NOTES

Defence Technology

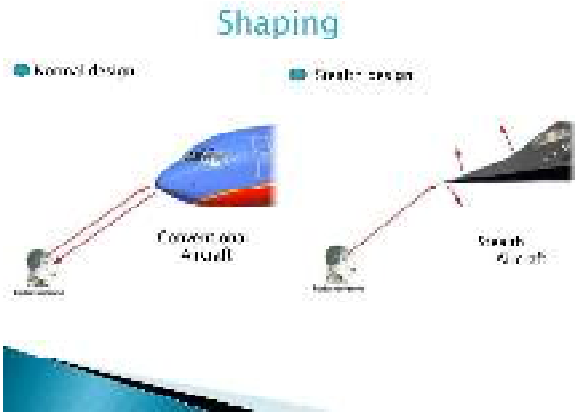
Weapon Innovation :

1. Stealth Technology - Also called Low Observable Technology. It includes a variety of techniques used with personnel air craft, ships, submarines, missiles and satelites which make them less visible to invisible to impossible to radar, infrared, sonar and other detection methods.

There are two ways to make something undetechtable

(1) Shape of the object

(2) Coating it with special paints:



Germany began developing stealth technology during world war-II

Horten Ho 229 __ 1st Stealth **Aircraft**

Well Known modern examples of US Stealth aircraft include

F-117 Nighthawk B-2 Spirit

F - 22 Raptor & F - 55 Lightening II

NOTES

Skjold class patrol boat - 1st Stealth Ship

Horten Ho - 229

F-117 Nighthawk

B-2 Spirit

F - 22 Raptor &

F - 55 Lightening II

Skjold class patrol boat

Unmanned Aerial Vehicles :

also known as drones are aircrafts controlled from ground or they may They are be autonomously following a pre-programmed mission. They are mainly of 2 categories.

(1) Those used for reconnaissance and surveillance purposes

(2) Those that are armed with missiles and bombs.

Benefits of using drones :

(i) It can stay aloft for many hours, unlike manned aircraft

(ii) Much cheaper than millitary aircraft.

(iii) being flown under remote control, the flight crew faces no danger.

Armed drones were first used in Balkan War.

Implications.

Use of drones is not combat as much as 'Targeted Killing' a preference to kill rather than capture individuals.

NOTES

Another disturbing aspect is the extent to which operators become trigger happy with remote controlled armaments.

Missiles:

''A Missile is ''any object that is thrown.''

Difference between a Missile and a Rocket :-

``Missile`` is a self-propelled guided weapon system rather than an unguided self-propelled munition reffered to as ``Rocket`` There are four system components in a missile.

(1) Trageting and/or Guidance.

(2) Flight system

(3) Engine

(4) Warhead

Missile can be categorized as **- by thier purpose**

(1) Surface to Surface

(2) Air to Surface- Which can be ballistic (falling totally under gravitation) cruise (unmanned self-contained bombs), anti-ship, anti-tank etc.

(3) Surface to air missiles- Which can be anti-air craft and anti ballistic missiles and anti-satellite missiles and missiles are subcategorized as-

- Short
- Medium
- Intermediate
- Inter-Continental

Ballistic Missiles : are largely used for land attack missions they are primarily surface launched from mobile launchers like silos, Ships or Submarines.

It's trajectory is largely unpowered and governed by gravity.

Long range Intercontinental Ballistic Missiles (ICBM):-

- Spends most of the time out of the atmosphere.

A ballistic missiles's trajectory consists of three parts :-

(1) The powered Flight portion

(2) The free flight portions (which consitutes most of the time)

(3) The re-entry phase

Short Range Ballistic missiles - Stay within the atmosphere of the Earth.

Cruise Missile :

- Is basically a small, pilotless airplane.
- Delivers a highly explosive bomb to a precise location.
- When the bomb explodes the missile is destroyed

Unlike ballistic missiles, a cruise missile is aerodynamically guided in powered flight.

NOTES

Categories of ballistic Missiles : & their ranges ;

(i)	Tactical Ballistic Missile -	(TBM)	150-300 Kms.
(ii)	Short-range Ballistic Missile - or less	(SRBM)	1000 km
(iii)	Medium-range Ballistic Missile - less than	(MRBM)	100 km
(iv)	Intermediate Range Ballistic Missile or Long Range Ballistic missile -	(IRBM)	3500 - 5,500 km.
(v)	Intercontinental Ballisitic Missile - greater than	(ICBM)	5,500 km
(iv)	Submarine Launched Ballistic Missile Intercontinental range	(SLBM)	

Theatre Ballistic Missile - Collective term for SRBM & TBM, MRBM & LRBM - can deliver nuclear weapons.

Defence R & D in India

Aim - achievement of self-reliance

Research co-ordination

The responsibility of developing India's defence technology is assigned to DRDO- i.e. the Defence Research and Development Organization.

It was set up in 1958

The Department of Defence Research and Development (DDRO) administers the DRDO and its 50 laboratories.

Ballistic Missiles India

Agni Missiles :

• Ballistic Missiles carrying nuclear warhead.

• Classified into 3type viz. MRBM, IRBM & ICBM

The Integrated guide missile development programme (IGMDP)

• Agni Missile :

Name	Type	Range	Status	Type
Agni-I	MRBM	700-1200	Deployed	Surface to Surface
Agni-II	IRBM	2000-2500	Deployed	Surface to Surface
Agni-III	IRBM	3000-5000	Deployed	Surface to Surface
Agni-IV	IRBM	2500-3700	Deployed	Surface to Surface
Agni-V	ICBM	5000-800	Tested	Surface to Surface
Agni-VI	ICBM	10000-12000	Under Development	Surface to Surface

Agni-I, II, III Missiles were developed under the IGMDP

Agni-IV + Agni V – are high accuracy Ring Laser gyro based

NOTES

Inertial Naviation system (RINS) and the most modern and accurate Micro Navigation System (MINS)

Prithvi Missiles : Surface to Surface (SRBM)

Name	Range (Km)
Prithvi- I	150 km
Prithvi- II	150 - 350 km
Prithvi-III	350 - 650 km

- **Dhanush** is the naval variant of Prithvi Missile-Sea to Surface
- **Prithvi - II** 1st missile developmed by DRDO under IGMDP

Prahaar:

- A Solid fuelled Surface to Surface Missile with range of 150 km
- Equipped with omnidirectional warheads and could be used for striking both tactical & strategic targets.
- **India Sea based Nuclear Armed Ballistic Missiles:**
  Surface to Surface

SLBM

Name	Range (Km)
Dhanush	350 km
Sagarika K15	700
K4	3500
K5	6000

``**Shourya**`` is the Land Version of Sagarika K15.

Surface to Air Missiles of India

Name	Feature	Range Km
Akash	Surface to Air	30 km
Trishul	—"—	12km
Maitri	—"—	15km

NOTES

Akash

Trishul

Maitri

Akash Air Defence Missile System:

- Medium Range Surface to air missile viz. Approx 35.km
- Can employ multiple air targets wnile operating in fully
- autonomous mode.
- can be launched from static or mobile platforms
- can carry conventional & nuclear warheads.
- can operate inall weather conditions
- developed under IGMDP by ISRO

LRSAM - India Israel joint venture missile

- Long Rage Surface to Air missile - called **Barak - 8** missile in Israel.
- Can take down an incoming missile as close as 500m. away **Intergrated Guided Missile Development programme (IGMD)**
- Prithvi - Short range surface to surface + Naval Variant (Dhanush)

  Trishul - Short range low level surface to air missile.

  Akash - Medium Range surface to Air Missile

  Nag - Third generation Anti-tank missile

  Agni - Only I, II, & II

Anti-Tank Missiles Inida

Nag :

- ''Fire and forget'' anti-tank missile
- All weather missile with a range of 3 to 7 km.
- Uses imaging (IIR) guidance with day & night capability
- Can be mounted on an infantry vehicle.

  A variant of NAG missile to be launched from helicopter is being developed under the project named ``HELINA'' (HELI Copter Launched NAG)

NOTES

Cruise Missiles India

Brahmos Missiles ;

- Can be launched from submarines, ships,aircraft or land (Cruise Missile)
- Presently worlds Fastest Cruise missile in operation (Brahmos)
- Brahmos - Mach 2.8 & Supersonic (Ruise Missile developed) in collaboration with Russia-300km.
- Brahmos 11- mach 7 hypersonic cruise missile in develpment collaboration with Russia.

Nirbhay:

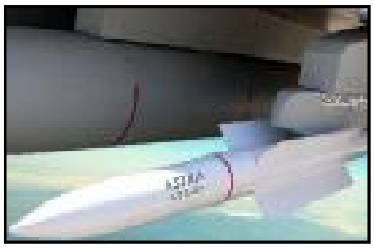
- 1st Long Range Subsonic cruise Missile
- Can be launched from land, sea and air (Cruise Missile)
- a ring laser gyro scope for high accuracy navigaton and a radio-altimeter for the height determination
- Strike range - 1000 km

From Integated Test range at wheeler Island, Chandipur Odisha by SFC, monitored by DRDO.

Air to Air Missile

Astra Missile - India's 1st Air to Air BVR :

- Beyond Visual Range Air to Air missile; smallest DRDO developed missile:
- Capable of engaging targets at varying range and altitude allowing for engagement of both short range targets (up to 20km) and long range targets (upto 80 kms) using alternative propulsion modes.



Unmanned Aerial Vehicle

Panchi

- Wheeled version of Unmanned Aeriel Vehicle (UAV) Nishant Capable off taking of and landing using small airstrips.
- Have all the surveillance capabilities of UAV nishant + longer endurance as it doesnot have to carry the air bags and parachute system as in the case of UAV Nishant.

NOTES

Nishant UAV : Remote piloted Vehicle) RPV.

- A multi-mission UAV with Day/Night operational capability, Inducted in Army.
- Designed for battfleield surveillance, targets tracking & localization, and artillery fire correction.
- Controlled from a user friendly Ground Control station + image processing system to analyze transmitted images from UAV.
- earlier called the Falcon

Netra

- Light weight (1.5 kg) Outonomous UAV designed for surveillance and reconaissance operations
- Developed by ideaforge + DRDO
- Made of carbon fibre composites
- Has no moving parts

Ahemdabad became the first city to use UAV for crowd management in 2013

India's Cold Start Doctrine

- Though officially denied, it's an offensive doctrine by the indian strategic establishment.
- Aimed at reducing mobilization time improved network centric warfare capabilities.

Goal.

- To establish the capacity to launch a retaliatory conventional strike against Pakistan that would inflict significant harm on the Pakistan Army before the international community could intercede.
- At the same time pursue narrow enough aims to deny Islamabad a justification to escalate the clash to the nuclear level.
- Offensive operations could begin within 48 hours after order have been issued. Such a limited response time would enable India forces to surprise their Pakistani countrerparts.

Missile Defence System

- Two tier missile defence system.
- It will destroy an incoming missile outside the earth's atmosphere and if it fails it will go on to intercept it withing the atmosphere
- Strike range - 2000 km

India's Advanced Air Defence - (AAD) tested in 2014

The Pinaka Rocket Launcher : Multi-barrel rocket launcher It is a mobile system with 12 solid propellant rockets capable of delivering

NOTES

"Saturation fire over targets that cannot normally be engaged by artillery guns.

It is contemporary with other systems, any where in the world.

Radar Systems of India.

- Indra - Low flying detection radar
- RANI & RASHMI - 2nd generation navigational radar
- APARNA - Surveliillance & Control Radar
- RAWS-03 - Naval fire Control Radar.

Precision Coherent Monopulse C Band Radar (PCMC) for tracking satellites and Other high speed Object.

Arjun - India MBT

- Indigenously built Main Battle Tank.
- Rated among top-3 MBT's in the world
- Top Speed - 70 kms / hr
- Can climb a gradient of 35^{O} for deployment in the Rajasthan sand dunes.
- can overcome ``ditch cum bund`` defences often encountered in riverine tracts.
- Arjun has an armour plating of composties called ''Kanchan'' successfully developed in India which is able to resist anti-tank missilles.

Tejas : - Light Combat Aircraft - LCA

- Same class as F-16 of USA
- First indigenously built LCA
- Project by DRDO and Hindustan Aeronautics Limited
- Tejas is the smallest, light weight, single engine, single seat and supersonic, multirole, combat aircraft.
- It's four variants include combat, trainer and naval.
- Advanced glass cockpit open architecture system complements, piloting.
- cost is around 200 crores.

NOTES

NanoTechnology

Definition - Nano The Greek word for 'Dwarf' indicates 1 billion i.e. 10^{-9} of Something.

Nano Science is an emerging area of science which concerns itself with the study of atoms, molecules and objects whose size is on nm scale.

Chronological Recap:-

The concept was first introduced in 1959 by an American scientist 'Richard Feynman' in his famous lecture 'There is plenty of room left at the bottom.

The term Nano Technology was defined by Tokyo Science University Proffessor 'Norio Tanigerchi' in 1974.

The technological significance of Nano Scale was promoted by Dr. K. Eric Dexler in his Famus book ' Engine of Creation: The coming Era of Nano Technology.

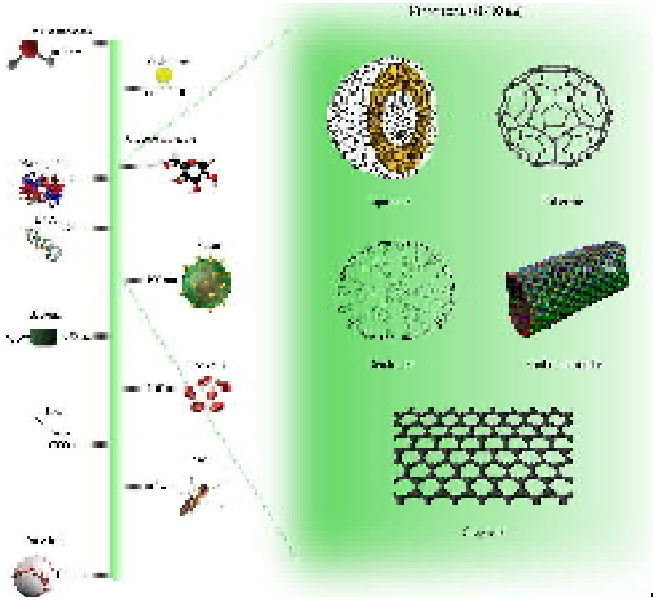
Process/ Method: - The two methods that are used in NT are Top Down & Bottom Up approach.

Top Down : In this nano object are constructed from larger entities. It is expensive and time consuming.

Bottom Up : This apporach builds larger structure by linking atom by atom using special molecular assemblers. Materials reduced to a Nano Scale can show different properties compared to what they scribe on macro-scale, enabling unique application.

Nano Materials : - 2 types

Organic Inorganic



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Organic Consists of carbon Nano tubes & Inorganic Nano material consisting of metals and their oxides.

The vastly increased surface area to volume ratio leads to alteration of physical, thermal and catculatic properties of Nano materials.

Carbon Nanotubes:- They are graphite sheet rolled to form a cylindrical Nano-tube. These are hollow, tubular and cage molecules.

Unique Properties of carbon Nano Tubes (CNT):

Strength: CNT are the strongest and stiffest material on earth in terms of tensile strength. They are 100 times stronger yet 6 times lighter than steel.

Electrical Properties: CNT can carry 1000 times more electric current than an equivalent copper or silver wire and they are regarded as ideal component for electric circuit.

Thermal Property: CNT are very good thermal conductor along the tube while good insulator laterally to the tube. The temperature stability of CNT is up to 2800^{O}C in Vacuum.

Application of Carbon Nano Tubes:

IT and Electronics :

- Tiny transistros of CNT will help in developing Nano Ciruits.
- Which will lead to further miniaturization of computer making them even more faster and compact.
- Which will increase data storage density of hard disk.
- replacing cathode ray tube by carbon Nano tube will lead to production of display with low energy consumption.

2. Industriy :

(a) Heavy Industry: Lighter and stronger carbon NT are of immense use to aircraft manufacturer leading to increasel performance.

(b) Automobile: Will have manufacturing stronger yet lighter anti-scratch and rust proof automobile component.

Increase in surface area of combustion engine will make utillize fuel more efficiently and reduce the exhaust of pollutants.

(c) Textile Industry: Nano fiber makes cloth water and stain repellant and worinkle free.

Nano fibers will be stronger than the stronger natural spider silk fibers.

Can be used to make strong bulet proof Jakcet.

In the field of health and medicine:

NT lead to a new branch of medicine called Nano-Medicine. It helps in diagnosis of disease, drug delivery, treatment and time engineering.

(i) Diagnosis - Lab-on-a-chip, device deals with handling of extremely small fluid valume even in picometres (10^{-12}) this low fiuid volume comsumption produces less wastge requires less volume of sample for diagnosis, lowers re-agents cost and the analysis is faster.

(ii) Drug Delivery: Formation of Nano-size Drugs help in lowering overall drug consumption and side effect by depositing active agent at specific places in the body there by ensuring drug delivery with cell precison.

