SCIENCE & TECHNOLOGY

SPACE

GSAT :

GSAT-19 E

Indian Space Research Organisation (ISRO) is working towards putting into orbit **an indigenous communication satellite GSAT-19, weighing 3.3 tonne** and **carrying Ka/ Ku band payloads.**

The **satellite assembly is in advanced stages.** The **launch campaign for the first developmental flight of GSLV Mk-III** has commenced on September 29, 2016 at Satish Dhawan Space Centre (SDSC), Sriharikota.

ISRO is working towards increasing the payload capacity of GSLV Mk-III beyond **four tonnes in the coming years**. The **strategies identified** to achieve the increased payload capacity **include** performance improvement of propulsion systems, inert mass optimisation and miniaturisation of avionics system.

The **Chandrayaan-2, comprising of Orbiter, Lander and Rover,** with **a total payload mass of 3250 kg** is **planned** to be **launched onboard GSLV Mk-II during the first quarter of 2018.**

This information was provided by the Union Minister of State (Independent Charge) Development of North-Eastern Region (DoNER), MoS PMO, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr Jitendra Singh in a written reply to a question in Rajya Sabha on December 1, 2016.

PSLV :

104 Satellites Launched in Single Mission

Indian Space Research Organisation (ISRO) created history by successfully launching a world record 104 satellites in a single mission on February 15, 2017. These satellites were launched on board of Polar satellite Launch vehicle PSLV-C37, on its 39th mission from Satish Dhawan Space Centre, Sriharikota, Andhra Pradesh. All satellites were launched into the polar Sun Synchronous Orbit (SSO), about 520 km from the Earth.

- Of the total 104 satellites, three were Indian and remaining 101 belonged to international customers.
- India's three satellites included earth-mapping Cartosat-2 satellite (main payload) and nanosatellites INS-IA and INS- 1B.
- ***Cartosat-2 Satellite*** is earth observation satellite that will provide remote sensing services. Images sent by it will be useful for coastal land use and regulation, road network monitoring and creation of land use maps, among others. It is similar to the earlier four satellites in Cartosat-2 Series.
- ***Foreign Satellites :*** Of the 101 co-passenger satellites, 96 belong to US and remaining from Israel, Kazakhstan, Netherlands, Switzerland, United Arab Emirates, respectively.
- Around 90 small satellites belonged to US-based company Planet Inc. They are named 'Doves' and their constellation will be used to image the earth at low cost.

PSLV-C36 Successfully Launches RESOURCESAT-2A Remote Sensing Satellite

In its **thirty eighth flight (PSLV-C36), ISRO's Polar Satellite Launch Vehicle** successfully **launched** the **1,235 kg RESOURCESAT-2A Satellite** from the Satish Dhawan Space Centre SHAR, Sriharikota on December 07, 2016. This is the **thirty seventh consecutively successful mission of PSLV.**

After PSLV-C36 lift-off at 10:25 am IST from the First Launch Pad with the ignition of the first stage and a flight of 17 minutes 05 seconds, the vehicle achieved a polar Sun Synchronous Orbit of 824 km height inclined at an angle of 98.725 degree to the equator (very close to the intended orbit) and 47 seconds later, RESOURCESAT-2A was separated from the PSLV.

After separation, the **two solar arrays of RESOURCESAT-2A deployed automatically** and **ISRO's Telemetry, Tracking and Command Network (ISTRAC)** at **Bangalore took over the control of the satellite.** The satellite will provide imagery from its three cameras. The **data sent by RESOURCESAT-2A** will be **useful** for **agricultural applications** like **crop area and crop production estimation, drought monitoring, soil mappicng, cropping system analysis and farm advisories generation.**

Like its predecessors **RESOURCESAT-1 and 2, RESOURCESAT-2A has a unique 3-Tier imaging system** with **Advanced Wide Field Sensor (AWiFS), Linear Imaging Self Scanner-3 (LISS-3) and Linear Imaging Self Scanner-4 (LISS-4) cameras.** The **AWiFS provides images** with **a sampling of 56 metres, a swath of 740 km and a revisit of 5 days** whereas the **LISS-3 provides 23.5 metre sampled images with 141 km swath and a repitivity of 24 days. LISS-4 provides 5.8 metre** sampled images with **70 km swath and a revisit of 5 days.**

With today's launch, the PSLV has yet again demonstrated its reliability. The **total number of satellites launched** by India's workhorse launch vehicle PSLV including RESOURCESAT-2A has now reached **122,** of which **43 are Indian** and the **remaining 79 are from abroad.**

Chandrayaan :

South Asia Satellite - GSAT 9

Prime Minister Narendra Modi's 'Gift' to south Asian nations, the South Asia Satellite (GSAT-9) was successfully launched on May 5, 2017, by ISRO from Satish Dhawan Space Centre, Sriharikota, Andhra Pradesh using ISRO's GSLV-F09 rocket. South Asia Satellite is a geosynchronous communications and meteorology satellite.

The entire project cost, up to the launch has been borne by India. To derive benefits from this satellite, the participating country will have to develop its own ground infrastructure. However, India Government has shown willingness to extend technical assistance in this matter.

The satellite will bring benefits in the areas of mapping of natural resources, IT- connectivity, education, tele-medicine and people-to-people links.

It will enable linking among the countries for disaster information transfer.

It will provide a significant capability to each of the participating countries in terms of DTH (direct-to-home).

Each participating country will get access to one transponder through which they could beam their own programming. There is also a scope to have a common "South Asian Programming".

South Asia Satellite will improve disaster and telecommunication links between India, Bangladesh, Bhutan, Nepal, Sri Lanka and Maldives. In words of PM Modi, the motto of 'sabka saath sabka vikaas' applies not only within India but also in global context with special reference to India's neighbouring countries.

Progress of Chandrayaan-2 Mission

Chandrayaan-2, India's second mission to the Moon, is a **totally indigenous mission comprising of Orbiter, Lander and Rover.** The **Orbiter and Rover flight system**s are in **advanced stage of realisation. Payloads** are **under development at various ISRO Centres / laboratories. Realisation of indigenous Lander is in progress.** Special tests for new systems in Lander have been identified and a Lander Sensors Performance Test (phase-1) over artificial craters created in Chitradurga district in Karnataka has been conducted. Lunar Terrain Test facility is ready for Lander drop test and Rover mobility tests.

The **Orbiter carrying six payloads will orbit around the Moon in 100 km lunar orbit**. The **payloads will collect scientific information on lunar topography, mineralogy, elemental abundance, lunar exosphere and signatures of hydroxyl and water-ice.**

ISRO is working towards the launch of Chandrayaan-2 during the first quarter of 2018.

This information was provided by the Union Minister of State (Independent Charge) Development of North-Eastern Region (DoNER), MoS PMO, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr Jitendra Singh in a written reply to a question in Rajya Sabha on December 1, 2016.

