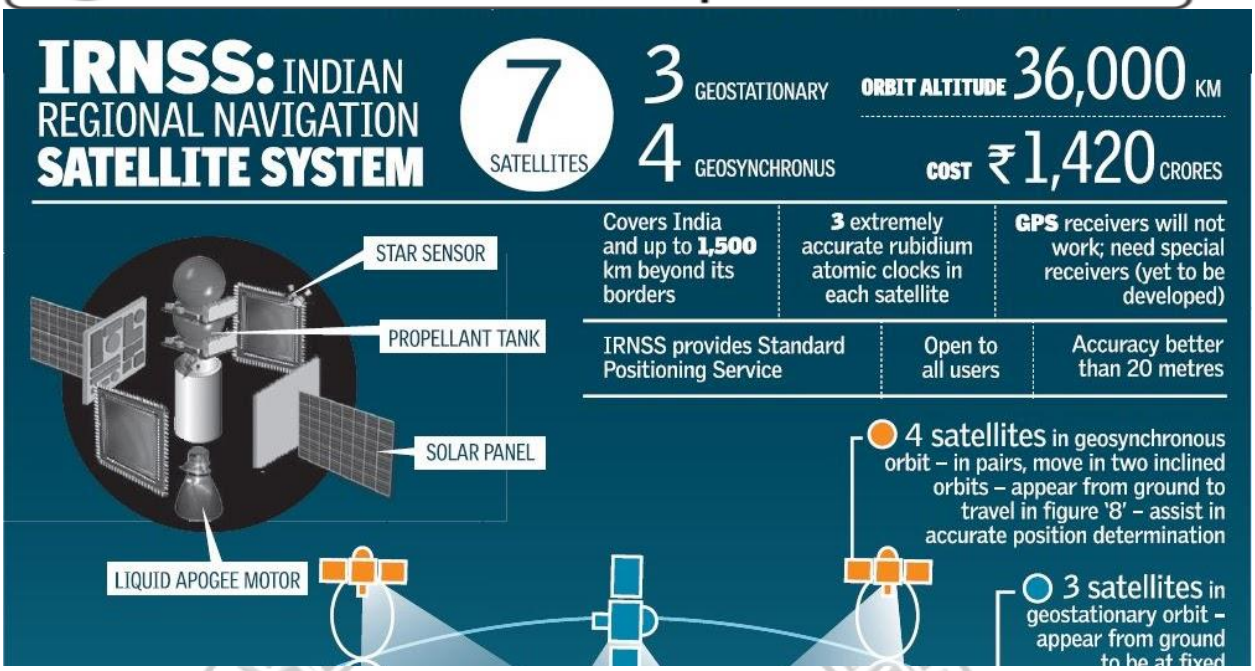

How many IRNSS satellites are up there now?

There are currently seven IRNSS satellites (1A to 1G) in orbit. A, B, F, G are placed in a geosynchronous orbit, which means they seem to be at a fixed location above the Earth and they orbit along with the Earth. The remaining three, C, D, E, are located in geostationary orbit-they seem to be at a fixed location above the Earth along the equator and orbit along with the Earth

IRNSS will provide two types of services:

- ✓ Standard Positioning Service (SPS), which is provided to all the users.
- ✓ Restricted Service (RS), which is an encrypted service provided only to the authorized users

Applications of IRNSS

- ✓ Terrestrial, Aerial and Marine Navigation
- ✓ Disaster Management
- ✓ Vehicle tracking and fleet management
- ✓ Integration with mobile phones
- ✓ Precise Timing
- ✓ Mapping and Geodetic data capture
- ✓ Terrestrial navigation aid for hikers and travelers

- ✓ Visual and voice navigation for drivers

What is GPS?

The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites. GPS works in any weather conditions, anywhere in the world, 24 hours a day

How GPS works

GPS satellites circle the Earth twice a day in a precise orbit. Each satellite transmits a unique signal and orbital parameters that allow GPS devices to decode and compute the precise location of the satellite. GPS receivers use this information and trilateration to calculate a user's exact location. Essentially, the GPS receiver measures the distance to each satellite by the amount of time it takes to receive a transmitted signal. With distance measurements from a few more satellites, the receiver can determine a user's position and display it electronically to measure your running route, map a golf cours, find a way home or adventure anywhere.