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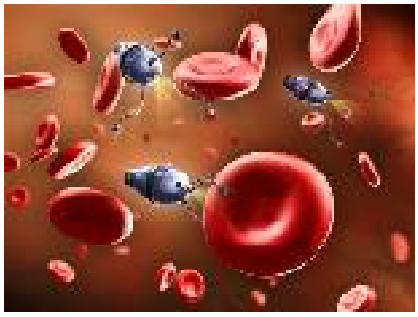
Cancer Diagnostic and treatment: It can locate and then eiminate cancer cell using 'Gold Nano Shell'

It can help to repair damaged tissue through tissue engineering thus making healing faster.



(iv) Nano Robotics : - The Nano size robots can navigate the human body, transport important molecules, manipulate microscopic object and communicate with physician by way of miniature sensors.

4. In the field of energy : It not only promotes the use of renewable and environment friendly sources of energy but also increases the efficiency of energy production by them.

Indium Selenide Nano particles can be used in making efficient solar cells.

Smart Windows : Having Nano coating of Vandium dioxide and Tungsten metal act as heat reflector although still letting all visible light to pass through the window. This makes offices and homes remain cool without the excessive use of air conditioning there by dramatically redcuing cost both financially and environmentally.

5. Field of Environment: Nano Filtration can be helpful in waste water treatment, producing safe and clean drinking water.

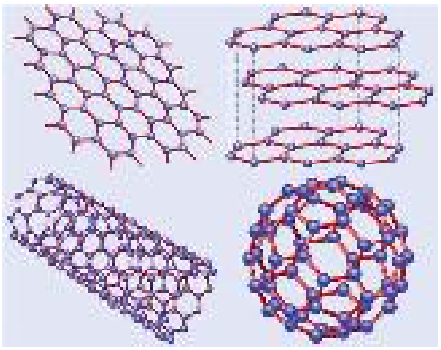
- highly effective in removing arsenic from ground water.
- Lanthanum Nano Particle absorbs phosphate from aqueous environment as a result preventing the growth of algae.

6. Agriculture: It can revolutionize agriculture sector by becoming an integral part of ' Precision Farming'. It is a site specific farm manaqgemt using information technology bundles to maximize output (crop yield) while minimizing input (Fertilizers and pesticides etc) through monitoring environment variables and applying trageted action.

Precision farming makes use of com puter GPS and remote sensing device to measuring highly locallized environment.

GRAPHENE :

- It is one of the thinnest, strongest two dimensional materials. It is only one atom thick.
- It is a two dimensional material consisting of a single layer of ' Carbon atom' arranged ina honeycomb or chicken wire structure produced through a process called mechanical exploliation.



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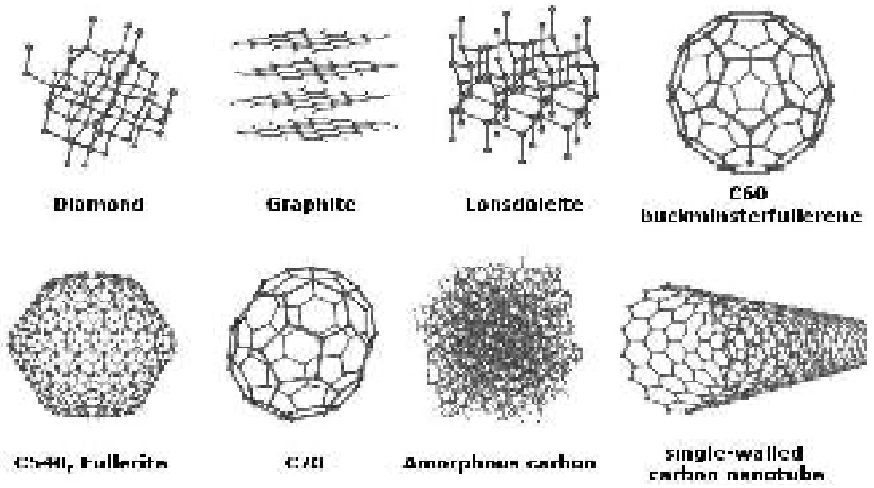
- It is the thinnest material known and yet it is also one of the strongest.
- It is an allotrope of carbon.
- It is 200 times stronger than steel, but it is incredibly flexible.
- It is a better conductor than copper of electricity.
- It is transparent and a good conductor of heat also.

Applications: are used in many applications such as materials science, electronics and nanotechnology like (Nanotubes, Megatubes, Polymers, nano-onions) and fullerene rings etc.

Implication of Nano Technology :

Significant environmental, health, & Safety ethical & Social issues might arise due to the development of Nano technology. The Potenatial risk of NT can be broadly grouped into 4 areas.

Allotropes of carbon :



Allotropes - Different forms of a chemical element found in its natural state.

Some allotropes of carbon are.

(a) Diamond - hardest naturally occuring substance Only a diamond can cut a diamond.

(b) Graphite

(c) Lonsdaleite

(d-f) Fullerenes (C60, C540, C70)

(g) amorphous carbon

(h) carbon nanotube.

Enviromental Issue : NT may lead to Nano Pollution which includes all the waste generated by manufacturing of Nano naterials & Nano devices. Due to it's extremely small size nano waste can float in the air and might easily penetrate animal and plant cells cauisng undersirable effects.

Health Issue: Nano Particles being slowly degradable may accumulate inside the body & because of thier large surface area may get adsorbed on the surface of tissues & fluids which may affect regulatory mechanism enzgymes and other proteins.

3. Soucial Issues & Nano Ethics : NT can worsen the division of rich & poor by creating Nano divide- NT has the potentioal to destabillize the

NOTES

international relations through Nano arms race as there is possibility of millitary applications in NT in biological and chemical warfare.

4. Gray Goo : It s a hypothetical end - of the world scenario involving molecular nano technology in which out of control self-replicating robots consume all biomass on earth while building more of themeselves, a scenario that has been called Ecophagy. The term was coined by Eric Drexler in his 1986 book Engines of creation.

Nano Technology in India.

In India Department of Science & Technology (DST) of central government has annouced a national initiative in Nano Materials.

Nano Mission : In 2007, a mission on NS & NT has been approved by GOI which aims at making India a world class center for NT. The govt. Sanctioned a sum of Rs. 1000 Crore for a period of 5 years for the mission.

DSt is the nodal agency for implementing the mission.

Objectives of Nano - Mission

Basic research promotion.

Infrastructure development for NS & NT research

Human resource development.

International collaborations.

NOTES

Information Technology

Information : When data is put into a meaning and useful context, it is called information.

Signals- Words, Pictures, sounds whatever we choose to carry information, are know as signals. with the invention of telephone - signals can travel in electrical pulses on a wire.

Information Technology → Computers + Telecommunication

Electronics : basis of IT, which encompasses the co-ordinated use of computers and communcation systems.

Electronics treats elecric current chiefly as the means of carrying information.

To serve as energy used to run electronic devices like motors bulbs, etc. current must by steady and unchanging.

To serve as a signal carrent must vary in some way There are some electronic devices that changes and modifies electric current Others interpret the signal.

Signals may be classified as :

(1) Analog **(2) Digital**

Comparison between analog & Digital Signal

Basis for Comparison	Analog Signal	Digital signal
Basic	An analog signal is a continuous wave that changes over a time period	A digital signal is a discrete wave that carries information in binary form.
Representation	An analog signal is	A digital signal is

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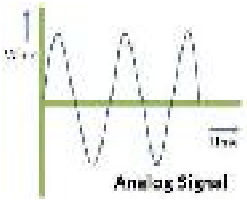
Basis for Comparisom	Analog Signal	Digital signal
	represented by a sine wave 	represented by square waves 
Discription	An analog signal is described by the amplitude period and frequency & phase	A digital signal is described by bit rate and bit infervals
Range	Analog Signal has no fixed range	Digital Signal has finite range i.e between 0 and 1
Distortion	An analog signal is more prone to distortion	A digital signal is less prone to distrotion.
Transmit	An analog signal transmit data in the form of a wave	A digital signal carries data in the binary form i.e. 0 and 1
Example	The human voice is the best example of an analog signal	Signal used for transmission in a are the digital signal
Fiexibility	Analog Hardware is not Flexible	Digital hardware is Flexible in implementation
Uses	Can be used in analog devices only. Best suited for audio and video transmission.	Best suited for computing and digital electronics.

Semi-Conductors : The fast and reliable control of both digital and analogue singals by electronic equipments is achieved with the help of semi-conductors.

Doping - Semiconductor materials are insulators if they are very pure, but their conductivity can be greatly increaased by adding tiny but controlled amount of impurities. And the process of doing this is called doping.

NOTES

Two types of semiconductors obtained this way :

N-Type - When Silicon is doped with phosphorous atoms which increase the number of negative electons that are free to move through the material.

P-Type- Doping is done with Boron (B) atoms. They create small gaps called ''Holes' and electrons jump from one hole to another for conduction to occur.

When P-Type semiconductor are joined with n-Type semiconductors diode is formed The boundary between them is called a Junction.

Transistor - It is a semiconductor device used to amplify or switch electronic signals or electrical powers.

Integrated Circuit - When more than hundred thousand transistors are put on a singe chip of silicon that is smaller than even a fingernail. such a chip is called IC.

Important Terminologies Telecommunitation

1. GSM - (Global system of mobile communication)

This standard uses 900 MHz and 1800 MHz frequency bands.

(Time division Multiple Access) (TDMA), as a technique of time division of communication channel to increase the volume of data transmitted simultaneously. Advantages of GSM are highter digital voice quality and low cost alternatives such as SMS and MMS.

2. CDMA : Code-Division Multiple Access :

Also known as ''digital mobile technology''

It is a digital cellular technology that uses spread spectrum technique

Unlike GSM that uses TDMA, CDMA doesnot assign a specific frequency to each usesr.

Individual conversations are encolded with a pseudo random digital sequence.

CDMA consistently provides better capacity for voice and data commuications than other commerccial mobile technologies.

The technology is used in ultra-high frequency (UHF) cellular telephone systems in the 800MHz and 1.9 GHS bands.

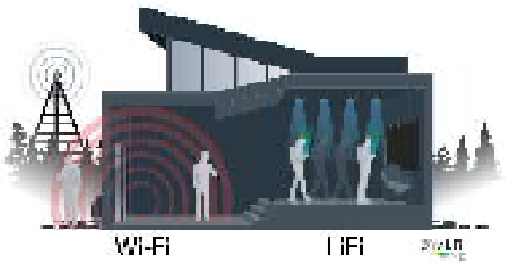
VOIP - Voice Over Internet Protocol.

It is IP enabled technology used for voice calling over internet.

Eg. Skype Yahoo messenger etc.

Lifi- Means Light Fidelity

It is a high speed wireless communication technology that uses visible light to transmit information



Wi-Fi and **LiFi** are similar because both technologies are wireless, but also very different because unlike WiFi relies on radio waves, Lifi uses visible light communication or infrared and near UV spectrum waves.

NOTES

Lifi work using light that is emitted by any regular lamp or bulb.

Advantages

The visible spectrum is 10,000 times larger than the spectrum occupied by radio waves.

A Lifi connection can transmit data at the rate of 224 GBPS

It can prove very useful in areas which are electro- Maganetic sensitive i.e. hopitals, airplane cabins and nuclear power plants.

Disadvantages : It would be useless where there is no light i.e. no internet while lying in bed at night!

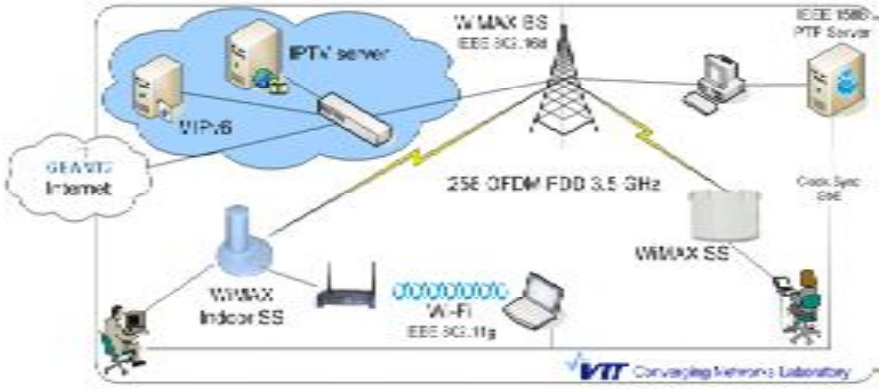
With WiFi router set at a particular place in your house,you can acess it sitting anywhere within the range but with LiFi this is not the case since inmediate vicinity of the source of light is required. to access internet.

High installation charge.

5. Wi-Fi. It is a popular wireless networking technology that uses radio waves to provide wireless high speed internet and network connections.

WiFi alliance owns the registrered trademark Wi-Fi and specially defines WiFi as any ''Wireless Local Area Network'' (WLAN) products that are based on the Institute of electrical and Electroniscs Engineer (IEEE) 802.11 standards'':

6. Wimax : Worldwide Interoperability for Micro wave Access (Wi Max) is an IP based, wireless broadband technology that provides & supports point to multipoint broadband wireless access.



It can provide broadband wireless access upto 50km for fixed stations and 5-15kms for mobile station.

It's uses are :

Providing portable mobile broadband connectivity across cities and countries through a variety of devices.

As an alternative to cabel and digital subscribes line (DSL) for ''Lastmile'' Broadband access.

Providing data, VOIP and IPTV services (Triple Play)

Providing a source of internet conectivity as a part of business continuity plan.

NOTES

7. IPTV: New generation TV that communicates over Internet protocoal.

3. Components: Delivery Network- Over which information is transmitted in the form of packets.

(ii) Setup Box: It is a commucation link between the broadband operator and TV of custormer.

(iii) Customers' TV

Disadvantages: Sensitive to packet loss

Delays if the connection is not fast enough.

8. LTE. Stands for Loling Term Evolution.

It is a wireless broadband technology designed to support roaming internet access via cell phones and handheld devices.

It's achitechture is based on Internet Protocol and it can theoretically support download at the speed of 300 Mbps.

9. Wibro - Stands for wireless Broadband.

It is an internet technology developed by South Korean Telecom industry.

It uses radio waves for a range of 1-5 kms at a speed of 30 Mbps for a wireless point to point communication.

10. GPRS. Stands or General Packet Radio Services.

It is a packet based wireless comunication services that promises data rate from 50 up to 115 Kbps.

Provides instant connection for information to be sent or recieved immediately as the need arises and this is why GPRS users are reffered to as being ''always connected''

11. Spamming It is the swamping of a network with unsolicited postings. Now a days it is reffered to unwanted messages in email.

12. Phishing : it is tricking someone to give confidential information.

(Phish means fish & Phishing means fishing for gullible customers)

Information like bank account,or credit card details, social security numbers and passwords are asked for.

Botnet: Combination of words derived from robot and networks.

It is a collection of Internet connected programmes Communicating with other similar programmes in order to perform tasks.

Botnets compromise computers whose security defences have been breached and control conceded to a third party.

The compromised computer is called a 'Bot''

The controller of these compromised computers is able to able to direct their acitivities.

14. Big Data : A term that describes large volume of structured and unstructured Data.

The commonly used softwares cannot manage and process big data due to it's variety, volume, velocity, value, variability and complexoty.

'Data minig' is required to obtain useful information out of big data.

NOTES

Data mining : it is the process used to derive useful data by analysing data patterns in large batches of raw data.

It is also known as ' Knowledge Discovery in Data' KDD)

GoI constituted a committee under Justice B.N. Srikrishna which came out with a white paper on Data protection framework for India.

Recently government has initiaied various steps for big data collection under following schemes

(1) Aadhar worlds lagrest ID platform.

A 12 digit social security number provided by the GoI to avail marginalized section of society, social benefits, which they previously missed out.

2. Digilocker - a personal storage space provided in the Cloud to Indian citizens for storing the electronic copies of their documents such as driving liscence, voter ID school certificates etc.

Block Chain Technology :

A blockchain is a growing list of records, called blocks, which are linked using cryptography.

It is an open distributed ledger that can record transaction between two parties efficiently and in a verifiable and permanent way.

It is typically managed by a peer - to peer network collectively adhereing to a protocol for inter-node communication and validating new blocks. Once recorded the data in any given block chain cannot be altered retroac tively without alteration of all subsequent block, which requires consensus of the network majority.

Blockchain was invented by Satoshi Nakamoto in 2008 to serve as the public transaction ledger of the cryptocurrency bitcoin.

Cryptocurrency :

It is a digital or virtual currency that uses cryptography for secutity and there fore it is difficult to counterfeit.

It is not issued by any central authority and thats why it is immune to government interference and manipulation.

NOTES

COMPUTERS

Evolution of computers;

'Abacus' was the earliest device which helped in making rudimentary computation.

Blaise pascal a French.Mathematician develped the first calculating machine of sorts in 1642.

Leibniz improved Pascal's machine in 1670 and Leibniz also developed a binary system of mathematics where O & 1 could be arranged to represent all numbers.

Charles Babbage developed the idea of a sort of mechanical computer called the analytical engine in the 1830s.

The first successful computer was built by Herman Hollerith in 1988 for tabulating the results of the United States Census Electricity was used for the first time in this system.

Computer Generations

Generation	Year	Use	Example
1st	1945-56	Vaccume tube	ABC, Z3, Colossus ENIAC, EDVAC, UNIVAC and IBM
2nd	1956-63	Transistor Technology	IBM, 1401, IBM 1620, Programming, RCA 301 and Honey - well - 400
3rd	1964-71	ICC (Integrated Circuit Tecnology	Sperry, Burroughs, DEC, NCR, and Honey well IBM
4th	1971-2018	LSI (Large Scale Present Integration) & VLSI (Very LSI) Chips + Semiconductors	Microprocesor till to date
5th	Present & Beyond.	Recent . Advances	E-Series, Core 17.