Status of Indian Satellites :

Indigenous Satellites Placed Successfully in Orbit

India presently has **38 indigenously manufactured satellites operational in orbit.** It comprises of **12 Earth observation satellites** (RESOURCESAT-1 & 2, CARTOSAT-1 & 2, CARTOSAT-2S [3 nos.], RISAT-1, OCEANSAT-2, MEGHA-TROPIQUES, SARAL & SCATSAT-1); **4 Meteorological satellites** (INSAT-3D, KALPANA, INSAT-3A & INSAT-3DR); **13 communication satellites** (INSAT-3C, 4A, 4B, 4CR, GSAT-6, 7, 8, 10, 12, 14, 15, 16 & 18), **7 navigational satellites** (IRNSS-1A to 1G) and **2 Space Science satellites** (Mars Orbiter Mission & ASTROSAT).

Since January 2011, none of the satellites got destroyed before being placed in the desired orbit.

The satellites are designed in such a way that it will not allow any information to be accessed or used without the knowledge of ISRO.

As on date, **29 satellites have been launched from outside the country.** Out of these, for **3 satellites (Aryabhatta, Bhaskara-1 & Bhaskara-2)**, free launch was provided by Russia as a part of Indo-Soviet friendship and for 1 satellite (Apple), Ariane offered a free launch in their developmental flight. Remaining satellites were launched by hiring launch services on a commercial basis.

This information was provided by the Union Minister of State (Independent Charge) Development of North-Eastern Region (DoNER), MoS PMO, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr Jitendra Singh in written reply to a question in Rajya Sabha on December 8, 2016.

Cryogenic Technology :

C25 - Cryogenic Upper Stage Engine

The C25 stage is Cryogenic Upper Stage engine for GSLV Mark III developed by ISRO. It uses Liquid Oxygen and Liquid Hydrogen propellant combination stored at minus 253 degrees centigrade. The development of C25 cryogenic stage will provide ISRO capability to launch 4 ton class satellites in Geosynchronous Transfer Orbit (GTO), an altitude where satellites revolve in sync with Earth's rotation. So far, the cryogenic engine consisting very complex technology has been developed only by Russia, US, France, China, Japan and India.

Recently, ISRO has successfully ground tested C25 at Liquid Propulsion Complex (ILPC) at Mahendragiri in Tirunelveli district of Tamil Nadu.

GSLV MKIII is the next generation launch vehicle of ISRO, capable of launching 4 ton class spacecraft in Geosynchronous Transfer Orbit (GTO). The vehicle consists of two solid strap-on motors (S200), one earth storable liquid core stage Vikas Engine (L110) and the cryogenic stage upper stage (C25).

Cryogenic Technology for Launching Space Vehicles

With the **last three consecutive successful launches** of **Geosynchronous Satellite Launch Vehicle (GSLV)** with **indigenous Cryogenic engine & stage, Indian Space Research Organisation (ISRO)** has **demonstrated** the **reliability of indigenous cryogenic technology.**

The **launch of GSAT-6 onboard GSLV-D6, on September 27, 2015, was the second successful launch of GSLV with the indigenous Cryogenic stage** after GSLV-D5/ GSAT-5 mission on 5th January, 2014. The recent launch of GSLV (GSLV-F05/ INSAT-3DR) on September 8, 2016 also used the indigenous Cryogenic Stage.

This information was provided by the Union Minister of State (Independent Charge) Development of North-Eastern Region (DoNER), MoS PMO, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr Jitendra Singh in written reply to a question in Rajya Sabha on December 15, 2016.

Scramjet Engine :

Scramjet Engine

The **first experimental mission o**f a sub-scale **Scramjet engine,** towards the realization of an **Air Breathing Propulsion System,** was successfully conducted on August 28, 2016 (at 0600 hrs IST) from Satish Dhawan Space Centre, Sriharikota. Various flight events, namely, burn out of booster rocket stage, ignition of second stage solid rocket, functioning of Scramjet engines, followed by burn out of the second stage took place exactly as planned. With this experimental flight, critical technologies such as **ignition of air breathing engines at supersonic speed, holding the flame at supersonic speed, air intake mechanism and fuel injection systems** have been successfully demonstrated.

The **total cost** incurred towards carrying out the first experimental mission of the **Scramjet engine** is **Rupees 8 crores.** The Scramjet engine, used in the first experimental mission is a scaled down version to demonstrate proof-of-concept.

Scramjet engine technology is a complex technology which is **yet to be fully proven worldwide.** A **series of technology demonstration tests are required before inducting the engine with required thrust into future launch vehicles.** The **technology will be useful** only during the atmospheric phase of the flight of launch vehicle and will **benefit in bringing down the cost of access to space, by reducing the need of carrying the oxidizer along with the fuel.**

This information was provided by the Union Minister of State (Independent Charge) Development of North-Eastern Region (DoNER), MoS PMO, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr Jitendra Singh in written reply to a question in Lok Sabha on December 7, 2016.

Reusable Launch Vehicle :

Reusable Launch Vehicle

Indian Space Research Organisation (ISRO) has **successfully carried** out the **first experimental mission of Reusable Launch Vehicle - Technology Demonstrator (RLV-TD),** on May 23, 2016 from Satish Dhawan Space Centre, Sriharikota. In this mission, **critical technologies** such as **autonomous navigation, guidance & control and reusable thermal protection system** have been successfully demonstrated.

The **Development of Reusable Launch Vehicle** is **a technical challenge** and it **involves** the **development of many cutting edge technologies. Presently,** it is **in the preliminary stage of total developmental process. A series of technology demonstration missions would be required before it is made operational.**

This information was provided by the Union Minister of State (Independent Charge) Development of North-Eastern Region (DoNER), MoS PMO, Personnel, Public Grievances & Pensions, Atomic Energy and Space, Dr Jitendra Singh in written reply to a question in Lok Sabha on December 7, 2016.

NASA :

NASA's Juno

Juno spacecraft is a unmanned spacecraft designed by NASA to study Jupiter's composition, gravity field, magnetic field, and polar magnetosphere.

It has travelled 2.7 billion kilometres since its launch to reach Jupiter on 4th July 2016 and started orbiting solar system's most massive planet. The spacecraft was launched by NASA as part of its New Frontiers program in 2011.

Juno is not the first spacecraft to orbit Jupiter. It is second spacecraft to orbit Jupiter, after Galileo probe which had orbited the planet from 1995-2003. Galileo probe in its mission had found evidence of subsurface saltwater on Jupiter's moons Europa, Ganymede and Callisto.

Copernicus Observation Program

Copernicus observation program is the world's largest single earth observation programme, directed by the European Commission in partnership with ESA. It consists of constellation of seven Sentinel Earth observation satellites.

On March 8th Sentinel-2B satellite, fifth of its Sentinel Earth observation satellites was successfully launched by European Space Agency (ESA) from French Guiana through Vega launcher. The programme aims at achieving a global, continuous, autonomous, high quality, wide range Earth observation capacity by providing accurate, timely and easily accessible information. It also aims at improving the management of the environment, understand and mitigate the effects of climate change, and ensure civil security.

They will take high-resolution, colour and infrared images for a wide array of environmental initiatives, including crop forecasting and monitoring natural disasters.

It will help track pollution of lakes and coastal waters, monitor land changes and produce disaster maps by providing information on floods, landslide and volcanic eruptions.

Cassini-Huygens Unmanned Spacecraft

Recently, NASA's Cassini spacecraft completed its final close flyby of Saturn's moon Titan successfully travelling between Saturn and its rings.

Cassini spacecraft is a joint endeavour of NASA, European Space Agency (ESA) and Italian space agency, Agenzia Spaziale Italiana (ASI).

Cassini was the fourth space probe to visit Saturn and the first to enter its orbit. The Robotic spacecraft included a Saturn orbiter and an atmospheric probe/lander called Huygens for the Saturn's moon Titan which entered and landed on Titan in 2005.

Space X Launches Reusable Launch Vehicle Falcon 9

Space Exploration Technologies Corporation (SpaceX) successfully launched it Falcon 9 from Kennedy Space Center, Florida and retrieved it on March 30, 2017. The rocket was used to launch communications satellite into space. Falcon 9 rocket used a booster that had previously flown cargo to the astronauts living at the International Space Station which makes it as the first ever recycled rocket sent by SpaceX.

Boosters are the most expensive part of the rocket which gives the thrust to attain the required speed while takeoff. They are typically discarded following liftoff, sinking into the ocean or sea nearby.

SpaceX is an Aerospace manufacturer and space transport services company founded on May 6, 2002 by Elon Musk. The products prepared are Falcon launch vehicles and Dragon capsules.

SpaceX aims to launch up to six reused boosters in 2017. The company has also planned to fly two paying customers to the moon in 2018 and also building a capsule to launch NASA astronauts.

It is also designing the Red Dragon, a robotic spacecraft intended to launch to Mars in 2020.

Others :

Blue Stragglers or Vampire-stars

India's first dedicated space observatory, ASTROSAT has captured the rare vampire star phenomenon. This phenomenon involves small star becoming bigger, hotter and bluer, giving it the appearance of being young (This star is called blue straggler), while the ageing companion burns out and collapses to a stellar remnant.

Cabinet Approves MoU between ISRO and United States Geological Survey

On December 14, 2016, the Union Cabinet chaired by Prime Minister Narendra Modi was apprised of the Memorandum of Understanding (MoU) signed between **Indian Space Research Organisation (ISRO)** and **United States Geological Survey (USGS)** for **Cooperation in the exchange and use** of **U.S. Land Remote Sensing Satellite Data.** The MoU was signed on 9th July 2016 at Bengaluru. This **MoU will enable ISRO to receive USGS's Landsat-7 & 8 in India** and **USGS to receive ISRO's Resourcesat-2 (AWiFS and LISS III) data of US region.**

Background:

Indian Space Research Organisation (ISRO) is **actively pursuing civilian space cooperation** with **many US organisations** including **National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA) and United States Geological Survey (USGS). Data from Landsat series** of satellites operated by USGS **was used by Indian scientists during the inception of Indian remote sensing programme.** ISRO received Landsat data during 1984 to 2001 through its ground station at Shadnagar (near Hyderabad, Telangana). **USGS has launched Landsat -8 satellite in February 2013. ISRO expressed interest** in **direct reception of the Landsat-8 data in India,** while **USGS expressed interest in obtaining data from ISRO's RESOURCESAT-2 satellite.**

ISRO and USGS, considering their mutual interest in data exchange of each other satellites, signed the Memorandum of Understanding (MoU).

MoU Between ISRO and Japanese Aerospace Exploration Agency

On January 18, 2017, the **Union Cabinet** chaired by **Prime Minister Narendra Modi** was **apprised** of the Memorandum of Understanding (MoU) signed on November 11, 2016 at Tokyo, Japan between the **Indian Space Research Organisation (ISRO)** and **the Japanese Aerospace Exploration Agency (JAXA) for cooperation in the field of outer space.**

The **purpose of this MoU** is to **pursue future cooperative activities** in the **exploration and use of outer space exclusively for peaceful purposes** in **accordance** with the **laws and regulations applicable in each country and their international obligations.**

This **MoU provides scope for pursuing cooperation** in **various areas of space science technology and applications including**: earth observation, satellite communication and navigation; exploration and space sciences; Research and development (space systems and space technology); and Space industry promotion.

ISRO and JAXA will bear the costs of their respective activities under this Memorandum, unless they decide otherwise in writing. Ability to fulfil their respective roles and activities under this Memorandum and its relevant separate Implementation Arrangement is subject to their respective funding procedures, the availability of appropriated funds and their respective national laws.

Framework MoU would lead to joint activity in the field of application of space technologies for the benefit of humanity. Thus all sections and regions of the country will get benefited.

Background:

India and Japan pursued space cooperation for more than 5 decades and **carried out studies** in the field of atmospheric study, observation of universe and scientific investigation in remote sensing. With the formation of JAXA in 2003, an "arrangement concerning the considerations of potential future cooperation in the field of outer space" was signed in October 2005 between ISRO/ Department of Space (DOS) and JAXA. Subsequently both agencies have signed cooperative documents addressing lunar exploration, satellite navigation, X-ray astronomy and Asia Pacific Regional Space Agency Forum (APRSAF).

During the ISRO-JAXA bilateral meeting held at New Delhi on April 05, 2016, both sides stressed the need for updating the contents of '2005

Arrangement' with enhanced scope of cooperation. Accordingly, both sides have arrived at the draft of new 'Memorandum of Understanding (MoU) between ISRO and JAXA concerning cooperation in the field of outer space' and got it signed on November 11, 2016 at Tokyo during the visit of Prime Minister of India to Japan.

Trappist Exoplanets

Astronomers from NASA (National Aeronautics and Space Administration) for the first time have discovered seven new Earth-sized exoplanets. These exoplanets are orbiting dwarf star named Trappist-I, which at 39 light years away. Exoplanet is a planet that orbits a stellar remnant, or brown dwarf . It is also termed as extrasolar planet. The star Trappist-I is at least 500 million years old and has a temperature of 250K. It is marginally larger than Jupiter and shines with a feeble light about 2,000 times fainter than Earth's sun.

The planets were detected using NASAs Spitzer Space Telescope and several ground-based observatories including Trappist robotic telescope at La Silla, Chile.

Of the seven planets, three are classified as TRAPPIST-I e, f and g. These three planets orbit in the Goldilocks zone. Goldilocks Zone refers to a habitable zone in space where the temperature is neither too high nor too low. Such conditions could allow for the presence on the planet's surface of liquid water - a key ingredient for life.