UNIVAC-I -Universal Automatic Computer became the first commercially available computer.

IBM introduced the first personal computer in 1981

Parts of a Computer :

Input devices — Processor — memory — Output devices

Input devices

- Keyboard
- Monitor
- Mouse / Track balls (Laptops), Optical Scanners, Disc Drives etc.

Processor :

- CPU - Central Processing Unit- Brain of the computer.
- ALU - Arithmatic and Logical Unit for Arithmatic & Logical Operations.

NOTES

Memory :

• (Random Access Memory)

• RAM - Provides the temprorary working space required by the computer to function. The moment the computer is switched off, everything in RAM is erased.

• ROM : (Read only Memory) Information that computer cannot change without the help of programmer.

The informations is programmed during manufacture and cannot be updated.

Computer Language. -

The efficiency and speed of a computer depends on the set instructions that are fed into it.

These set of instructions are called ''Programme''

The development and writing of such instructions is called computer programming

Programming requires the knowledege of :

(i) a particular programming language.

(ii) a set of procedures (Known as algoriths) to solve a problem or develop software

Programmes can be into the following languages ::

(1) Machine Language :

It is sequence of Instructions in Binary i.E.

0 and 1.

(2) Assembly language : It requires the use of symbols, lettors, digits, and special characters Precison and details is required to run a program.

High Level Language :

Uses the English words such as OPEN, LIST, PRINT which might stand for an array of instructions.

A program written in a high level language is portable i.e. it can be used on several computers with little or no change.

Some high level languag are :

(1) Cobol - Common Business Oriented Language.

(2) FORTRAN - Formula Translation.

(3) BASIC - Beginner's All purpose Symbolic Instruction Code

(4) Pascal - Named after Blaise Pascal.

(5) LISP - List Processing

(6) PROLOG - Programming in Logic

(7) C & C ++

(8) ALGOL - ALGO rithmic Language.

(9) SNOBOL - String Oriented Sym Bolic Language.

(10) JAVA.

Whatever language we use it has to be finally translated into Binary which is the only language a computer can undesstand.

NOTES

The first high- Level programming language to be designed for a computer was Plankalkul. developed by Konrad zuse.

The Translatation of symbolic instructions into machine language is done by software called assemblers or Compilers or interpreters.

Operating system.

It is a software program containing instructions for the operation of a computer .

It controls the input and output devices e.g. Windows and DOS etc.

Types of Computer

Analog Computer : Operates on continuous data, usually of a physical nature, such as length, voltages or currents.

e.q. Thermometers. weighing scales etc.

Digital computer: works on discrete data, quantities are represented in numerical terms. The accuracy of such devices is limited to the number of digit they can display.

e.g. digital thermometers, speed, ometers watchs etc.

Hybrid Computer :

They are a combination of digital and analog computers.

There are some inheren difficulties in both analog and digital computers.

The accuracy of a digital computer can be increased through precise algorithms and certain techniques, the solution time for some kinds of problems cannot be decreased because the computer operates serially, therefore more steps means more time for computation.

On the other hand the basic solution speed is much greater in an analog computer.

''The hybrid computers combine the speed of an analog computer with the accuracy of a digital computer''

Digital types of computer are extensively used in to days world and is further classified into:

Microcomputers : also known as embedded computers. Personal Digital Assitant (PDA), tablets and smartphones are all types of micro computers. It is essentially a micro processor installed in the device.

Minicomputers : Minicomputers are used by small businesses & firms. They are also known as ''Midrange computers'' these are not designed for a single user. Individual departments of a large company or organizations use mini-computers for specific purposes.

Mainframes : Mostly used by large corporation, institutions and government agencies. It can store huge amounts of information and solve complicated problems On a large mainframe, hundreds of people may work simultaneously.

Super Computer : A super computer that is one of the most powerful, Fastest systems in the world at any given point in time.

NOTES

They are most powerful computers in terms of performance and data processing . These are specialized and task speatic computers used by large organizations.

Seymour cray designed the first super computer ''CDC 6600'' in 1964 CDC 6600 is known as the first ever supercomputer.

Presently china's "Sunway Tiahulight." is the world's fastest computer the Tanhe - 2 perfor 100 peatflops i.e. quadrillions of floating point operations per second.

Top 7- Super Computer of the world

(1) Sunway Tiahulight	-	China
(2) Piz daint	-	Switzerland
(3) Tianhe - 2 (Miky way2)	-	China
(4) Titan	-	Cray XK7, Cray Inc. USA
(5) Sequoia	-	Blue Gene / Q, IBM - USA.
(6) K Computer, Fujitsu	-	Japan
(7) Mira Bluegene / Q custome IBM	-	USA

Uses of super computers.

Recreating Big Bang - The biggest Question of all: What is the origin of the Universe?

Super computer simulations make it possible to observe what went onduring the universe's birth Cosmic Mysteries such as invisible, dark matter which makes up about 25% of the universe and dark energy which makes up more than 70% can be studied by thier realistic models created by super computers.

Understanding Earthquaks:

By Making a three dimensional model of the structure of the Earth, researches can now predict how earthquake waves would travel locally & globally.

By Knowing how the how Earth looks like aon can know how the wave looks like.

The resulting technique can be used to map the subsurface for oil exploration, or carbon sequestration and can help understand the processing ocurring deep in the earth's mantle & core.

Mapping the blood stream :

The total length of all veins, artries and capillaries in the human body is between 60,000 to 100,000 miles.

Such a technique to map the flow of blood could help researchers better understand strokes, traumatic brian injury and other vascular brain diseases.

Propagation of Pandemics like Swine Flue. Ebola, Nipah can be studied by studying the viruses which propagate them Super computers can also be used to peer into the virus itself They can figure out how drugs would bind to the virus and simuulated the mutations that might lead to drug resistance which can help doctors prescribe the drugs that won't promote resistance.

NOTES

Folding Protiens : Protiens are made of long strands of amino aads folded into complex three-dimensional shapes. their function is driven by their form. When a protein misfolds, there serious con sequences and learning and finding out how the proteins fold and how can it go wrong could be the first step in curing these diseases.

Testing Nuclear weapons :

Testing of nuclear weapons has been long since banned. But that doesn't mean that nuclear arsenals of various countries is out of date.

Super computers come in handy when their simulations ensure that the nuclear weapons are functional and safe.

The prime directive of such supercomputers is to create better simulations of nuclear explosions and to do away with real world nuke testing for good.

Weather forecasting:-

To undrstand a storm's path To study hurricanes rainfall etc. and simulations are useful after strom also, to model vulnerable electrical lines and power stations helping officials make dicisions about evacuation wpower shutoff & repair.

Predicting Climate Change :

The challenge of predicting global climate is immense.

There are hundreds of variables, from the relectivity of the Earth's surface (high for icy spots, low for dark forests) to be tagaries ocean currents. Dealing with there variable requires super computing capabilities.

Building brains :

Super computers are really good at computation : eg. It would take 120 billion people with 120 billion calculators 50 years to do what this Sequoia can do in a day. But when it comes to the brains ability to process information in paralled by doing many calculations simultaneously, even supercomputers lag behind. The 'Blue brian'' project aims to build a woriking neural circuit that reaserchers would use to understand brains function and test virtual psyahiotric treatments : It could even be better than artificial intelligence.

Indian supercomputer Proramme :

India started it's Journey towards super computer when it was denied the import of Cray computers form the USA due to the arms embargo imposed on India after the nuclear test in the 1970s.

Cray being a dual use technology it was feared it could be used for developing a nuclear weapons.

Supercomputing programme was started in the late 1980s.

PARAM 8000 was the first indigenously built supercomputer in 1990 by Centre for Development of Advance Computing (C-DAC) with Russian assitance.

The speed of a supercomputer is measured according to how many Floating Point Operations per second (FLOPS) they can do.

NOTES

India joined the 'Teraflop' club of the world in 2003 ''Param Padma'' was dedicated to the nation.

(A teraflop is one trillion floating operations a second)

National Super Comuptting mission (NSM)

Government of India in 2015 approved as 7 year super computing programme which aims to create acluster of 73 super computer connecting various aacademic and research institutions across India at an estimated cost of Rs.4500 cr.

The mission would be implemented by the Department of Science and Technology and Department o Electronics and Information (DeitY) C-DaC and IISC Bangalure.

These super computer will also be networked on the National Super Computing Grid over the National Knowledge Network (NKN). The NKN is another programme of the GoI which connects academic institiutions and R & D labs over a high speed network.

Pratyush :

India's Fatest and first multi-petaflops (PT) super computer It is at pune based Indian Institute of Tropical Meteorology (IITM)

Pratyush means sun.

Weather forecasting improvement and climate studies in terms of monsoon, cyclones, tsunamis, earthquakes would be it's primary function.

Pratyush is the fourth fastest super computer in the world dedicated to weather and climate research.

Mihir : Means (Sun) of which pratyush i s a component is a high performance computer system, was launched by Ministry of Earth Sciences (MoE's) at the National Centre for Medium Range Weather Forecasting Noida.

NOTES

CYBER SECURITY

Definition: The Security of Information and it's communicating channels as applied to computing devices such as computers and smartphones, as well as computer networks such as private and public networks, including the internet as a whole ''

Cyber space : A complex environment consisting of interaotion between people. software and services supported by world wide distribution of information and communication technology devices and network.

Cyber space has become central to human existence and the diffused nature of threats makes it difficult to catch the intangible perpretators.

According to the ''International Telecommunication Unioun (ITU) 2 Billion people uses the internet now-a-days.

Cyber Threats : can be divided into the following based on the motive of the perpetrators :

Cyber Espionage

Cyber Crime

Cyber Terrorism

Cyber warfare

Cyber espionage : It is the act of obtaining secret information without the permission of the holder of information (personal, sensitive, proprietary or of classified nature) from individuals, competitors, governments, personal enemies, or for economical, political or millitary advantage using methods on the internet, networks, or individual computers through the use of cracking techniques and malicious software including Trojan horses and spyware.

Trojan horse : It refers to software that tricks to damage. it will appear as useful software but will cause damage once installed . Users end up opening files offected by it as they feel they are recieving legitimate software or files.

NOTES

Cyber crime : '' Any type of offensive maneouves employed by individuals or whole organization with on intention to damage or destroy targeted computer network or system

Cyber crime can range from installing a spyware on a PC or attempts to destroy the critical infrastructure of the entire nations.

Methods of Cyber attacks :

(1) Physical Attack : using conventional methods like bombs fire etc. to harm the cyber infrastructure.

(2) Syntactic Attack: causing damage to infrastructurs the logic of the system in order to introduce delay or make the unpredictable. Viruses and Trojans are used for it.

Semantic Attack : During a semantic attack the information keyed in the system during entering and exiting the sytem is modified without the users knowledge in order to induce error.

Tools of Attacks :

Trojan - as explained above

Spyware - Technology that is deployed without proper user consent and is implemented in ways that send user activity information to the perpretator without user's knowledge.

Spoofing : The ability to misguide a biometric sensor in the recognizing an illegitimate user as a legitimate. User during verification or into missing an identification of someone that is in the database.

Spamming : unsolicited commercial e-mail sent to numerous addresses.

Skimming - It is an act of obtaining data from an unknowing end user who is not willigly submitting the sample at that time

Phishing : it is a type of ''Social engineer attack'' where someone misrepresents their identity or authority in order to induce another person to provide personally identifiable information (PII) over the internet.

Pharming : a method used by phishers to decieve users into believing that they are comanicating with a legitimate website.

Malware : a program iuserte into a system, usually covertly with the intent of compromising the confidentiality ,integrity or availability of victims data, applications or operating system.

Identity Theft : Unlawfully obtaining & possessing someone's identity information with the intent to use the information deceptively dishonestly or fraclulently to commit a crime.

Logic bomb : a program that perform useful function but consists of a code which when activated destroy data, may format hard disk and corrupt files.

Hacking: Generic term used for any type of unauthorized access to a computer

Denail of Services (DOS) : Attacks which are aimed at denying authorized persons access to a computer.

NOTES

Botnet : Short form of Robot Network It is a collection of internet connected programs communicating with other similar programs in order to perform tasks. Botnets sometimes compromise computers whose security defenses have been breached and control conceded to a third party. Each such compromised device, known as a bot is created when computer is penetrated by softwere from a malware distribution. The controler of a botnet is able to direct the activities of these compromeised computers through communication channels formed by standards based network protocols.

Virus - A computer virus is a program code that attaches itself to application program and when application program run, it runs along with it. It is detrimental in effect since it is corrupting the system or destroying the data.

Worms : a code that replicates itself and consumes the resources of a system to bring it down.

Cyber terrorism : it is a convergence of cyber space and terrorism.

Unlawful attacks and threats of attacks against computers networks and information stored there in when done to intimidate or coerce a government or it's people in furtherance of political or social objectives An attack should result in voilence or cause enough harm to generate fear to qualify as cyber terrorism.

Cyber Space has become an important tool at the hands of various terrorist organizations to propagate their myopic ideological views and brainwash individuals by spreading malicious content online and cyberspace is always being used for funding purposes anonymously.

Cyber Warfare : When Nation-State or their proxies infilterate another nation's networks or computer for the purpose or causing damage. and disruption or espionage.

India and cyber Security

Strengthening the Legal framework

The IT act 2000 which was further amended in 2008 to define data protection & Cyber Crimes.

Criminal offences Under various sections of IT Act.

66A-Sending offensive messages including attachments through communications service.

66B - Dishonestly recieving stolen computer resource or communication device.

66C - Identity Theft.

66D - Cheating by personating.

66E - Violations of privacy

66F - Defination of Cyber Terrosism : Defined as causing Deni al Services, illegal access, introducing a virus in any of the critical information infrastructure of the country defined under section 70 with the intent to threaten the unity, integrity, security or sovereignty of India or strike terror in the people or any section of the people ; or gaining illegal access to data or database that is restiricted for reasons of the security of state or friendly relations with foreign states.

NOTES

Supreme Court Struck down section 66A IT Act :

After the incident when two girls posted and liked views against Mumbai shutdwon at the time of Shiv Sena leader Bal Thackray's death

It was strick down because the public's right to know is directly affected by section 66A of the IT Act.

National Cyber Security Policy - 2013

With an aim to monitor and Protect information and strengthen defences from cyber attacks the national cyber security policy was released in 2013 by GoI.

Objective : To ensure a secure and resilient cyberspace for citizens. businesses and governments and also to protect anyone from intervening in your privacy.

NCSP is a policy framework by Department of Electronics and Information Technology (DeitY)

Strategies : Creating a Secured Fcosystem

Creating an assurance Frame work.

Encouraging open standards

Strengthening the regulatory framework

Securing E-Governance Sevices.

Promotion of R&D in cyber security

Human resource development

Creating cyber security awareness.

To develop bilateral and multilateral relationship in the area of cyber security with other country (Information sharing and co-operation)

Proper implementation framework ;

A national and sectoral 24x7 mechanism has been envisaged to deal with cyber threat through national critical information Infrastructure protection centre (NCIIPC)

Computer Emergency Response team (CERT-IN)

Government mandated information technology security organization.

created by Indian department of informatin technology in 2004

After the 2008 IT Act amendment CERT-In is responsible for overseeing administration of the IT Act. Certi-In is adesignated to perform the following function as nodal agency after IT act amendment 2008.:

Collection analysis and dissemination of information cyber on incidents.

Forecast and alerts on cyber security incidents.

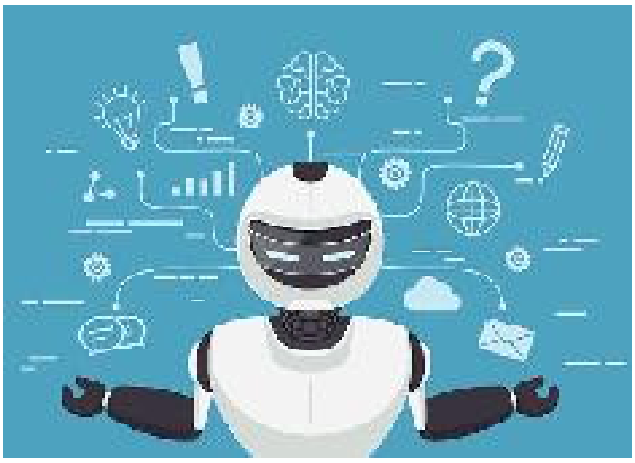
Emergency measures for handling cyber security incidents

Co-ordination of cyber incident response activities etc.

NOTES

ARTFICIAL INTELLIGENCE

It is the ability of a digital computer or computer controlled robot to perform tasks commonly associated with intelligent beings, such as the ability to reason discover meaning generalise or learn from past experience.



Fuzzy Logic : A computer fails to accurately mimic human reasoning because of bivalent / binary logic In Binary logic every event has only two state either it occurs or it doesnot . Fuzzy logic is a branch of logic which, instead of only allowing two extreme logical states of true and false has continuum of possible states between these extremes. This logic has application in expert systems and artificial inteligence.

Indias AI research & Development and it's application is being led by a panel formed by the GoI, under the leadership of Rajiv Kumar.