ENERGY

Wind Power :

Guidelines for Setting up of Wind Power Projects

Ministry of New & Renewable Energy (MNRE) has sanctioned a Scheme for Setting up of **1000 MW Inter State Transmission System (ISTS)** connected **Wind Power Projects on June 14, 2016.** The Scheme provides for formulation of Guidelines by MNRE for implementation of the Scheme. This was stated by Mr. Piyush Goyal, Minister of State (IC) for Power, Coal, New and Renewable Energy and Mines in a written reply to a question in the Lok Sabha on December 1, 2016. Accordingly, after stakeholders' consultation, MNRE issued Guidelines on 22 October 2016. The salient features of the Guidelines are given below:

- Scheme to be implemented by Solar Energy Corporation of India (SECI).
- Wind projects will be selected through open and transparent competitive bidding process followed by e-reverse auction.
- Eligible project capacity will be minimum 50 MW and maximum 250 MW per bidder.
- Trading Company, selected by SECI, will sign Power Purchase Agreement (PPA) with selected bidder and back-to-back Power Sale Agreement (PSA) with buying entities at a pooled price of the total bids selected. The duration of PPA and PSA will be 25 years from commercial operation date of the project.
- The transmission of power up to the point of interconnection where the metering is done for energy accounting shall be the responsibility of the bidder. Use of State transmission system to bring wind power at **Inter State Transmission System (ISTS)** point also allowed.
- Part commissioning allowed subject to commissioning of atleast 50 MW or 50% of the allocated Project Capacity, whichever is higher.
- Project to be completed within 18 months from issue of Letter of Award. Maximum period of 27 months allowed for completion of project with penalties.
- Minimum declared Capacity Utilization Factor to be 20%. Provision of compensation in case of shortfall in minimum generation.
- Wind projects to submit monthly performance data through Online.

Energy Efficiency :

17.90 Crore LED Bulbs Distributed Across the Country

Bulk procurement by **Energy Efficiency Services Limited (EESL)** for implementation of **Unnat Jyoti by Affordable LEDs for All (UJALA) Scheme** has resulted in **huge savings for the consumers across the country.** This was stated by Mr. Piyush Goyal, Minister of State (IC) for Power, Coal, New & Renewable Energy and Mines, in a reply to a question in Lok Sabha on December 1, 2016.

The Minister informed that the **e-procurement of LED bulbs through a transparent and**

competitive bidding process has **resulted in reduction of approximately 88% in procurement prices of LED bulbs from Rs. 310 in February, 2014 to Rs.38 in August 2016,** the **retail price being reduced from Rs.550 to Rs. 65,** which is passed on to the consumers.

As on November 21, 2016, **17.90 Crore LED bulbs** have been **distributed to households across the country,** that **resulted in avoided capacity generation of 4,656 MW** and **a saving of 23.25 billion KWh per year,** Mr. Goyal further added.

Prime Minister of India, Mr. Narendra Modi, launched the **National LED programme** on 5th January, 2015, which is being implemented by **Energy Efficiency Services Limited (EESL)**, **a joint venture company of Public Sector Undertakings (PSUs) under Ministry of Power.**

Mr. Goyal said that **EESL aggregates demand across the country and procures LED bulbs for further distribution to domestic consumers at lower rates compared to retail market.** EESL has developed an innovative business model in which the **entire investment in these programmes is made by it and is paid back over a time from energy savings.** This **obviates a need for any government funding for this programme**. There is **no element of subsidy in the scheme.**

In a reply to another question, the Minister said that **UJALA Scheme** covers **Urban as well as backward, rural, semi-urban and remote areas**. **EESL** has **initiated nationwide** implementation of the **programme to replace 77 crore incandescent bulbs with LED bulbs by March, 2019.** This **will result in an estimated avoided capacity generation of 20,000 MW** and **save 100 billion KWh per year.**

Mr. Goyal also informed that there is no proposal to revamp the funding and execution pattern of 'LED distribution scheme'.

Mr. Goyal added that under the National LED programme, the **Street Lighting National Programme (SLNP)** has also been initiated wherein street lights respectively are replaced with LEDs.

Solar Energy :

Solar Micro Dome "Surya Jyoti"

Surya Jyoti is a solar micro dome devise that operates in three modes, day light without any electricity, evening time with solar PV and has the ability to operate during night time with conventional grid after 17 hours of operation. It can work for 16 hours continuously giving an illumination equivalent of a 60W incandescent lamp with a life of 20 years for dome structure.

The Micro Solar Dome is leak proof and has a transparent semi-spherical upper dome made of acrylic material which captures the sunlight. The light passes through a sun-tube having a thin layer of highly reflective coating on the inner wall of the passage. It also contains a lower dome made of acrylic. There is a shutter in the bottom of the lower dome which can be closed if light is not required in the daytime.

Surya Jyoti is now eligible for 30% subsidy under off grid solar lighting scheme of Ministry of New and Renewable Energy (MNRE).

Benifits

"It would also lead to an emission reduction of about 12.5 million ton of CO2 equivalent thus supplementing government's Green Energy initiatives.

This device will also increase the productivity of women who stay at home and are involved in small income generation activities.

The manufacturing process, being labour-intensive, would also generate huge job opportunities in the economy.

Gratzel Solar Cells Using Jamun Pigment

Scientists at IIT Roorkee used naturally occurring pigment in the Indian summer fruit Jamun to create more efficient and inexpensive solar cells.

The pigment is used as an inexpensive photosensitizer of the solar cells. Such Dye Sensitized Solar Cells (DSSCs) are also called as Gratzel cells. In other words, Gratzel Cells are thin film solar cells composed of a layer of dye molecules that absorb sunlight, a porous layer of titanium dioxide (Ti02) coated photoanode, an electrolyte for regenerating the dye and a cathode.

This effort is in line with the search undertaken by researchers across the world to find an alternate energy to relieve pressure off fossil fuels, especially during the wake of rising concern of global warming.

Waste to Energy :

Municipal Waste-to-Power Plant

One of the aim of Swachh Bharat Mission is 100 percent management of municipal solid waste by 2019 in the country. In this context, 24 megawatt (MW) Narela-Bawana waste-to-energy plan was inaugurated in New Delhi on March 10, 2017.

The project has been developed on public private partnership model by Ramky Group, a Hyderabad-based waste management company, in collaboration with the NDMC. The plant will use 2,000 metric tonnes of solid waste every day to generate 24 MW of energy. The capacity would be expanded further to process about 4000 metric tonnes of waste.

The power generated from the plant would be sold to distribution companies for a price fixed by electricity regulator. However, the company will share 3 percent of the profit with North Corporation.

The plant is expected to provide relief from overflowing landfill sites in Delhi as it will dispose off the waste to generate power. Delhi has four landfill sites, of which 3 are overflowing namely Bhaswa (North Delhi), Ghazipur (East Delhi) and Okhla (South Delhi)

The plant would not only dispose of waste on a daily basis but also produce compost and energy.

Besides this plant Delhi also has two other plant at Ghazipur and Okhla landfill sites. The Ghazipur plant uses about 2,000 tonnes of garbage and produces 12 megawatt of energy while the Okhla landfill waste-to-energy plant has a capacity to produce 12 megawatt capacity from 1,200 tonnes of garbage.

Hydrogen Energy :

Synlight Project

Researchers at the DLR institute for Solar Research, Germany have created the "Synlight" which they call as the "world's largest artificial sun".

Synlight is a system composed of a huge collection of 149 individual film projector spotlights (Xenon lamps) with honeycomb-like setup, assembled at a single place to produce about 10,000 times the intensity of the natural solar radiation on Earth's surface and temperatures of around 5,400 degrees Fahrenheit. It is basically the world's largest artificial sun. Synlight would easily fry a human, which is why no humans are allowed inside the test chambers during experiments.

Every day, a huge amount of energy hits the Earth in the form of light from our Sun and though we already have ways to harness the Sun's energy, such as through solar panels still much of still remains untapped.

The "Synlight" Experiment harnesses this wasted energy to produce water vapor that can be split into hydrogen and oxygen.

Hydrogen fuel is considered to have zero pollutant emissions and no greenhouse gases and therefore is also touted as the fuel of the future since it does not add to global warming. But while hydrogen is the most common element in the universe, is rare on Earth. Hydrogen is produced by electrolysis i.e the process of splitting water into hydrogen and oxygen, and requires large amounts of electricity. But the Synlight researchers hope to bypass the electricity stage and instead use the immense heat generated by the experiment to set off a reaction to produce hydrogen fuel.

The Synlight technique currently uses a vast amount of energy. About four hours of operation consumes as much electricity as a four-person household in a year. So it is expensive.

Once researchers have mastered hydrogen-making techniques with Synlight, the process can be scaled up ten-fold on the way to reaching a level fit for industry.

ENVIRONMENT

Namami Gange :

Cleaning of Rivers Under Namami Gange Mission

The **Namami Gange programme** is **an umbrella programme** to **ensure effective abatement of pollution** and **conservation of the river Ganga** and **all its tributaries.** Under the current Namami Gange programme, other than river Ganga, pollution abatement work is taken up on certain critical tributaries like Ramganga, Kali and Yamuna as a first priority.

The **works** are **executed** by the **State Project Management Groups (SPMGs)** of the **respective States** through the designated Executing Agencies. In addition, **5 central public sector units,** namely, **Water and Power Consultancy Services Limited (WAPCOS), Engineer India Limited (EIL), National Buildings Construction Corporation Limited (NBCC), National Projects Construction Corporation Limited (NPCC)** and **Engineers Projects India Limited (EPIL)** have been engaged to execute entry level activities in their respective river stretches in **Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.**

The **National Ganga River Basin Authoruty (NGRBA)** has **resolved** that **no untreated**

municipal sewage or industrial effluent will be discharged into river Ganga by year 2020. Construction and beautification of Ghats are included under "Entry Level Activities" of Namami Gange. As on 30th Sep., 2016, schemes for **118 Ghats have been approved in the five main-stem Ganga states.**

This information was given by Union Minister of State for Water Resources, River Development and Ganga Rejuvenation Mr. Vijay Goel in a written reply in Lok Sabha on December 1, 2016.

Status of Projects Under Namami Gange Programme

As on 30th September 2016, **128 projects have been sanctioned** under **Namami Gange Programme** at an estimated project cost of **Rs.9,419 crore.** The existing legislations i.e., the **Water (Prevention and Control of Pollution) Act, 1974** and the **Environment Protection Act, 1986 provide** for **necessary penal action against the offenders.**

Central Pollution Control Board (CPCB) has inspected 752 Grossly Polluting Industries (GPIs) (as on 30th June, 2016) out of the **identified 764 Grossly Polluting Industries (GPIs)** operating on the bank of River Ganga and issued directions under Section 5 of E (P) Act, 1986 to 573 units found non-compliant during inspection. Out of these 573 units, 65 units were issued closure directions. **Five key industrial sectors** namely, **distillery, sugar, pulp & paper, tannery and textile** contributing **90% of inorganic load into the river system** have been issued directions to **achieve water conservation and zero liquid discharge by March, 2017.**

This information was given by Union Minister of State for Water Resources, River Development and Ganga Rejuvenation Mr. Vijay Goel in a written reply in Lok Sabha on December 1, 2016.

New Crab Species Discovered

Scientists from the University of Kerala have discovered a new species of long-legged, tree-dwelling crabs named Kani maranjandu in Western Ghats of Kerala. It has been named after the Kani tribe in Kerala and are substantially different from other congeners (organisms within the same genus).

Kani maranjandu is the first crab species of its kind to offer a record of an arboreal crab (species that lives in trees).

Solar Calculator App

"ISRO has launched a solar calculator app that can calculate the benefits of installing solar panels in different regions of the country.

The App determines solar energy potential (in kWh/m2) at any given location, determination of which is important for setting up of photovoltaic thermal power plants.

The app provides monthly and yearly solar potential by processing data obtained from Indian Geostationary Satellites (Kalpana-1, INSAT-3D and INSAT-3DR).

In addition, the app also suggests the optimum tilt angle for the installation of solar PV.

Climate Change :

Cabinet Approves India's Approach to Climate Change Negotiations

On December 14, 2016, the Union Cabinet chaired by Prime Minister Narendra Modi gave ex-post facto approval to **India's approach to Climate Change Negotiations** at the Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCC), held in Marrakesh, Morocco during November 7 to 18, 2016.

Approval to India's Approach to Climate Change Negotiations at the COP is intended to **safeguard the interest of poor and vulnerable groups** by **emphasizing** on **adaptation, loss and damage,** and **protecting the development space.** It **incorporates the interest of all strata of society in the country.**

Growth and development of a country are **linked** with Greenhouse Gas emissions. **While combating the ill-effects of climate change,** the **development space for India** and **developing countries needs to be preserved.** The **approach** outlined in the note **enables the achievement of this goal** and **also seeks to address the adaptation needs of the country.**

Impact of India's INDC Commitment

India's Intended Nationally Determined Contribution (INDC) is **comprehensive** and **balanced**, **incorporating all its development priorities. India's contribution takes into account** its **commitment to conservation of nature, along with development challenges** like **poverty eradication, food security, universal access to education, health and energy.** India's NDC allows Gross Domestic Product (GDP) to grow, while reducing the emissions.

Under the Paris Agreement, the **developed countries have committed to mobilise US $100 billion per year** and agreed to **enhance it by 2025 beyond US $100 billion per year. Green Climate Fund (GCF)** has been set up under the **United Nations Framework Convention on Climate Change (UNFCCC)** as **an operating entity of the financial mechanism of the Convention. India** is **an eligible country for accessing Green Climate Fund (GCF).**

Government of India has **established** the **National Adaptation Fund for Climate Change (NAFCC)** with a **budget** provision of **Rs 350 crore** for 2015-16 and 2016-17 **to assist States and Union Territories to undertake projects and actions for adaptation to climate change. Rs. 182.27 crore** has been **released for 18 projects** for **sectors** including a**griculture and animal husbandry, water resources, coastal areas, biodiversity and ecosystem services.**

Financial assistance of Rs. 10 lakh has been **provided** to each State Government for strengthening capacity of nodal agencies for implementation of **State Action Plan on Climate Change (SAPCC). Twenty Nine (29) States/ Union Territories (UTs),** viz., Bihar, Chhattisgarh, Chandigarh, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Puducherry, Punjab, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Gujarat, Lakshadweep, Andhra Pradesh, Telangana, Nagaland, Arunachal Pradesh, Uttar Pradesh and West Bengal have **submitted their projects for capacity building.**

This information was given by Minister of State (Independent Charge) in Ministry of Environment, Forest and Climate Change, Mr. Anil Madhav Dave, in a written reply to a question in Rajya Sabha on December 5, 2016.