For millitary use of AI N Chandrasekran, heads the committee made by department of defence production.

For Use of AI in Economic :

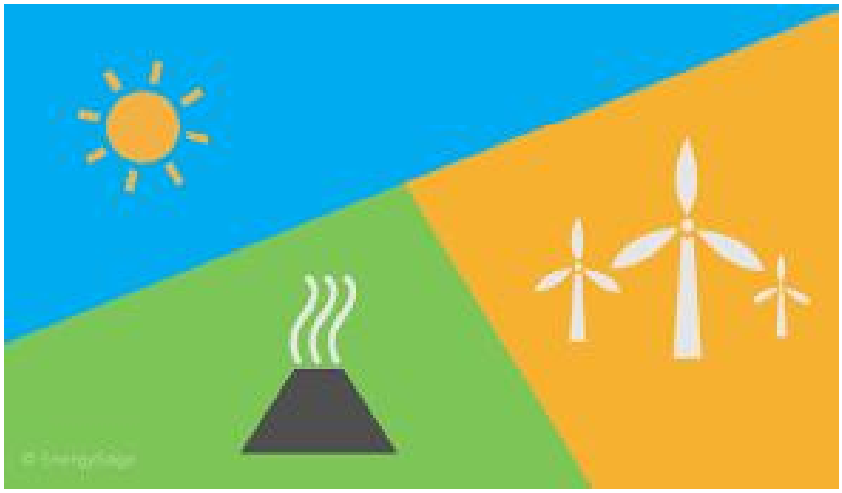
V.Kamakoti heads the committee formed by commerce & Industry Ministry.

Robotics is a major field related with AI

In Artificial Intelligence - Turing Test is the method of inquiry for determining whether or not a computer is capable of thinking like a human being.

NOTES

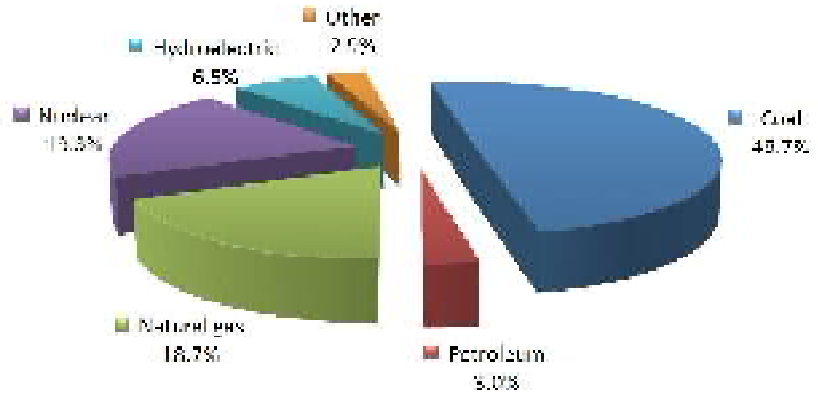
Energy Scenario In India



India is the 4th largest consumer of energy after USA,China? Russia, but it is not endowed with abundant energy resources. It must, therefore, meet It;s development needs by using all available domestic resources of coal, uranium, Oil, hydro & other renewable resources.

Mecting energy needs of achieving 8% economic growth while also meeting energy requirements of the population at affordable prices, therefore, presents a major challeng. It calls for a sustained effort at increasing energy efficiency while increasing domestic production as much as possible.

Sources of electrictiy in India by Installed capacity.



(2) Energy zecllrity:Concens and Reforms:-

The energy and the electricity sector arguably presents the most critical infrastructure bottencck, indeed supply-side constraint, facing the indian economy. Standard solutions to the problem have revolved round deregulation and private participation in fuel exploration, power generation and distribution, coupled with efficiency improvements in public utilities. But such techno;cratic assessments simplify the pssue and do little to meaningfully address the problem.

NOTES

Any serious attempt to reform the energy sector has to revolve around four objectives-

- increasing fuel availability by narrowing demand-supply gap.
- addressing energy pricing through periodic tariff revision.
- reforming free and unmetered agricultural supply etc.
- bringing policy and power sector reforms such as reducing distribution losses etc.

We also need to resolve the ``Political Collective action problem"

Concerns	Re Forms.
(i) Energy Demard & Supply Gap • Even though domestic production of energy resources is projected to increase, import dependence will continue. By the end of 12th plan import dependence on crude oil and coal is estimated to be 78% and 22% of the demand respectively. • It is estimated that up to a third of Indias power Qeberatuib **capacity,** both thermal and gas generations, is lying idle due to fuel scarcity, while the state owned coal mining monoply, CIL should shoulder its share of the blame for the current crisis, The major problems lie beyond mining per se. Land acquisition and environmental clearances are essential for both new mining projects and capacity-expansion in old mines, as well as for laying rail transport lines. We there fore have a situation where even the mined coal is stuck at the pithead for lack of adequate transportation facilities and capacity-addition projects are delayed inordinately. **2. Energy Pricing Issues** • An economically important but alsopolitically sensitive issue.	• Bring reform in ``New Explorotion and Liscencing Policy" [NELP] and amend coal mines Act 1973 to allow private parties take up the mining. • A coal bank can be created that will manage the demand-supply gap. • Agriculture power reforms assume great urgency. Free farm supply adversely affects the quality of rural electricity supply indicriminate use of motors depletes ground water leving dedicated agriculture feeders incurs massive capital investments. A more cost-effective and efficient approach would be to assure farmers **equivalent (or higher) units of Free supply instead of restricting supply timings.** Farm connections would be metered and agriculture tariffs fixed. Each farmer would pay his monthly electricity bill,whereup he would be reimbursed theprevious month's bill to the extent of the units consumable It is no wonder that the coal blocks allocted for captive power generation remained mostly unexploited. • Tariff policy needs to be depoliticized.

NOTES

It was precisely to depoliticize the tariff in crease that regulatory authorities were established. Unfortunately, they have become handmaiden. of govt.

- Misalignment of energy prices poses both micro-economic (under pricing energy to consumers reduces the incentive to be energy efficient and promotes leakage of subsidized products for sale in open market) and macroeconomic (hit's either producers or leads to excessive import dependence with implications. for Balance of Payment) challenges **Concern.**

(3) Ploicy Neglect of Energy

- There is no National Policy on Energy. endorsed or suppored by parliament. Nor is there an official body authorised and accountable for overseeing the countriy's energy policy.

(4) Tronsission & Distribution Problem.

- Transmission and O ismbution losses accunt for 27% of electricity generated.
- At least two-thirds of the national average distribution losses (which is 23%) are commercial losses, mostly in the form of billing deficiencies or pilferage .

Reforms

- There are currently a plethora of regulatory bodies some like CERC and PNGRB, fall under the umbrella of the central govt; some like the state regulatory commissions report to the state governments and others like the Indian Energy Exchange [IEX], and the National power exchange fall between several stools and have an indirect dotted line linkage with central and state government-There is overlap and on occassion & contention over matters like the setting of prices and tariffs. A
- Department of energy Resource &security in PMO should be created to act as energy regulators ombudsman between central and state and local appointed regulators.

Reform

- A bill shoud be introduce d in Parliament defining the inter-linkages betwen energy, food, water, enviroment tchnoloy, infrastucturs, conservation and efficiency and layout the roadmap to energy independence, energy secllrity and energy sustainability, It should define measurable metrics for progress towards these objectives and make explicit, Indias global obligations and commitments.

NOTES

	Reforms • Discom reforms as suggested by Shunglu committee should be done. • Under ground cabling to improve safety and theft. • Smart grid • Integration of renewable into the grid. • strengthening of NLDC/ RLDC/SLDC is vital for grid management. • Prepaid meters for those consumers with chronic defaults.

Energy Resouces

Conventional sources of energy	The resources which are widely used and constitute the major source of energy. Example-Coal, Oil, Natural Gas Wood etc. # These are limited, Non-renewable. Costiy, cause pollution & exhaustible.
Non-Conventional sources	solar energy,wind energy Tidal energy, Geothermal energy. Ocean Thermal energy conversin (OTEC) etc. # Renewable, cheap, pollution free & inlexhaustible.
Renewabl sources of energy	Solar energy, wind , Tidal, Fish Trees etc.
Non-renewable sources.	Fossils (coal, oil) Gas, Mlinerals, Nuclear power etc.
Biotic sources	Which have life, forest, Crops, Animals.Coal & Mineral oil.
Abiotic sources	Land, water,Minerals .

NOTES

Asok Chawla Committce on Natural Resources.

- Creation of national database of natural resources.
- Allocation of natural resources. if possible , through e-auction .
- Measures for benefit of stakeholders in mineral rich areas.

Need for conserving Conventional Energy Resources.

- Are limited in supply and can not be renewed easily.
- Due to population explosion,modernization the demand for energy resources is increasing day by day
- To control energy crisis there is need to conserve conventional energy resources.
- There is also an eminent need to explore alternative sources of energy.

Energy Crisis

- A situation in which resources are less than the demand.
- Major causes for energy crisis:
  - → Rapid industrialization
  - → Over population
  - → Transfer losses
  - → Rise in oilprices
  - → problems in middle east
  - → wastage.

Coal

- Quality of coal is detcrmined by its carbon content
- Major problems of Indian Coal
  - → Low carbon Content
  - → High ash content
  - → Low calorific Value
- Major coal producing areas in India
- Jharkhand> Odisha> Chattisgarh> west Bengal.
- Chhota Nagpur Region-Hub of 90%of Indian minerals (esp.in coal & Iron-Ruhr of India)

Major types of coals-

Anthracite

- Best Quality coal
- Approximately 90% carbon content
- Found at J & K only in India
- Very little smoke and ash content
- Burms without flames.

Bituminous :

- 70–90% carbon contant
- Most common in India
- Used in making coke

NOTES

Lignit :

- 40 – 70% carbon content
- Known as brown coal

Peat :

- 1st transformation of wood into coal
- – 40% carbon content

Coke :

Coke is a solid carbonaceous residue derived from low-ash, low-sulphur bituminous coal from which the volatile constituents are removed by baking in an oven without oxygen at high temperatures (in the range of 1000^{O} C) so the fixed carbon and residual ash are fused together.

It is used as a fuel and a reducing agent in smelting iron or in a blast furnace.

Clean Coal Technology-

It is a collection of technologies being developed to reduce the enviromental impact of coal energy generation. some of them are as follow-

→ Coal washng
→ Wet scrubbers or flue gas desulpphurisation system.
→ Low NOx burners
→ Electrostatic precipitators
→ Gasification-avoids burning coal altogether.
→ Post combustion capture.
→ Oxy-fuel combustion.

Petroleum/Mineral Oil

- Found in sedimentary rocks of marine origin.
- Formed by decomposition of tiny marine creatures, plants and vegetation undernud, silt & sand.
- Over the years, it underwent chemical changes to form crude oil & natural gas under the action of heat and pressure.
- 20% of India's crude oil &gas demand is produced domestically & 80% is imported.
- Jamnagar Refineries of Relaince industries is worlds larqest refinery complex.

Natural Gas (NG)

- NG is any gas found in the earth's crust, including gases generated during volcanic activity
- It is naturally occuring combustible gaseous mixture of hydrocarbons trapped in pore spaces in sedimentary rocks.

NOTES

- Consists mostly of methane - drawn from gas wells or in conjuncation with crude oil production.
- Tranported through network of pipelines
- Propane, butane, pentane and hexane are also present
- NG is often found dissolved in oil or as a gas cap above the oil.
- Sometimes, pressure of natural gas forces oil up to the surface, Such natural gas is known as assocated gas or **Wet gas.**
- Some Resevoirs contain gas an no oil. Such gas is termed non-associated as or Dry gas.
- **Sour Gas-** NG often contains substantial quantities of hydrogen sulfide or other organic sulphur compounds.

Sweet Gas

Coal methane because of it's lack of hydrogen sulphide.

NG is usually bought & sold not by volume but by Calorific Value.

Uses of natural Gas :

- Electric power generation
- Industrial, dometic of commercial usage.
- Many buses and commercial automotive fleets now operate on CNG
- It is an ingredient in dyes and inks
- Used inrubber compounding operatoins.

Ammonia is manufactured using hydrogen derived from methane. Ammonia is used to produce chemicals such as hydrogen cyanide, nitric acid, urea and a rage of fertilizers.

Russia has the worlds largest natural gas reserves in the world.

CNG

Compressed Natural Gas :

- is natural gas under pressure which remains clear, odourless and non-corrossive.
- Major gas in CNG is methane
- also cantain other hydrocarbons in minor percentage.
- Sulphur odourant is mixed in CNG to detect any leakage.

NG is lighter than air so it dissipates in air if any leakage is detected, which is an advantage. of using it over petrol and LPG.

LNG

Liquified Natural Gas

- A form of natural gas which is stored at super-cooled or cryogenic temperatures.
- It is typically stored at - 120^{O}C & 170^{O}C
- It provides advantage over fuels due to its high energy density and thus does not require frequent refueling.
- The high cost of cryogenic storage and major intrasfructure requirement for storage and dispengation is one of the disadvantages.

NOTES

LPG

- **Liquified Petroleum Gas :** Occurs as a byproduct of NG processing & petroleum refining.
- Mainly consists of propane, butane, propylene in various proportions.
- It evaporates at normal temperature and pressure and therefore stored in stel bottles or cylinders.
- Unlike NG, LPG is heavier than air, so in case of leakage it settles down at the floor and becomes hazardous.

PNG

- It is similar to CNG. Only difference is that it is supplied through pipelines for household uses.

New exploration and liscencing policy - 1997

- It was conceptualized by Amit B. Singh during 1997-98 to provide an equal platform to both public and private sector companies in exploration and production with **Directorate General of Hydrocarbons** (DGH) **Nodal agency** of its implementation.
- Liscences of exploration & production are awarded only through competetive bidding system.
- 100% FDI is allowed under NELP.
- Blocks are alloted under ``Production sharing Contracts:
- In 'Production sharing contract investment and revenues is shared with government.

Open Acreage liscensing Policy - OALP

- There are demands to replace NELP with OALP
- The new policy will allow bidder to Carve out areas where they want to drill.
- It provides operational flexibility to the investors. It is departure from the current liscensing policy of government identifying the oil and gas blocks and then putting them on auction
- 'National Data Repository' is a prerequisite for functioning of OALP.
- The OALP auction will be held under the ovehauled exploration liscencing policy, allowing pricing and marketing freedom to operators and shifts to a revenue sharing model.

Revenue sharing contracts

- Seen as a better alternative to OALP and NELP.
- Govt. gets share in revenue from the very beginning
- Unlike the PSC (Production sharing Contract) which allows govt. to have revenue share only after costs are covered by the explorer.

NOTES

- In PSC, explorers inflate investment by classifying revenue expenditure (Salaries, Maintenance etc.) as capital expenditure (equipment, technology etc.)
- This resulted in lower government share. It delays revenues to the government decades.

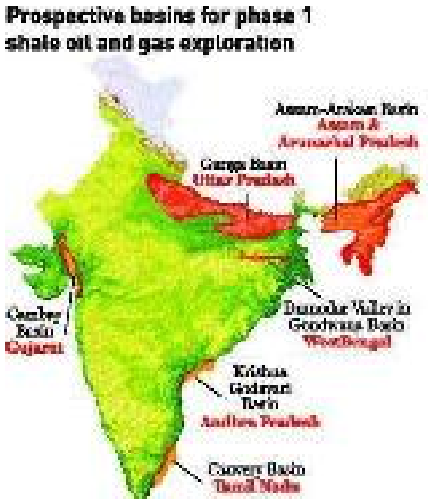
Kelkar Committee Recommendations.

- Deep sea offshore blocks - production sharing contracts should be adopted.
- Onshore and shallow blocks - Revenue sharing model should be adopted.

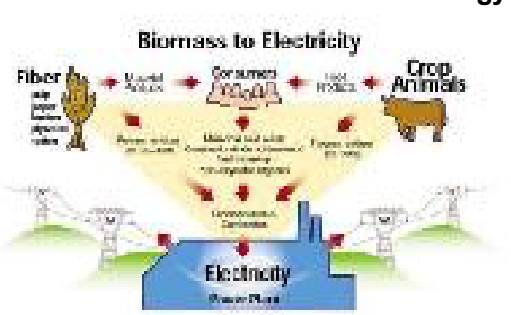
Rangarajan Committee Recommendations.

- Suggested linking gas price to price of imported gas and gas pricce prevailing in exchanges of USA , UK and Japan (weighted average) so as to bring it at parity with international price.
- This would result in increase in price which would affect vote bank adversely and therefore was not implemented.

Distribution of Natural Gas in India.



- KG, Basin, Assam, Gulf of Khambhat, Cuddalore district of Tamil Nadu, Barmer in Rajasthan etc.



- Biomass a renewable energy source, is biological material derived from living or recently living organism such as wood waste and alcohol fuels.
- Biomass is commonly plant matter grown to generate electricity or produce heat.

NOTES

- Biomass also includes plant and animal matter used for production of fibers or chemicals Biomass may also include biodegradable wastes that 'Burnt as fuel'.
  It excludes organic material such as fossil fuel which has been transformed by geological processes into substances such as coal or petroleum.
- Although fossil fuels have their origin in ancient biomass they are not considered biomass by the generally accepted definition because they contain carbon that has been 'out' of the carbon cycle for very long time. There combustion therefore distrubs the corbon-di-oxide content in the atmophere.

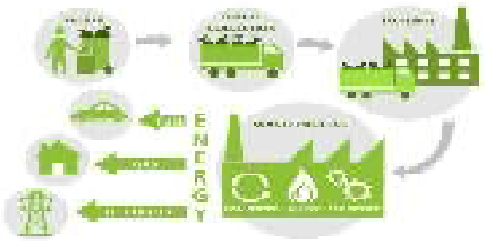
Biomass Sources

- It is derived from three distinct Energy sources.
- **Wood energy :** It is derived both from directed use of harvested wood as a fuel and from wood waste streams like waste products from proceses of the pulp, Paper and paper board industry. The waste product from these industries is the largest source of energy from wood and is called pulping liquor also known as 'Black liquor"

- In India the traditional method of direct burring are contributing to deforestation with it's dangerous consequences. An attempt has been made to counter this by undertaking vigorous afforestation programmes by planting fast growig high calorifc value type of plants and trees. These are known as Energy Plantation.

(b) Waste Energy : It is the single largest source of biomass energy. The main contributors of waste energy are municipal solid waste (MSW) manufacturing waste and landfill gas.

- **Biomass alcohol fuel -** or Ethanol is derived almost exclusively from corn. It is an alcohol made by fermenting sugar components of plant materials and it is made mostly from sugar and starch crops.



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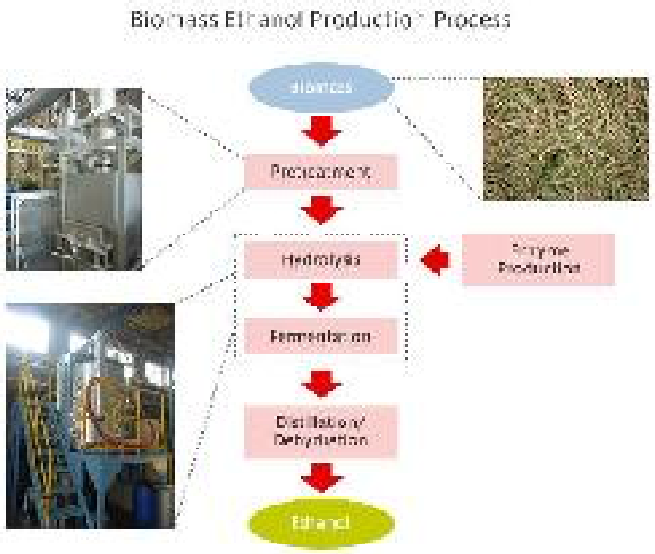

- **Biomass to liquid -** Ethonol can be used as a fuel fom vehicles in it's pure form **Bioethanol** is widely used in USA and Brazil when used in blends with gasoline, ethanol enhances the combustion of gasoline due to oxygen molecules resulting in a more efficient burn and reduced emisisons.
- **Bio-Diesel :** is made from vegetable oils, animal fats or recyded grease.

- It can be used as a fuel for vehicles in it's pure form, but is usually used as an additive to reduce level.. particulates, carbon-monoxide and hydrocarbons from diesel powered vehicles.
- The sythetic process for the preparation of bio diesel from - rice bran, **Jatropha curcus** seeds, karnajia, pongomia sunflower has already been undertaken in India mainly on wasteland area which amount to the size of 100 mn hectares
- Handling of biodiesel is safer as existing facilities can be utilized for its storage and dispensation.

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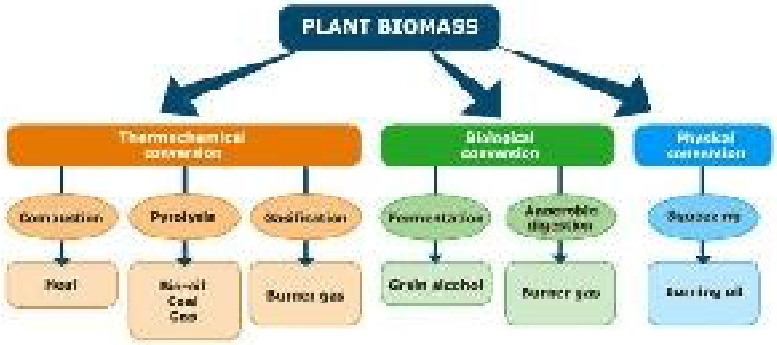
How can Biomass be converted into energy ?



1. **Burning :** Burning stuff like wood, waste and other plant matter releases stored chemiccal energy in the form of heat which can be used to turn shafts to produces electricity.
2. **Decomposition -** Things that can rot, like garbage, human and animal waste, dead animals and the likes can be left to rot releasing a gas called Biogas (aka methane or andfill gas) methane can be captured by a machine called microturbine and coverted to electricity. Sometimes animal waste (Poop) can also be converted into methane by a machine called 'Anarrobic Digestor'
3. **Fermentation -** Ethanol can be produced from crops with lots of sugars, like corn and sugarcane. The process used to produce ethonol, is called Gasification.
4. **Biorefinery -** Technology for biorefineries convert biomass into a range of valueable fuels chemicals materials and products much like oil refineries and petrochemical plants do.

Biomass energy in India:

About 32% of total primary energy use in the country is still derived from biomass and more than 70% of the country's population depends upon it for it's energy need.

NOTES

Current availability 500 mn. metric tones / year

over 5800 MW biomass based powerplants in India. among them 4,760 mw grid connected & 927 off grid.

Bottlenecks faced by the Indian Biomass Industry :

- Lack of adequate policy framework and effective financing mechanism.
- No proper regulatory framework
- Lack of technical capacity
- Absence of effective information dissemination.
- Limited successful commercial experience.

Government incentives and subsidies for Biomass Energy Production.

- Capital subsidy and contral finance assistance and financial incentives to the biomass energy projects are provided by ministry of New & Renewable Energy (MNRE) Global Environment facility - UNDP's sponsered project BERI- Biomass Energy for Rural India aims at developing and implementing a bio-energy technology package to reduce GHG emissions & Promote sustainable and participatory approach in meeting rural energy needs.

Shale Gas

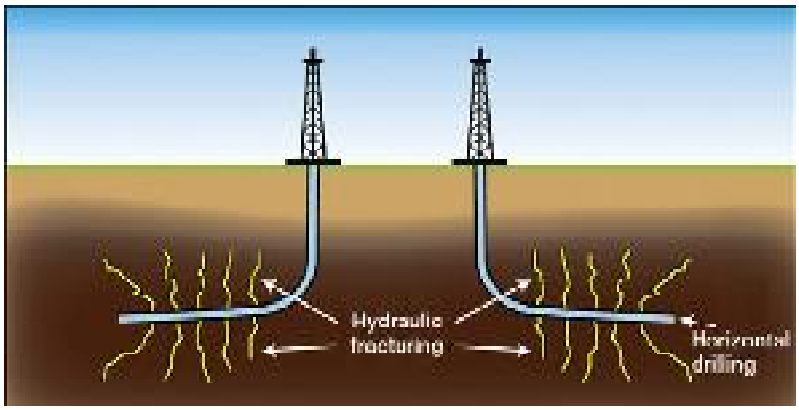
Shale gas refers to natural gas that is trapped within shale formations Shale are fine grained sedimentory rocks (Made up of clay, Quartz and calcite minerals) that can be rich sources of petroleum and natural gas. Gas prone shale may be associated with other resources, such a tight gas and coal bed methane in areas where shale is interbedded with coal.

Extraction of shale gas is done by the following two techniques:

A vertical well is drilled and at a desired depth

(i) Horizontal Drilling- the drill bit is turned to bore a well that stretches to the reservoir horizontally.

(ii) Hydraulic Fracturing - In this technique. fluid is pumped into a well at high pressure to fracture the rock, which creates an interconnected network of cracks that opens spaces for the movement of gas.



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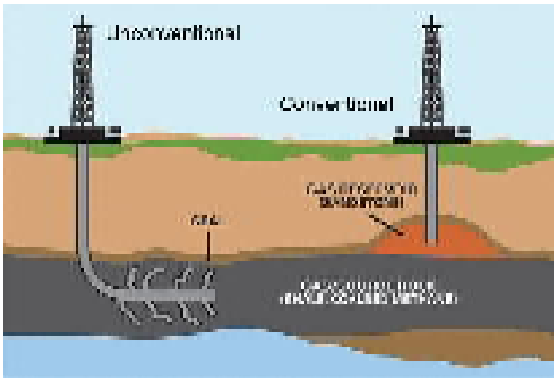
Shale gas Vs. Conventiona Gas

Coventional Gas reservoirs are created when natural gas migrated toward the earth's surface from an organic rich source formation into highly permeable reservoir rock where it is trapped by an overlying layer of impermeable rock. It is like a big balloon of gas trapped under ground the way to extract it is to drill a well, puncture the balloon and collect the gas.

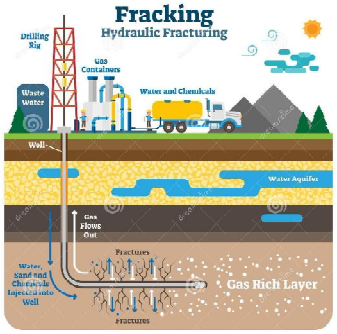
In contrast, shale gas resource form withing the organic rich shale source rock. The low permeability of the share formation greatly inhibits the gas from migrating to more permeable resevoir rock and they are spread like million of bubbles stretching over large tracts of land. Without horizonal drilling and hydroulic fracturing, shale gas production would not be economically feasible.



Issue:

(1) **Economic :** As shales ordinarily have insufficient permeability to allow significant fiuid flow to a well bore, most shales are not commercial sources of natural gas.

(2) **Induced Seismicity :** Seismicity has been induced by hydraulic fractureing itself, for which concerns ave been raised by various countries. The injection of waste waters into deep disposal wells also causes seismicity.



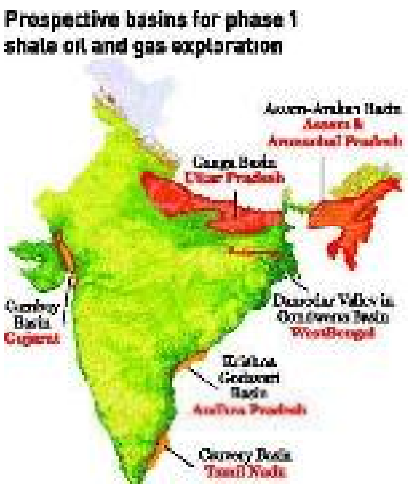
(3) **Water contamination :** Large quantity of chemicals and water are injected deep underground during hydraulic fracturing whose flow is unpredictable and cause contamination of ground water.

Water demand:- Water scarcity is a major challenge as shale production uses huge quantity of water during frcking.

Green House Gas Emission : Leakage of Green house gases during extraction and pollution caused due to improper processing of natural gas are the two major environment concerns.

NOTES

The Environment Protection Agency (EPA) in 2010 concluded that shale gas emits larger amounts of methane a potent green houses gas, than does conventional gas but, still far less than coal.



Shale gas in India.

Major Shale gas basine of Interest in terms of potential are :

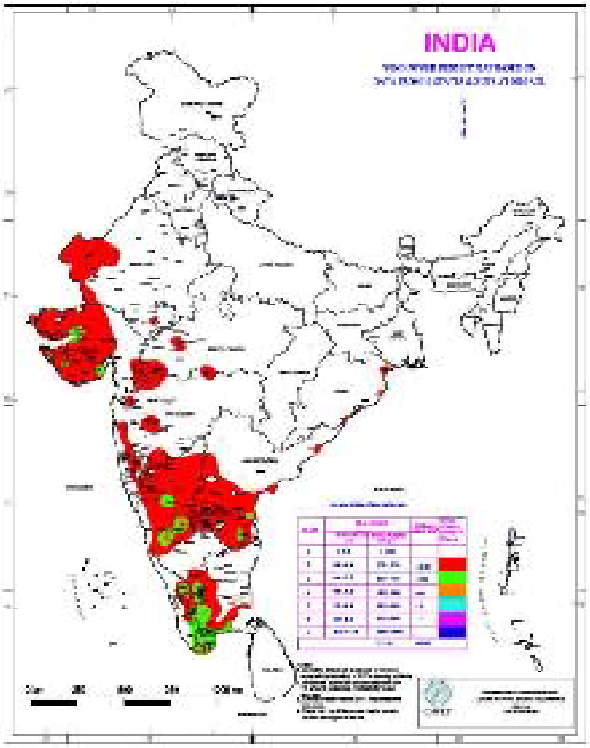
(i) Combay basin
(ii) Krishna Godavari Basin
(iii) Cauvery Basin
(iv) Upper Assam Basin
(v) Damodar Valley Basin
(vi) Indo-Gangetic Basin

Shale gas and oil exploration policy inIndias :

In 2013, cabinet approved policy on shale gas and oil exploration.

The ONGC and OIL : state-run agencies were initially permited to explore shale resources from on land block that were allotted to them on a nomination basis before the advent of the New exploration Licecsing Policy in 1999 under which exploration blocks are offered on a bidding basis.

Electricity in India.



NOTES

(1) Wind Energy in India

The Union Government has set an ambitious target of achieving 175 Giga Watt (GW) power capacity from clean renewable energy resources 2022.

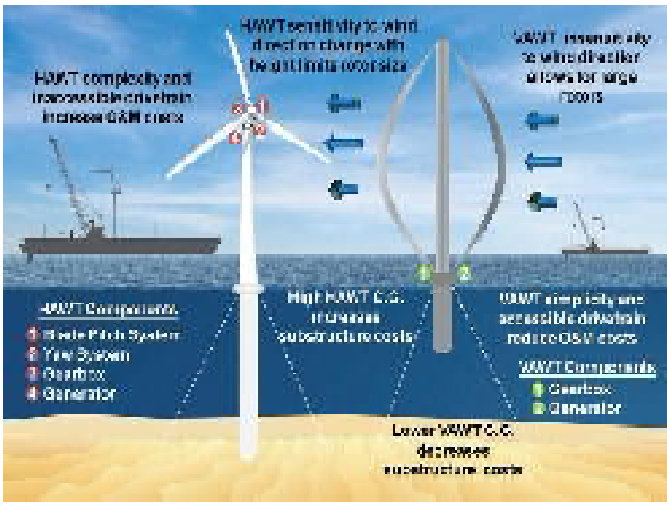
- Out of which 60GW target is set for wind power.
- At present installed wind power capacity in the country is nearly 26.7 GW which is nearly accounting for 9% of total installed capacity.
- India is at the 4th position globally after China, USA & Germany in terms of installed wind power capacity.
- The wind power potentioal in India is assessed by the National Institute of Wind Energy under the Ministy of New and Renewable Energy at 100 meter above ground level.
- The 8 most windy states, in india are Maharashtra, Gujrat, Andrapradesh , Madhya Pradesh, Karnataka, Rajasthan, Tamil Nadu & Telangana.
- Largest Producer - Tamil Nadu
- Nagarcoil (Tamil Nadu) and Jaiselmer (Rajasthan) are well
- known for their effective utilization of wind energy.

National Offshore Wind Energy Policy.

- A major renewable energy policy initiative was taken in the year 2015 in the form of the National Offshore Wind Energy Policy 2015 to help offshore Wind Energy development.
- Under the policy a major fillip has been provided on setting up offshore wind power projects and research and development activities in waters, in or adjecent to the country, upto the seaword distance of 200 nautical miles, exclusive economic zone (EEZ) of the country from the base.

There are two types of wind turbines :

1) Horizontal Axis variety : - Like the traditional farm Wind mills.

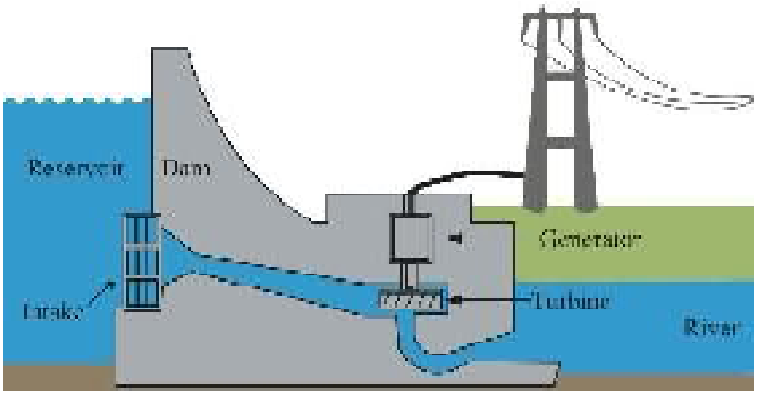


2) Vertical Axis Design : Like eggbeater style (also know as Darrieus Model, named after it's French inventor)

NOTES

Wind Farm: When wind turbines are grouped together into single wind power plant.

Tidal Energy



Every 12 hours the tidal cycle occurs due to the gravitational force of the moon. To capture sufficient power from the tidal energy potential, the height of hight tide must be at least 5 meters (16 Feet) greater than low tides.

Only 20 locations on Earth have such favourable conditions and India is one of them.

The Gulf of combay and Gulf of kutch on west coast in Gujrat have maximum tidal range of 11 m and 8m with overag tidal rage of 6.77 m & 5.23 m respectively.