Cabinet Approves Ratification of the Second Commitment Period of Kyoto Protocol to the UNFC

On January 24, 2017, the **Union Cabinet** chaired by **Prime Minister Narendra Modi** gave its **approval** to **ratify** the **Second Commitment Period** of the **Kyoto Protocol** on **containing** the **emission** of **Green House Gases (GHGs).** The **second commitment period** of the **Kyoto Protocol** was **adopted** in **2012.** So far, **75 countries have ratified the Second Commitment Period.**

In view of the **critical role played by India** in **securing international consensus on climate change issues,** this **decision** further **underlines India's leadership in the comity of nations committed to global cause of environmental protection** and **climate justice. Ratification** of the **Kyoto Protocol** by **India will encourage other developing countries** also to undertake this exercise. Implementation of **Clean Development Mechanism (CDM) projects** under this **commitment period** in accordance with **Suslainable Development priorities will attract some investments in India as well.**

The **United Nations Framework Convention on Climate Change (UNFCC) seeks** to **stabilise Green House Gas concentrations** in the **atmosphere at a level that would minimize interference with the climate system. Recognizing** that **developed countries** are **principally responsible for the current high levels of Greenhouse Gas (GHGs) in the atmosphere,** the **Kyoto Protocol places commitments on developed nations to undertake mitigation targets** and **to provide financial resources and transfer of technology to the developing nations. Developing countries like India have no mandatory mitigation obligations** or **targets under** the **Kyoto Protocol.**

Background :

The **Kyoto Protocol was adopted in 1997** and the **1st commitment period was from 2008-2012.** At **Doha in 2012,** the **amendments to Kyoto Protocol for** the **2nd commitment period (the Doha Amendment)** were **successfully** adopted for the period 2013- 2020. **Developed countries have already started implementing** their commitments under the **'opt-in' provisions** of the **Doha Amendment.**

India has always emphasized the importance of climate actions by developed country Parties in the pre-2020 period. Besides, it has **advocated climate actions based on the principles and provisions of the Convention,** such as the **principle of Equity and Common but differentiated responsibilities** and **respective capabilities (CBDR&RC).**

Eco-Sensitive Zones :

Final Notification Issued on Eco-Sensitive Zone in Sanjay Gandhi National Park, Mumbai

On December 6, 2016, the Union Government issued the Final Notification for an **Eco-Sensitive Zone area of 59.46 sq kms** of which 1**9.25 sq km is forest land and 40.21 sq km is non-forest land in Sanjay Gandhi National Park in Mumbai**

suburb. Announcing the decision, the Minister of State (Independent Charge) of Environment, Forest and Climate Change, Mr. Anil Madhav Dave, said that after completing all processes, the final notification has been done. Now from its boundary, 100 metres to upto 4 kms, has been marked as eco sensitive zone. The extent (of ESZ) varies at different places taking into consideration its geographical area. No construction will take place in this (ESZ) area. The Minister added that the **step** has been **taken** with a view **to avoid man-animal conflict.**

The **Eco-Sensitive Zone has a minimum extent of 100 metres** and **maximum extent of up to 4 km from the Park boundary.** The **objective** of **notifying Eco-Sensitive Zones** is to **create a buffer as further protection around Protected Areas (PAs)** such as **National Parks and Wildlife sanctuaries.**

The **Notification** also **provides** that in areas around Housing Societies and with high human habitation, and in view of the fact that the National Park has a large population of leopards, **a high wall with fencing may be erected to ensure that man-animal conflict is avoided.**

Background :

In order to conserve and protect the unique habitat in and around the Sanjay Gandhi National Park, a draft notification S.O (229 (E) was published on 22.01.2016 around the Park as Eco-Sensitive Zone from ecological and environmental point of view and for regulating development around the National Park.

The Ministry of Environment, Forest and Climate Change had received a large number of responses from elected representatives, various organisations and agencies such as the Bombay Municipal Corporation, the Mumbai Metro Rail Corporation and others on the Draft Notification.

Taking these into consideration, an area of 1.65 sq km land for the Mumbai Metro Rail Shed of Mumbai Metro Rail Corporation, temple etc has been excluded in the Final Notification published on 05.12.2016.

Due to its unique location in the middle of a bustling city, any **new construction within Eco-Sensitive Zone** shall be in accordance with Bombay Municipal Bye-Laws and Approved Development Plans and applicable laws and regulations under the Maharashtra Regional and Town Planning Act and vide provisions of the ESZ notification.

About Sanjay Gandhi National Park :

Sanjay Gandhi National Park is spread over three **districts** - **Palgar, Thane and Mumbai Suburb** and falls within the **Tehsils of Kurla, Borivalli and Thane.** The **National Park is home to a number of endangered species** of **flora** and **fauna** and **harbours approximately 800 species of flowering plants, 45 species of mammals, 43 species of reptiles, 38 species of snakes, 12 species of amphibians, 300 species of birds, 150 species of butterflies.** Notable amongst them are **large mammalian species** such as **leopard, wild boar, four-horned antelope, black-naped hare, wild cat, jackal and porcupine** and many **bird species** such as **Lesser grebe, Purple Heron, Smaller Egret, Lesser Whistling Teal, Pariah Kite. Many reptiles, including snakes as Indian Cobra and Viper** are also found in the National Park.

Others :

Wheat Rust

Wheat leaf rust is a fungal disease that affects wheat, barley and rye stems, leaves and grains.

Wheat rust, a devastating disease known as the "polio of agriculture", has spread from Africa to South and Central Asia, the Middle East and Europe, with calamitous losses for the world's second most important grain crop, after rice.

It is caused by the Magnaporthe oryzae fungus and was discovered in Brazil in 1985. The fungus attacks the leaf of the crop and eats its chlorophyll, thereby affecting the plant's growth. In recent times, due to temperature rise caused by climate change has contributed to the spread of the fungus.

The Food and Agricultural Organization (FAO), a United Nations agricultural agency has called for International collaboration on wheat rust to curb threat to global supplies.

Four New Miniature Frog Species Discovered

Scientists have discovered four new species of miniature frogs no bigger than a human thumbnail in Western Ghats, a global biodiversity hotspot. These species were discovered among the seven new 'Night Frogs' by a team of researchers from the University of Delhi and Kerala Forest Department.

Four new species of miniature night frogs are

(i) Athirappilly Night Frog: It was discovered close to the Athirappilly waterfalls.

(ii) ***Sabarimala Night Frog :*** It was discovered near the Sabarimala hill shrine.

(iii) The Radcliffe's Night frog and

(iv) ***Kadalar Night Frog*** were reported from plantation areas.

Night Frogs belong to the Nyctibatrachus genus, endemic to the Westem Ghats. They make a distinctive chirping sound comparable to that of a cricket. These tiny amphibians are present in abundance in the region but were overlooked in the past because of their extremely small size, secretive habitats and insect-like calls.