Oceanic tides are used to generate electricity by conrstucting floodgate dam across inlets of sea ocean. During high tide water flows into the inlets and gets trapped when the gate is closed After the tide falls outside the floodgate the water retained by the floodgate flows back to sea through a power generating turbine

NOTES

- La rance in France was the 1st tidal power station in the world which became operational in 1966.
- Total identified potential of tidal energy is about 9000MW in west coast Gulf of Cambay (7000MW) & Gulf of kutch (1200MW) and east coast Ganges Delta in the sunder bans in West Bengal for small scale power develeopment estimates the potential in this region to be about 100MW.
- Durgaduani Creek in Sunder bans - MNRE set a Tidal Power Plant.
- A variety of Different technologies are currently under development throughout the world to harness this energy in all it's forms including waves (4000 MW), tides (9000MW) & Thermal Gradient (180,000 MW)

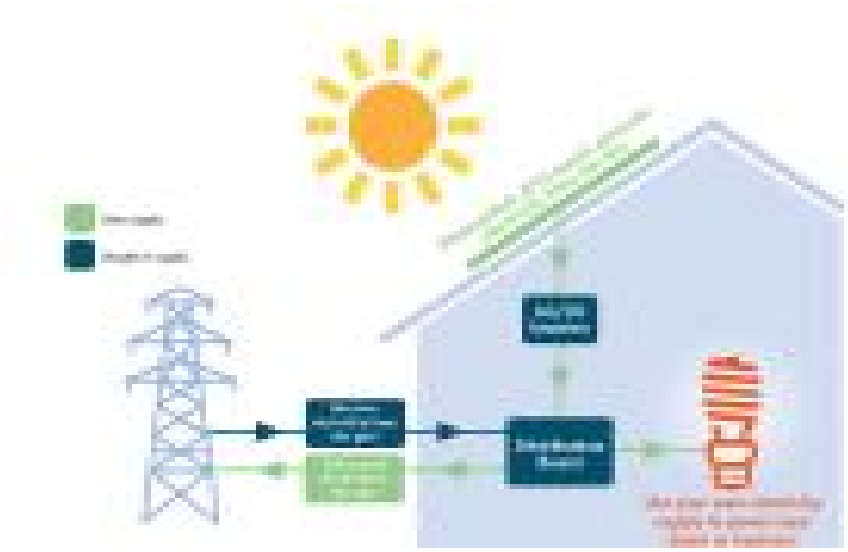
Pros : Tides are totally predictable so the energy availability duration can be predicted.

- It is totally carbon neutral.

Cons;

- Installation costs are high and a vailability of sites is limited.
- Power generation is inflexible due to dependence on tides.
- Local areas are impacted environmentally due to flooding & land modification.

Solar Energy



Availability of Solar power in India :-

- The calculated solar energy incidence on Indias total land area is about 5000 trillion kilowatt-hour (KWH) per year and most parts recieving 4-7 Kwh per sqmeter per day with over 300 clear and sunny days every year.
- The solar energy available in a year exceeds the possible enerygy output of all fossil fuel energy reserves in India.
- Photovoltaic system (PVC) and Concentrating Solar Power. (CSP) system are two ways to harness solar energy.
- The largest solar plant in India is located at Madhavpur near Bhuj where solar energy is used to sterilise milk cans.

NOTES

Jawaharlal Nehru National Solar Mission.

Also known as National Solar Mission:

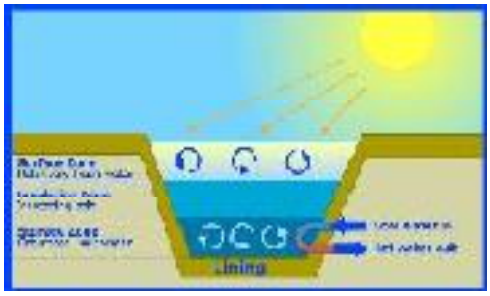
Objecive

- To establish India as a global leader in Solar energy by creating the policy conditions for it's diffution across the country as quickly as possible.
- To promote ecologically sustainable growth while addressing India's energy security challenges.
- Targest are set for three phases:
  (1) First phase - 2010-2013
  (2) Second Phase - 2013 - 17
  (3) Third Phase - 2017 - 22
- Total Target of 100,000 MW by 2022
- MNRE has proposed to achieve it through 40,000 MW through Rooftop Solar Projects and 60,000 MW through large and medium scale solar projects.

Domestic Content Controversy :

- Guidelines for the solar mission mandated cells & modules for solar PV projects based on crystalline sillicon to be manufactured in India.
- This accounts to over 60% of total system costs.
- For solar thermal, guidelines mandated 30% project to have domestic content.
- A vigourous controversy emerged between power project developers and solar PV equipment manufacturers.
- The Former camp prefers to source modules by assessing highly competetive global mark ets.
- The latter camp prefers a controlled environment to force developers to purchase from a group of module manufacturers in India.
- US Trade representatives has filed a case complant at World Trade Organization challenging Indias Domestic Content Requirement citing discrimination against US exports and WTO ruled in fovour of USA.

Solar Pond



- A solar pond is a large scale energy collector with integrated heat storage for thermal applications. In the solar pond, the water in the pond is made dense artificially by adding salt to it. This prevents water from rising to the top of the pond after getting hot. The solar energy remains entrapped inside the pond and temperature in the range of 85°C are attained.
- In India, a solar pond project is soltuated in Kutchan Gujrat, is called the Bhuj Solar Pond Project.

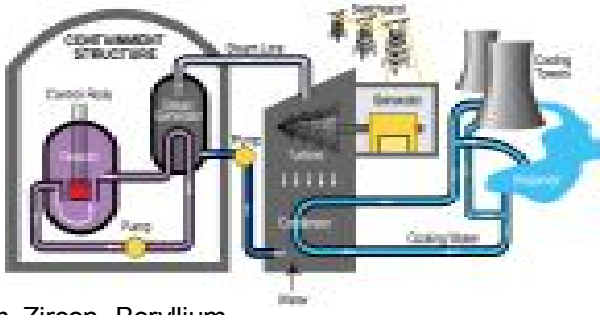
NOTES

- Gujrat is the leader in solar power Generation.
- Asia's biggest solar pack is located in Gujrat at Charanka Village.
- The Ultra Mega Power Plant generating 4,000 mw near Sambhar Lake in Rajasthan would be world's largest solar power plant upon completion.
- In May 2011, India's first 5 mw of installed capacity solar power project was registered under the Clean Devlopment Mechanism. The project is in Civagangai village, Sivaganga district Tamil Nadu.

Geo-Thermal Energy

- It refers to the electricity and heat produced by using the heat from the interior of the Earth.
- It is due to the Earth becoming progressively hotter with increasing depth.
- Ground water in such areas absorbs heat from the rocks and becomes hot.
- It becomes very hot and even rises to the Earth's surface or it also turns into steam.
- This steam is used to turn turbines and generate electricity.
- Two projects which are set up in India to harness Geothermal Energy are-
  (1) Parvati Valley near Manikaran in Himachal Pradesh.
  (2) Puga Valley Ladakh.

Nuclear Energy

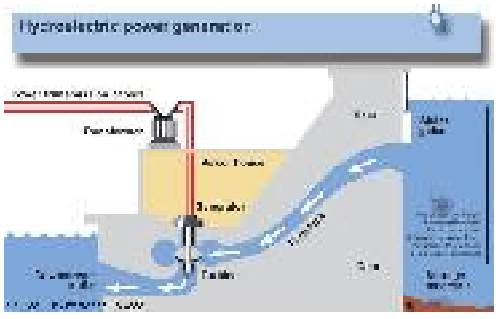


- 26% of total energy production
- Energy obtalned form atomic minerals viz. Uranium, Thorium, Zircon, Beryllium.
- Provide colossal energy through a small quantity of substance.
- Thorium is found as **monazite sand** in lakes & sea baeds.
- Thorium is found in AP>IN>Kerala>Odish and consititutes 30% of world reserves in India.
- Largest producer-Tamil Nadu

NOTES

- Eco-friendly as it doesnot produce Green house gases that pollute the atmosphere.
- It is very economical.

Hydro electricity.

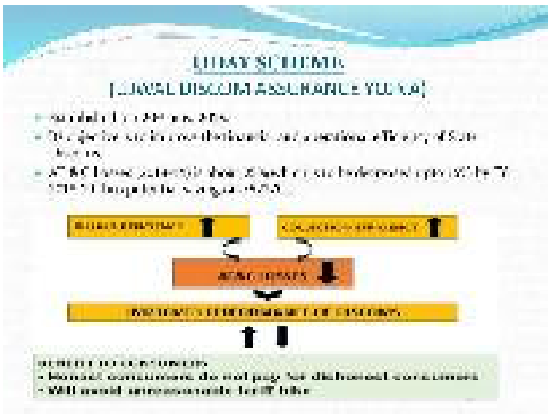


- The central electricity authority has estimated hydel power potential of 84000 MW at 60% load factor from 39000 mw at present.
- Amounts to 18% of total energy production.
- It is renewable and clean.
- 25 MW producing power plants. are called Small Hydel Power (SHP) plants-They are economically viable.
- Largest producer-Andhra Pradesh.
- The SHP comes under MNRE.
  & The Large Hydel powers comes under Ministry of powers.

NOTES

Class	station capacity (KHI)
Micro hydro	Upto 100
Mini hydro	101-2000
Small Hydro	2001-25000

Uday Scheme



Ujwal Discom Assurance yojna

- It is the financial turnaround and reival package for electricity Distribution companies (DISOMs) of India initiated by the GoI.
- The intention was to find a permanent solution to the financial mess that the power distribution is in.

Ministry/Department:- Ministry of Power.

Scheme:-

- It has an ambitious target of making all discoms profitable by 2018-19
- The financial crunch faced by the Discoms will be eased by the scheme, that has impaired their ability to buy electricity.
- The premise on which the scheme is based is that, it is state's responsibility to ensure that discoms become financially viable.
- The states shall take over 75% of Discom debt as on 30 sept 2015 over two years i.e. 50% of DISCOM debt shall be taken over in 2015-16 and 25% in 2016-17
- The scheme is optional for the states to join.
- The debt taken over by the states as per the above scheme will not be included by the GOI in the calculation of fiscal deficit of respective states in financial year 2015-16 & 2016-17.
- States will issue non-SLR including SDL bonds in the market or directly to the respective banks/Financial Institutions (FIs) holding the Discom debt to the appropriate extent.
- The Discom debt which is not taken over by the state shall be converted by the BAnks/FIs into loans or bonds.
- The scheme was launohed in 2015.
- Odisha and west Bengal are the states that have not joined the scheme till 2017.

NOTES

Ujjwala Scheme

- The pradhan Mantri Ujjawala Yojna (PMUY) was launched by PM Narendra Modi in may 2016.
- The tagline of the scheme is **Swachn Indhan, Behtar Jeevan.**

- Under the scheme Free of cost LPG (cooking gas) connections are provided to women from BPL Households.
- Through it cash assistance is also given to the beneficiaries to get a deposit free connection.
- The aim of the scheme is to empower women and protect their health by shifting them from unclean traditional cooking fuels or fossll fuels to clean cooking gas.
- It is the First social welfare Scheme implemented by Ministry of Petroleum and Nalural Gas.
- According to World Health Organisation, polluting fuels used for cooking purposes results in 1.3 Million premature deaths in India every year.
- India has set and ambitious target at increasing LPG usage to cover 80% of the households by March 2019.
- Identification of the beneficiary will be done through Socio-Economic Caste census (SECC) in consultation with state governments and union territories.

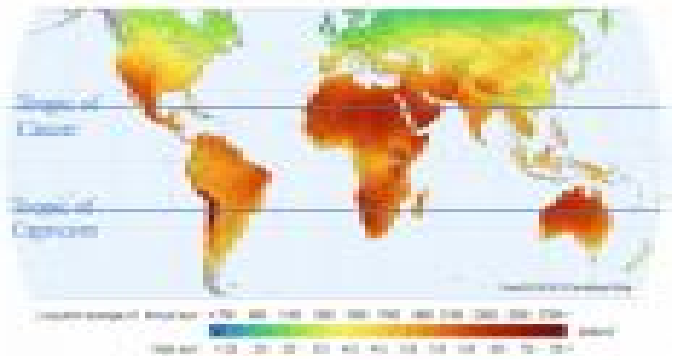
International Solar Allaince (ISA)

- Indian prime Ministes and the French President inaugurated ISA in National Institute of solar Energy (NISE) in Gwalpahari Gurugram along with interim secretariat of the ISA.

- It has been set up with United Nation as strategic partner.
- It is the India first international and inter governmental organisation of 121 countries to have head quarfers in India with UN as stralegic Partner.
- It creates a collabo prative platform for increased deployment of solar energy technologies to enhance energy security and sustainable development.

NOTES

- It improves access to energy and oppurtunities for better livelihoods in rural and remote areas and to in crease the standard of living.
- ISA consists of most of those countries which are located between the Tropic of Cancer and Tropic of Capricorn also known as **sunshine countries.**



- The ISA has set a target of 1 TW of solar energy by 2030.
- The primary objective is to collectively work for efficient exploitation of solar energy to reduce dependence on fossil based fuels.
- The initiate was launched at the India Africa Summit and a meeting was held among them before the conclave of 2015 UNCCC in paris on November 2015-Cop-21 and has become a reality at Marrakesh meeting Cop-22.
- The framework agreeement says that the members of ISA would take cordinated actions through programmes and activities that will aggregate the demands for solar finance, solar tahnologies. innovation, research and development and capactity building.

Working plan of ISA:-

- As the countries lying in the tropics are the ones which are developing at a faster pace and would require huge amount of electricity consumption. The ISA aims at them to produce electricity through solar energy avoid fossil fuels.
- For this the ISA seeks to do three things to bring down the costs of technology as well as finance needed for a sloar project.
- It wants to boost global demand, which will result in further reduction in the prices of solar energy and deployment.
- It seeks to promote standardisation in the use of equiprnent and processes for generating electricity. Standardisation will make the manufaturing of equipment and other hardware cheaper.
- It seeks to boost research and development, Particularly in areas of efficient storage systems.

Role of India in ISA:-

- Apart from being a founding member, India plays a significant role in the allonce in termes of being a host as well as major contributor to the achievement of the target.
- The ISA is the first international body that will have secretariat in India.

NOTES

- India, with a target to produce 100 GW of solar energy by 2022, would account for a tenth of ISA's goal India will produce 175 GW of electricity from renewable sources by 2022 and 100 GW will be from solar energy.
- India will also start a solar tech mission to lead R & D and provide 500 training slots to ISA member countries

Focles Areas under ISA:

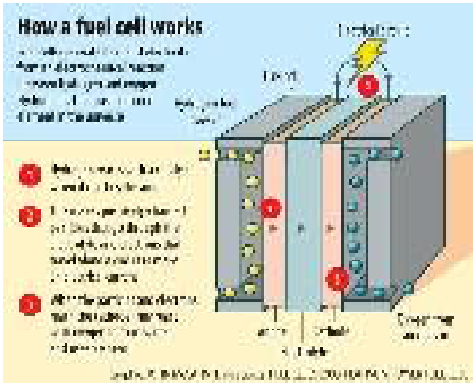
- **Grid connected:-** Solas parks, solar thermal projects, Rooftop solar projects, canal top projects, solar on water bodies, Farmers and unemployed Youths as generators.

Off-Gird connected & decentralized application:-

- Village electrification and mini-grids, solar lanterns, Mobile chargers, solar powered telecom towers,Milk chilling centres. Potters wheels, Solar Spiners for weavers, Street lights, solar pumps etc.
- Employment generation in a decentralized manner at local levels and also spurring econnomic activities.

Fuel Cell Technology.

- Fuel cells are highly efficient power-generating systems that produce electricity by combining fuel (hydrogen) and oxygen in an electrochemical reaction.



- It converts chemical energy directly and very efficiently into electricity (DC) and heat, thus doing away with combustion.
- Hydrogen and phosphoric acid are the most common type of fuel cells, although fuel cells run on ethanol, methanol and nutural gas are also available.
- A fuel cell consists of an electro....yte sandwiched between two electrodes. Oxygen passes over one electrode and hydrogen over the other, and they react electro chemically to generate electricity, water and heat.
- High initial cost is the biggest hurdle in the widespread commercialization of full cells.

Biotechnology [BT].

- Biotechnology is the industrial use of micro organisms and living plant and animal cells to produce substances or effects beneficial to people.

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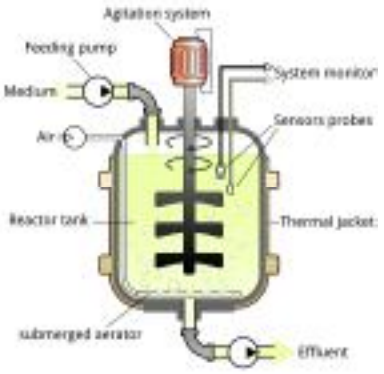
- It involves genetic manipulation and encompases the manufacture of antibiotics, vitamins, vaccines etc.
- Brewing is Sometimes called the oldest form of BT.

BT Technigues.