ROBOTICS

BRABO, Industrial Robot Developed by a Tata Company

- TAL Manufacturing Solutions Limited has unveiled India's first 'conceptualized, designed and manufactured articulated industrial robot' called "BRABO".
- The robot will be easy to install, use, program and maintain. It comes with low-cost power transmission system. It will be able to work on single phase power supply suitable for MSMEs. It has an inbuilt programmable logic controller and can act as a virtual controller for simulation.

SREP Robot Developed by NIO

Scientists at CSIR-National Institute of Oceanography (NIO) have developed a robotic platform, Seabed Resident Event Profiler (SREP) that is capable of being stationed at any water depth from 0-200 metres to track the oceanic processes. The robot has been designed to regularly record the water column information at every 10 to 25 cm during every profile four times a day.

The SREP robot has been designed particularly to carry out studies related to the monsoon, global climate and upwelling.

Cyber Physical System

The Department of Science and Technology (DST) under union Ministry of Science and Technology has initiated a Cyber Physical Systems (CPS) programme with a financial outlay of Rs. 3000 crore.

Cyber Physical Systems (CPS) refers to a physical system which is controlled by a computer programme/ algorithm that has been closely integrated with internet and its users.

CPS follows an interdisciplinary approach in which cyber technology vs combined with conventional knowledge areas such as physics, electronics, communication, aviation, etc. on real-time basis. Smart electricity grids, robot-executed surgeries, self-driving cars and unmanned Aerial Vehicles WAV)/Drones are some examples of CPS.

At 104th Indian Science Congress in Tirupati, Prime Minister Modi referred to cyber physical systems as a challenge which can have a negative of CPS may take away jobs from employable youth and thereby snatching away India's demographic dividend. It is suggested that by training the workforce in areas of robotics, Internet-of-Things, quantum communication, artificial intelligence and digital manufacturing this threat can be converted into a golden opportunity for our youth.

Bharat QR Code

The Union Government has launched Bharat quick response (QR) code which has been developed jointly by National Payments Corporation of India (NPCI), Visa, MasterCard and American Express under instructions from Reserve Bank of India. It is world's first interoperable payment acceptance solution that facilitates acceptance of Aadhaar-enabled payments and Unified Payments Interface (UPI). It is expected to boost digital payments (less-cash economy) without card swiping machines.

- QR code is a two dimensional (matrix) machine-readable code made up of black and white square used to store information liked URLs, Phone Numbers, etc. This code can be read by the camera of a smartphone.
- QR Code can store up to 7089 digits as compared to conventional bar codes which can store max 20 digits.
- It stores amount of data in one-tenth the space of a traditional bar code.
- It has error correction capability and data stored in it can be restored even if it is partially damaged or dirty.

Cyber Swachhta Kendra

The Union Ministry of Electronics and Information Technology (MeitY) has launched Cyber Swachhta Kendra as a part of Digital India initiative to create

a secure cyber space by Botnet cleaning and Malware analysis. It complies with the objectives of the National Cyber Security Policy, 2013, which aims at creating a secure cyber space system in the country.

Cyber Swachhta Kendra is being operated by the Indian Computer Emergency Response Team (CERT-in) under provisions of Section 70B of the Information Technology (IT)Act, 2000. It operates in close coordination and collaboration with Internet Service Providers (ISPs), academia, banks and Product and Anti-virus.

Malware is malicious software which is specifically designed to disrupt or damage authorized access to a computer system. It is an umbrella term used to refer to a variety of terms of hostile or intrusive malicious software including computer viruses, warms, trojan horses, spyware, ransomware, adware, scareware, etc.

Botnet is a network of private computers with malicious and controlled as a group without the owners' knowledge. Such infected computer is referred to as a zombie. It is used to steal data and send spam.

Besides, some cyber security tools were also launched. They are

- ***USB Pratirodh :*** It is a desktop security solution to protect from USB mass storage device threats.
- ***AppSamvid :*** It is a desktop solution to protect systems by allowing installation of genuine applications through white listing. It helps in threats from malicious applications.
- ***M-Kavach :*** It is an indigenously mobile application to address the security threats in mobiles.

HEALTH

Traditional Medicines :

More than 3 Lakh Formulations from the Texts of AYUSH System Digitalized

As per the information provided by **Department of Industrial Policy & Promotion (DIPP), 204 Patents have since been granted on formulations/ processes/ products of herbs / plants. DIPP has further stated** that **Patents are issued on inventions that satisfy the patentability criteria as laid out in the Patents Act, 1970.** As per the **Patents Act 1970 (as amended), patents can be imparted only to new formulations based on products related to herbs/ plants or processes related thereto, which are not in public domain and fulfill the criteria of patentability.**

The **Drugs and Cosmetics Act 1940 and Rules 1945,** does not have any provision for registration of Ayurvedic formulations. To protect **Traditional Medicinal Knowledge of India,** the **Ministry of AYUSH** has **created Traditional Knowledge Digital Library (TKDL)** in **collaboration with Council for Scientific & Industrial Research (CSIR) for digitalization of traditional medicinal knowledge. More than 3 lakh formulations from the texts of Ayurveda, Unani and Siddha Systems have been digitalized till date under TKDL** to **protect Traditional Knowledge from misappropriation by providing defensive protection.**

This information was given by the Minister of State (Independent Charge) for AYUSH, Mr. Shripad Yesso Naik in a written reply to a question in Lok Sabha on December 9, 2016.

Superbugs :

Superbugs

The World Health Organisation is warning new antibiotics urgently need to be developed to combat 12 families of bacteria posing a threat to human health. The WHO said many of the bacteria have evolved into superbugs that are resistant to antibiotics.

What earns bacteria the title "superbug"? Bacteria can carry genes that allow them to survive exposure to the antibiotics we currently have. This means that infections caused by these bacteria are harder to treat, although they are not necessarily more severe or infectious. What is concerning is that the gene that carries antibiotic resistance can be passed between bacteria, allowing for the creation of bacteria that carry resistance genes to many different antibiotics, a superbug.

Overusing antibiotics is a major cause of antibiotic resistance, as is incorrectly taking antibiotics you have been prescribed.

Recently, scientists from University of Western Australia have successfully mapped three-dimensional molecular structure of EptA protein that causes multi-drug resistance by masking bacteria from both the human immune system and important antibiotics. Thus EptA protein is

responsible for bacteria being tagged as superbug.

The shape of protein was mapped using technique called X-ray crystallography which is mainly used for determining the atomic and molecular structure of a crystal.

This mapping is a breakthrough because it will allow development of a drug to prevent superbugs hiding from medication. Thus, it opens door to combating the threat of antibiotic resistance and is considered as a huge step forward in the global fight against superbugs.

BIO-TECHNOLOGY

CRISPR-Cas9 Technique

CRISPR-Cas9 is a unique technology that enables geneticists and medical researchers to edit parts of the genome by removing, adding or altering sections of the DNA sequence.

This gene editing technology has the potential to revolutionise the treatment of blood diseases, tumours and other genetic diseases. It is faster, cheaper and more accurate than previous techniques of editing DNA and has a wide range of potential applications.

CRISPR short form of clustered regularly interspaced short palindromic repeats. It allows scientists to selectively edit genome parts and replace them with new DNA stretches. CRISPR is a collection of DNA sequences that direct Cas9 where to cut and paste.

Cas9 is an enzyme that acts as a pair of 'molecular scissors' that can cut the two strands of DNA at a specific location in the genome so that bits of DNA can then be added or removed.

Biobag- Artificial Womb

Researchers have created a fluid-filled transparent container called the Biobag to simulate how foetuses float in amniotic fluid inside the uterus of their mothers.

Researchers tested five lambs with a biological age corresponding to 23-week human premature babies in the artificially created womb like device.

After four weeks, the lambs were seen opening their eyes, started growing wool, breathe and swim. In a sum, the results were found very promising.

The artificial wombs can facilitate development of premature babies in a uterus-like environment. The womb-like environment will offer them a better chance of healthy survival. At present, the premature babies are hooked to ventilators and other machines inside incubators. Premature babies have high risk factor for getting serious disabilities such as cerebral palsy. One of the biggest risks the premature babies face is that their lungs are not ready to breathe air. When they are hooked to ventilators there is a high risk of lifelong lung damage.

Biodegrading Plastic Waste

Scientists from Chinese Academy of Sciences (CAS) have identified a soil fungus Aspergillus tubingensis that uses enzymes to rapidly break down plastic materials. In order to grow on plastics, it secretes enzymes on the surface of the plastic which break the chemical bonds between the plastic molecules, or polymers. This fungus also uses the physical strength of its mycelia (the network of root-like filaments) to break apart the polymers.

In another discovery, the wax worm, the larvae of insect Galleria mellonella, is found to possess the ability to biodegrade polyethylene, which is one of the toughest and most used plastics. Wax worms live as parasites in bee colonies and are commercially bred for fishing bait.

Significance of the discoveries

The conventional plastic waste disposal through burying, recycling, incineration or other methods are unsustainable, degrade the environment, costly and result in toxic by-products, which are hazardous to human health. It is estimated that a trillion plastic bags are used every single year. These discoveries could be used to come up with a biotechnological solution for managing plastic waste that threatens our environment in sustainable, safer and more effective way.

NANO TECHNOLOGY

Stretchable Integrated Circuit (IC)

Researchers from US based Michigan State University have developed the first stretchable integrated circuit (IC) made entirely using an ink jet printer. This elastic material is made up of several materials fabricated from nanomaterials and organic compounds. These compounds are dissolved in solution to produce different electronic inks, which can easily run through printer to make devices.

An integrated circuit (IC), also called a chip or microchip, is a semiconductor wafer on which thousands or millions of tiny resistors, capacitors, and transistors are fabricated. An IC can function as an amplifier, oscillator, timer, counter, computer memory, or microprocessor.

Benefits : As the material is produced using a standard printer, it has a major potential cost advantage over current technologies that are expensive to manufacture. Besides, stretchable electronic fabric can be easily folded and put in one's pocket without breaking. Its potential applications are the following :

- They can be used in smart tablet that could be stretched in size, from small to extra-large.
- They can be used in wearable electronics like rubber band-like wrist monitor that measures the wearer's heartbeat, soft robotics applications and wallpaper that turns an entire wall into an electronic display.

GraphAir Technology

Scientists from Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) have developed a novel "GraphAir technology' which transforms soybean oil, a renewable, natural material into graphene films in a single step. Graphene thus produced is commercially more viable. Earlier, graphene was produced in a highly-controlled environment with explosive compressed gases that required long hours of operation at high temperatures and extensive vacuum processing. This production process was costly and was major roadblock in its commercialisation.

Significance : This unique technology makes graphene fabrication fast, simple, safe, potentially scalable and integration friendly. It results in good and transformable graphene properties, comparable to graphene made by conventional methods. It is expected to reduce cost of graphene production and improve uptake in new applications. Besides, it can also help to produce graphene from waste oil, leftover from cooking.

Graphene is a carbon material that is one atom thick. It is the world's strongest and lightest known material derived from carbon. It has high conductivity and excellent electronic, mechanical, thermal and optical properties. It is used in many applications ranging from miniaturised electronics to biomedical devices, water filtration and purification, renewable energy, sensors, personalised healthcare and medicine, etc. It is also used to improve battery performance in energy devices and to produce cheaper solar panels.

MISCELLANEOUS

Thubber

Scientists have developed novel rubber like material nicknamed 'thubber'. Thubber is an electrically insulating composite material that exhibits an unprecedented combination of metal-like thermal conductivity, elasticity similar to soft biological tissue.

Thubber consists of a soft elastomer with non-toxic, liquid metal microdroplets suspended within it. This semi-liquid state allows the metal to deform with the surrounding rubber at room temperature. When it is pre-stretched at room temperature, it stretches up to six times its initial length. During this phase, liquid metal microdroplets form into elongated pathways through which heat can easily travel through. At the same time, the material is electrically insulating.

Potential Applications :

In developing wearable computing and soft robotics, athletic wear and sports medicine and in advanced manufacturing, energy, and transportation.

Japan Officially Recognises Bitcoins

Bitocoins were in news as Japan has officially recognized bitcoin and digital currencies as legal money along the lines of other fiat currencies with effect from April 1, 2017.

The recognition means 'Bitcoin exchanges' will come under additional regulatory scrutiny from governing banks and financial institutions. They will be required to comply with strict anti-money laundering (AML) and Know Your Customer (KYC) requirements, along with annual audits. Other requirements include meeting the stated capital and cyber security requirements to ensure consumer protection.

Bitcoin is a form of digital currency, created and held electronically. It is the first example of a growing category of money known as cryptocurrency. It is digital currency that can be transferred from one person to another through internet without the middle men like Banks. It is just like emails which have replaced the postbox letters. This implies there is no transaction fees or brokerage cuts. Further, there is no regulation or filling up applications or forms to do in order to transact in bitcoins implying its open source. Its value is ever fluctuating.

Bitcoin has several important features that set it apart from government-backed currencies.

1. It is decentralized: The bitcoin network is not controlled by one central authority. Every machine that mines bitcoin and processes transactions makes up a part of the network, and the machines work together. That means that, in theory, one central authority canot tinker with monetary policy and cause a meltdown.

2. It is easy to set up: You can set up a bitcoin address in seconds, no questions asked, and with no fees payable.

3. It is anonymous: Users can hold multiple bitcoin addresses, and they are not linked to names, addresses, or other personally identifying information.

4. It is completely transparent: Bitcoin stores details of every single transaction that ever happened in the network in a huge version of a general ledger, called the blockchain. If you have a publicly used bitcoin address, anyone can tell how many bitcoins are stored at that address. They just do not know that it is yours. There are measures that people can take to make their activities more opaque on the bitcoin network, though, such as not using the same bitcoin addresses consistently, and not transferring lots of bitcoin to a single address.

5. Transaction fees are miniscule: Your bank may charge you a £10 fee for international transfers. Bitcoin does not.

6. It is fast: You can send money anywhere and it will arrive minutes later, as soon as the bitcoin network processes the payment

7. It is non-repudiable: When your bitcoins are sent, there is no getting them back, unless the recipient returns them to you. They are gone forever.