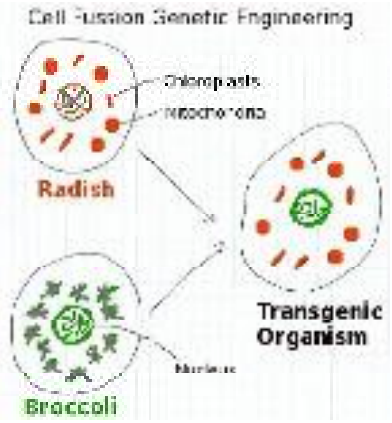
(1) Bioreactors:-



Bioreactors are containers that allow a biological process to take place in optimum conditions, pnoducing a uesful substance in large amounts.

(2) Biotransformation:- Some bioreactors carry out a chemical process without using living cells.Instead, enzymes are used to frigger the conversion on one chemical or material into another.

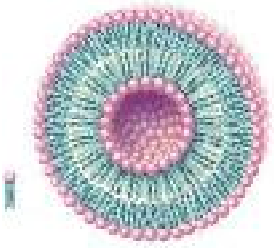
(3) Cell fusion:- involves combining two cells to make. a single cell that contaln sall the genetic material of the original cells. e.g. Pomato plant-characteristics of both Potato and Tomato Cell fusion used to make the fused cells known as ``Monoclonal Antibodies" which are increasingly important for



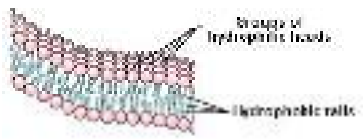
divising new and more accurate diagnotic test.

For eg.-to diagnose pregnancy, to measure bloodsugar level, detect ovulation etc.

(4) Use of Liposomes:-



- Liposomes are microscopic spherical capsules that form biological molecules called lipids which form a suspension in water.
- The lipid molecules in liposome arrange themselves s0 as to create a tiny space inside the centre of the liposome that can carry another substances, such as a drug.



- can become new means of drug delivery that too targeted.

(5) Cell Tissue Culture:-

- It is a technigue in which individual cells grow and divide in a bath of sterile, nutritive fluid wihch often contains growth substances.
- **In Vitro-**Latin for in glass.

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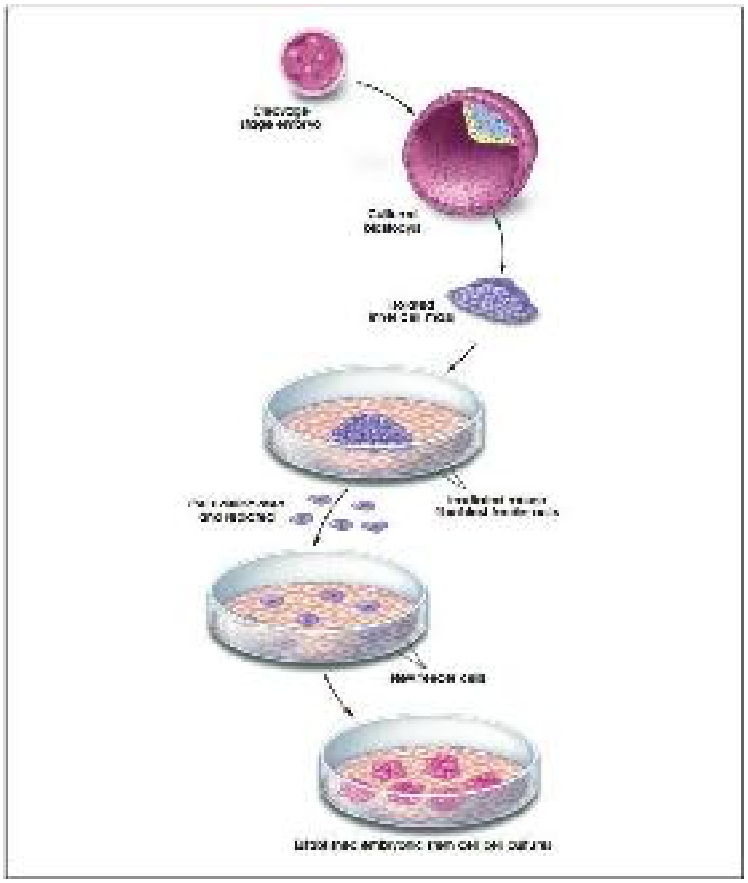
- **In Vivo-**Latin for what is alive.



Genetic Engineering (GE)

- It is a term applied to the techinques that alter the genes (Chereditary material) or Combination of genes in an organism.
- By altering the genetic structure scientists can give organisms different traits.

Gene Splicing:-It is a techrique to isolate a single gene.

Tradifional hybridisation procedures used in plant and animal breeding very often leads to inclusion and multiplication of undesirable genes along with the desired genes.

- The techniqiques of GE which indude creation of recombinant DNA, use of 78 gene cloning and Gene transfer,overcome this limitation and allows us to isolate and introduce only one or a set of desirable qenes without introducing undesirable genes into the target organism.

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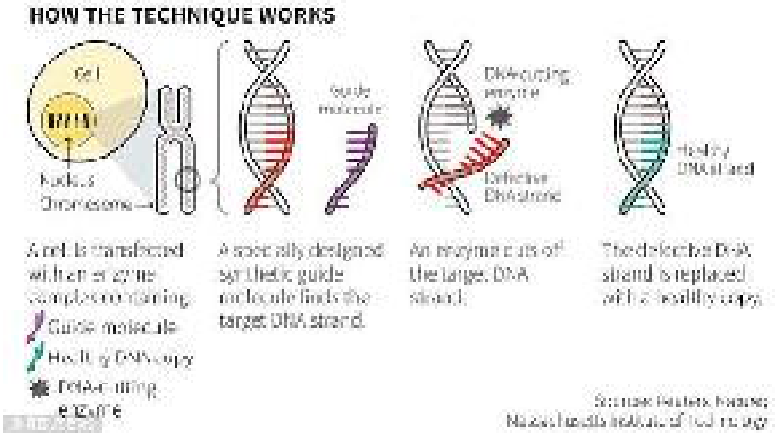
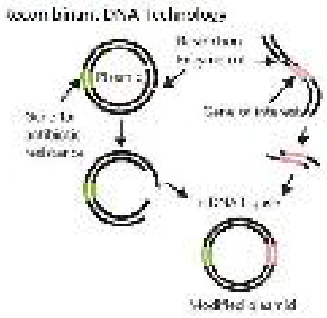


Process of Formation of recombinant DNA:-

Step-I Gene-sized DNA fraqments are isolated by means **of restriction enzymes** also known as ``**moleaulas scissors".**



Step-II-These enzymes react chemically with as pecific base sequence and break the molecule at a specific point called the``**cleavage site."**

Step-III-After the isolation of the gene, it is spliced with another DNA fragment with the help of **ligase enzyme.**

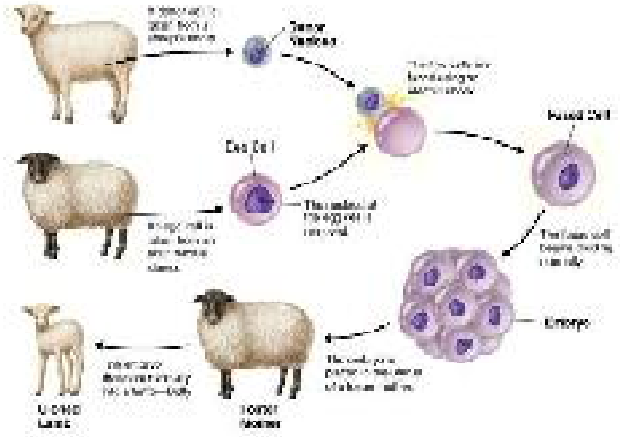
The hybrid molecule thus formed is called Recombinant DNA

Recombinant DNA is used to produce:-

- Recombinant human insulin
- Recombinant human growth hormone.
- Insect-resistant crops etc.
- It is used to identifiy, map and sequence genes and t determine their functio.

Cloning

- Cloning is the production of identical animals, plants or micro-organism from a single individual through asexual reproduction.

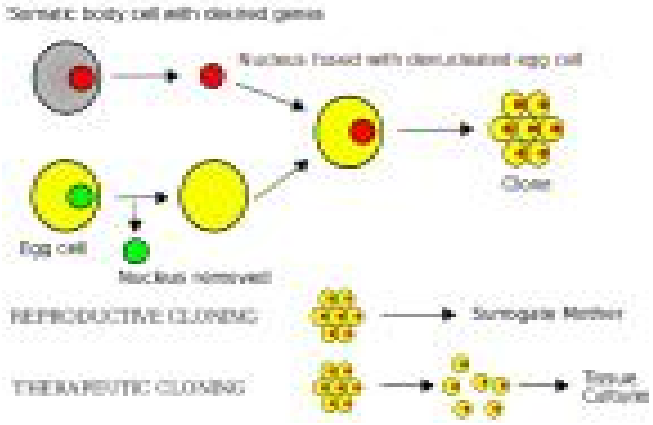


NOTES

- In contrast, in sexual reproduction the progeny inherits genetic material in equal amount from both parents by in heriting their chromosomes equally.
- Mammals, all of which reproduce sexually, can not clone naturally. Natural clones in mammals are confined to the production of identical twins.
- Cloning in plants is called **Tissue Culture** (Micro propagation)
- Cloning of animals has been based on a technique known as

``Nucleartransfer".

- The process involves fusing two cellstogether; a donor cell containing all of it's DNA and an egg cell from which the DNA has been removed.
- The two cells are fused using electric impulse. and the resultant egg is implanted in the mother.



- within a week this single cell becomes a ball of mass having 200-300 unspecialized cells. This stage of development is called as ``Blastocyst".
- Animal cloning experiment succeeded in 1997 when scientists led by Dr. Ian Wilmut at the Roslin Institute at Edinburgh cloned a sheep named Dolly for the First time from udder cells of an adult sheep.
- The udder cell of the donor was chemically Forced into a state of hibernation known as **quiscence** i.e. it was live but stopped multiplying to ensure that it was in the excat stage of its lifecycle as the egg in which it was trans planted .

Process of Cloning

Two ways-

(1)Artificial Embryo Twinning:_

NOTES

- As the name suggest,this technique mimics the natural process that creates identical twins.
- In nature, twins form very early in development when the embryo splits in two.Twinning happens when the embryo is made of just a small number of unspecialized cells.
- Each half divides continuosly to form complete individuals and since the developed from the same egg, the resulting indviduals are genetically identical.
- Artificial embryo twinning uses the same approach but it is carried out in a petri-dish instcad of inside the mother.

(2) Somatic Cell Nuclear Transfer:-

- This technique uses a different approach than artificial twinning but it produces the same result; an exact copy of clone of an individucal It was the method used to create Dolly:
  Somatic Cell:- Any cell in the body other than sperm or the egg. i.e. reproductive cell or germ cell.
  The somatic cells has two complete cells of chromosomes which the germ cell have only one complete set.
  Nucleas:-parf of cell that hold's DNA
  Information is contained into chromosomes that forms the DNA
- **Transfer-**The DNA or nucleas from a somatic cell is transfered into an egg cell, which has already been denucleated.
- The egg is then implanted into a surrogate.

Uses of cloning:-

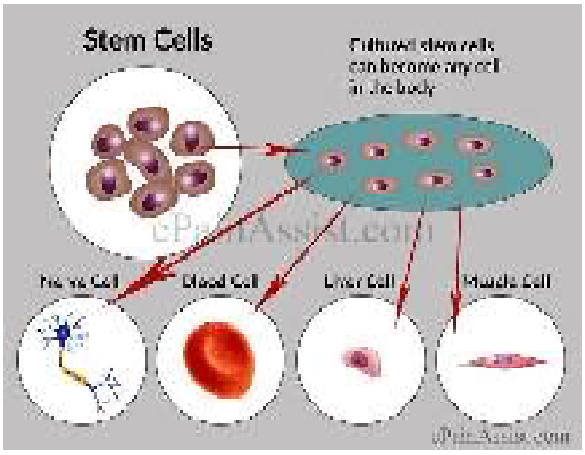
- Can help us understand and delay the process of ageing.
- therapeuticuse can permanently cure Parkinsons Alziemers, diabetes, and various heart disease.
- helpin cases of infertility.
- Understand and cure cancer.
- Can help treat genetic disorders like Down'ssyndrome and Tay-Sach's disease

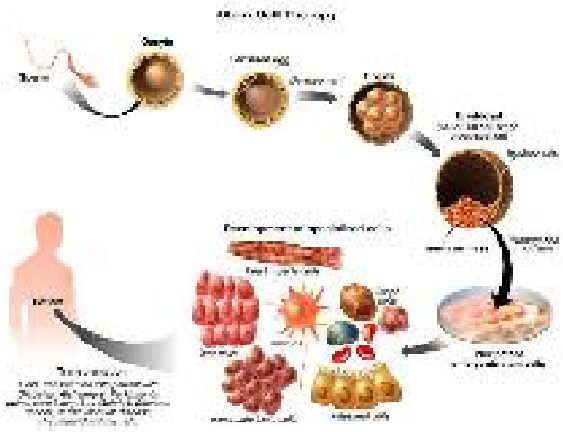
Concerns and Ethical issues regarding cloneing:-

- Opposed on ethical and environmental grounds.
- WHO opposes cloning on the grounds that it under mines society's respect for human life.
- may destroy social institutions such as marriage and family.
- The lines between family identities and relationships will get blurred as the clone may both be regarded as offspring and sibling.
- may result in dangerous mutations whose results cannot be predicted.

NOTES

Stem cell technology





- The term was proposed by the Russian histologist Alexander Maksimov in 1908
- Astem cell is an undiffrentiated cell that divides mitotically, giving rise,usually to a succession of stages, to mature functional cells.
- e.g. stem cells in bonemarrow give rise to entire immune system blood cells.

stem cellsare of two types :- Embryoric Adult.

- Embryonic stem cells. Are isolated from the inner cell mass of blasto aysts.
- **Adultstem cells:-** are found in adult tissues.
- In a developing embryo stem cells can differentiate into all of the specialised embryonic tissues.
- Inadults stem cells and progenitor cells acts as a repair system for the body replenisning specialised cells and also maintains turnover of regenerative organs such as skin, blood etc.

A Stem cell reguires two properties to be called so:-

(1) Self renewal-the ability to go through numerous cycles of cell division while maintaing the undifferentiated state.

(ii)Potency:- the capacity to differentiate into specialised cell types.

- They are unspecialized.

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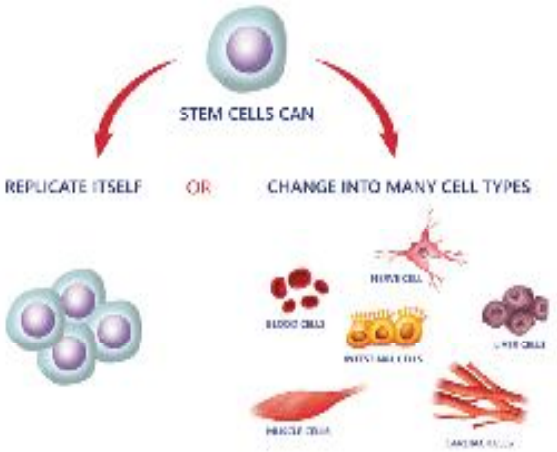
Type of stem cells.



(1) Totipotent:- or ompipotent stem cells can differentiate into any kind of cell type:-

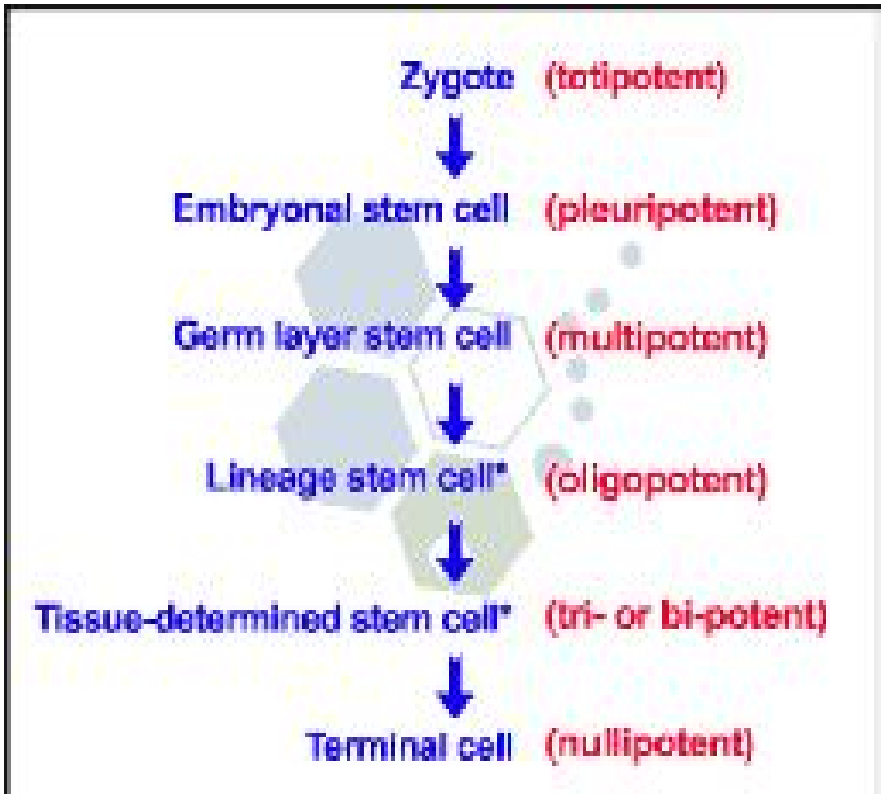
- Such cells can constrct a complete viable organism.

(2) Pluripotent:- can differentiate into nearly all cells i.e. cells. derived from any of the three germ layers.

(3) Multipotent:-Stem cells can differentiate into a number of cell,but only of a closely related family of cells.

Oligopotent:-can differentiate into only a few cells. eg.lymphoid & myeoid stem cells.

Unipotent:-can produce only one cell type, their own but they have the property of self renewal.



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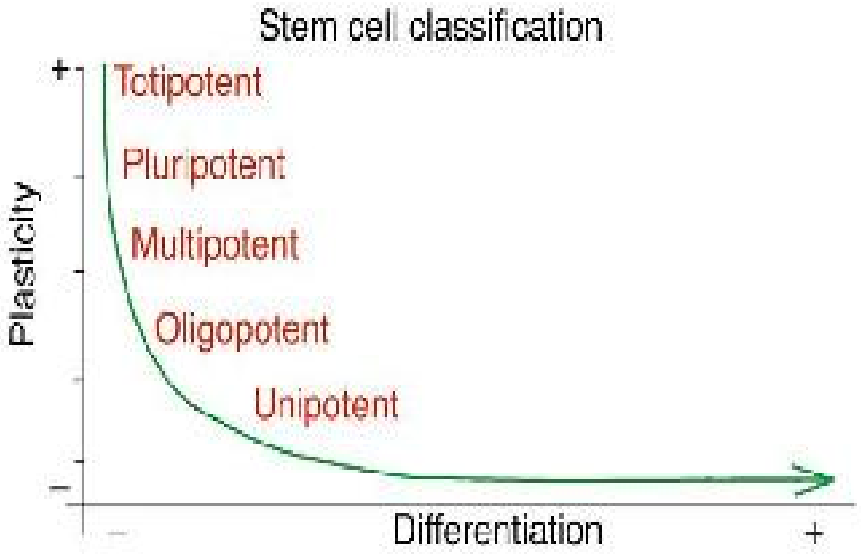

Embryonic stem cell Lines:-(ES)

- are cultures of cells derived from inner cell mass of a blastocyst.ES are pluripotent and can develop into each of the more than 200 cell types of the adult body under specific conditions.

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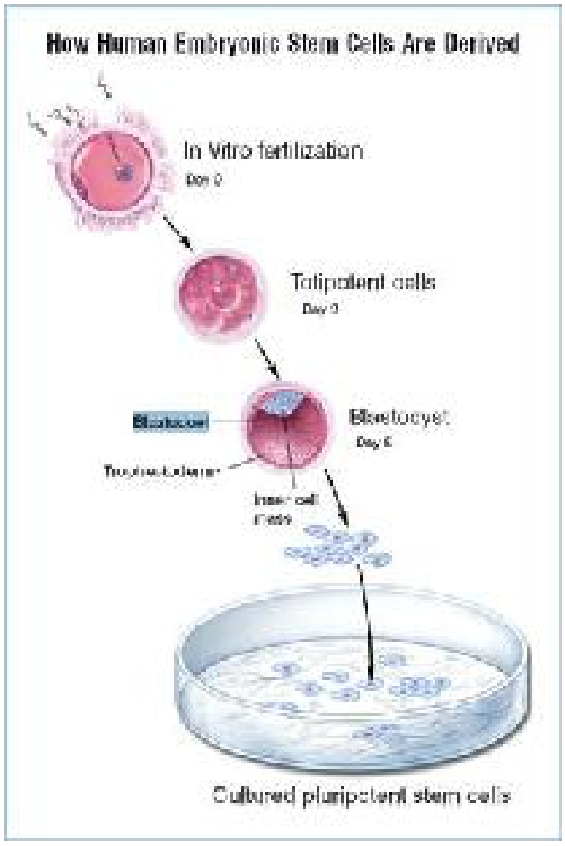
- But now some techniques have been developed to obtain stem cells without harming the embryo.

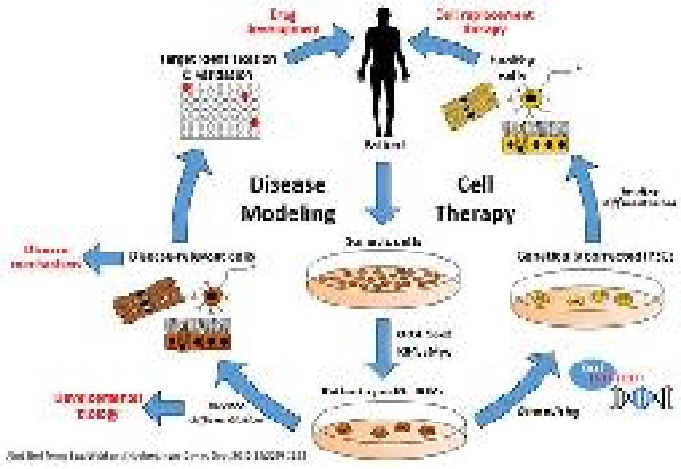


Induced Pluripotent Stem Cells.:-

Induced pluripotency is artificially achieved from a non-pluripotent cell-typically an adult stem cell (somatic)by inclucing a Force d ``expression of specific genes.

Stimulus triggered acquistion of pluripotency (STAP)

a phenomenon where pluripotent stem cells are generlaled by subjecting ordinary cells to certain types of stress



NOTES

Useof Stem cells.

- Bone marrow transplant usedto treat leukemia
- Diseasesincluding cances, Parkinsons disease, spinal cord injuries,Amyotrophic lateral sclerosis,multiple sclerosis and muscle damage can be cured.
- Heart patients can be benefitted by directly injecting stem cells in the weakened heart muscles.
- Other ailments like Type 1 diabetes can also be cured by stem cells engineered to produce insulin.

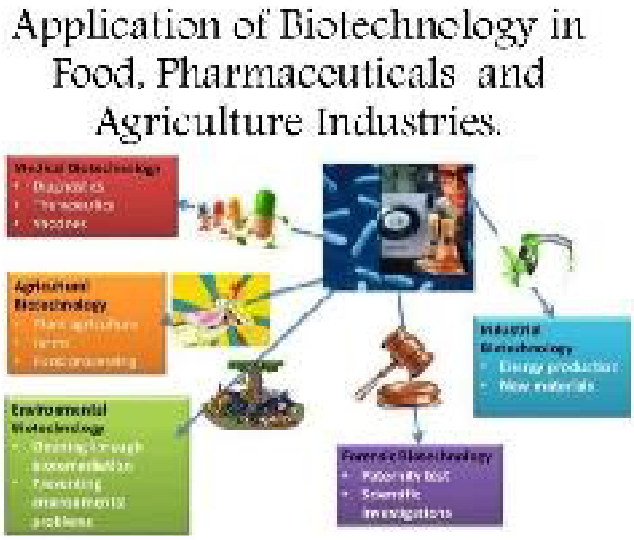
Controversies.:-

Embryonic stem cells require the destruction of an embryo which can fundamentallv devalue human life.

Applications of Biotechnology

(1) Medicine:-

- Used for the diagnosis and treatment of various diseases
- Techniques like gene therapy, recombinant DNA technology and Ploymerase Chain Reaction are used to identify unheal thygenes and reinsert healthy genes in their place.



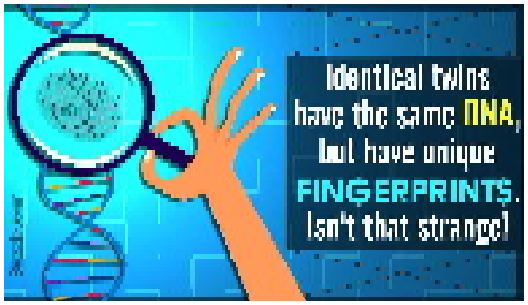
NOTES

Biopharmaceuticals:-

- Micro-Organisms are used to develop develop drugs
- Hormones are also made by the Use of micro organisms which can be genetically modified.
- mass production of drugs is possible which will reduce the cost of expensive treatments.
- selective interaction with genes is also made possible by biotechnology Oligonucleotides which can bind to a targeted site at DNA can turn off genes at will
- It forms a triple helix which which inactivales that gene.
- to make them sustainable for using as a drug the oxygen atom in them is repaced by sulphur atom and this special class of oligonucleotides called S-oligos or phosphoro thiotes.

Drugs are used to inactivate genes.

DNA Fingerprinting



- Also known as genetic finger printing
- It is the technique of identifying the components of DNA that is unique to a particular in dividua.
- Like fingerprints, DNA fingerprints also vary from individual to individual.
- The varying bit of genetic material take form of sequences of DNA called Mini -Satellites,which are repeated several times.

  Technique:- Chromatography and Electrophoresis are used to analyse an organism's DNA from a sample of blood, semen, tissue etc.

  Uses:-It has become an established forensic technique used for providing evidences in case of rape and providing paternity suits.
- Illegal trading of endangered animals can be prevented by comparing the DNA patterns of parents and offsprings.

(2) Agricalture:-

- Crops that are genetically engineered are the best example of biotechology's use in agriculture.
- **Hybrid seeds:-** are developed using BT which perform better than their parents.
- Photosynthesis can be imporved using genetic modification which can increase the yield of crops like pulses and vegetables.
- The dangerous after effects prouced on the soil and environ ment by the use of pesticides and insecticides.

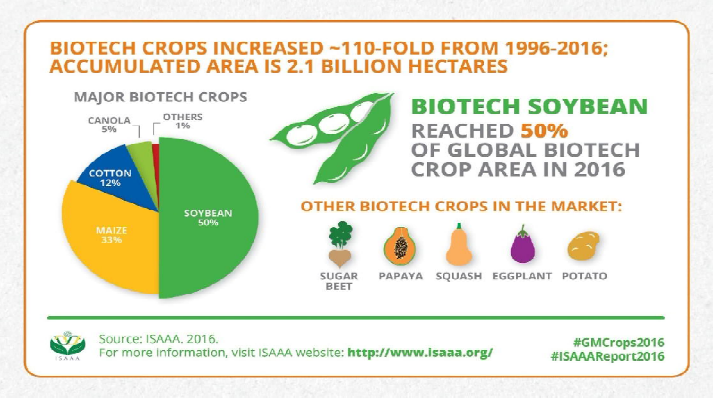
  can be over come by using biopesticides and bioinsecticides which are environment friendly and non-cancerous, besides they affect the targeted insect rendering no harm t useful organisms.

NOTES

(3) **Food processing:-** It is the process which converts non-edible and easily perishable food into edible and having a longer shelf-life. The method by which micro-organisms are used to do this is called Fermenation.

Neutraceuticals:- a cross between nutritional food items and pharmaceuticals made possible using BT.

GM Crops:-



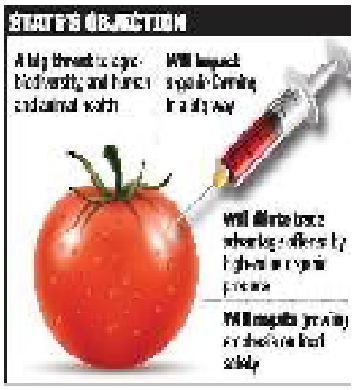
- **BT Cotton-** Bacillus Thuringiensis also called the Toxin Gene confers the crops resitstant to a vanety of pests.
- **Golden Rice-** it is GM rice and it helps to produce boeta carotene which is the precursor of vitami-A. **Terminator Gene Technology:-** It has created a controversy when the US companies Mongantopatented ``Control of Plant Gene expression".

  In thistechnology-The First Generationseeds wouldddevelop normally but the second geneation seeds would be stterile, which means farmers cannot store seeds for sowing in the next season. They will have to buy seeds from these giants every time they have to sow.
- **GM Mustaud:-** Dhara Mustard Hybrid-11 (DMH-11)

  It is considered that DMH-11 can have a bad effect on honely bees and therefor hamper the pollination process and other pollinators. The Genetic Engineering Apprasal Comittee has deffered the use of DMH-11commerscial and it alsoseeks additional data and demands. more tests to be conducted before it's commercialization
- It is Herbicide Tolerate.

Health Risks of GM food & Crops:-

- Allergies- due to introduction of previously unknown novel genes which have not undergone evolution
- Toxicity.
- **Pleiotropic Effect:-** Producing or having multiple effects froma single gene.
- Antibiotic ressistance.

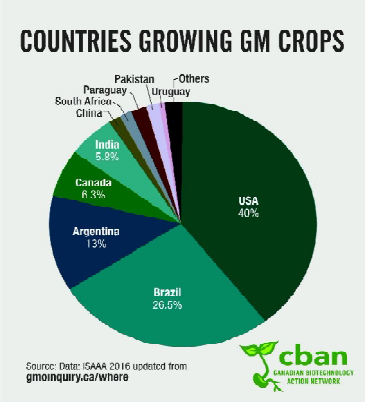


NOTES

(4) Environment:-

- Biomarkers can be used for the detction of Pollution in the environment.
- Bio energy-like biodiesel, biogas can be used for a pollution free enxironment.

Bioremediation:- use of natural microoganisms to clean harzrudous waste into non-toxic compounds.



Biotrans formation

Biosensors:- Which are capable of detecting extremely low levels of protiens. hormones, pollutants, gases and other molecules.

- can be used by police and doctors for drug detection in human body.
- By gcologists in detecting even small quantities of minerals in deep underground ores.

(5) Animal Husbandary :

Embryo Trans plantation to produce cattle and other farm animals.

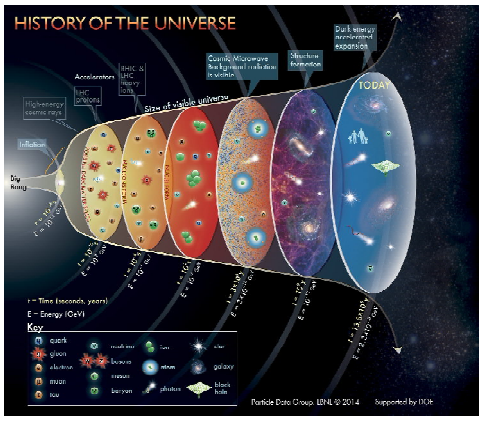
Space Technology

Various tems related to space :

Cosmology : The study of the Universe in it's entirety .i.e. it's nature, orgin and evolution.

NOTES

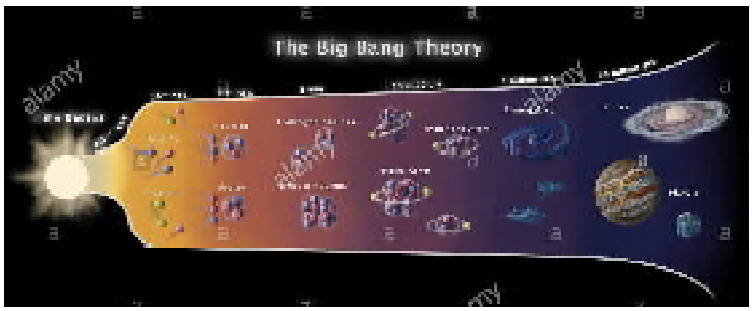
2. **Astronomy -** Study of objects of the Universe
Theories for the Origin of Universe:



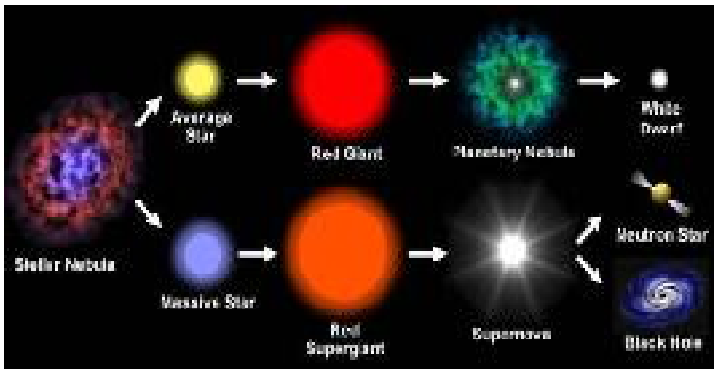
Big Bang Theory - Proposed by A.G.E. Lemaitre in 1927

2. Steady state theory by Herman Bondi et al in 1948

The Objects in the Universe : -



Stars : It is a self illuminating body



The Size of Star : Astronomers have divided stars into 5 main groups by size :

(1) **Supergiants :** The largest known stars. They can have diameters about 1000 times as large as the sun's

(2) **Gaints Diameter** 10-100 times that of the sun

(3) **Medium sized stars :** Common called Main Sequence stars or dwaf stars are about as large as the sun, their diameter .... from a tenth that of the sun to about 10 times the sun's diameter

NOTES

White dwarfs are small stars

(5) Neutron stars - are the tiniest stars. Their mass may be equal to that of the sun's but are so compact that their diameter is only 20kms. The rapidly spinning neutron stars are called Pulsars.

Classification of stars can also be done on the basis of their brightness :

Variable stars shine brightly, then dimly and then brightly again.

There are 3 main types :

1. Pulsating variables They change in brighthess as they expand and contract. The time taken by such a star to range from bright to dim and back to bright is called a ''period''

Astronomers also call them cepheid variables since they were first discovered in the constalation cepheus.

e.g. North star.

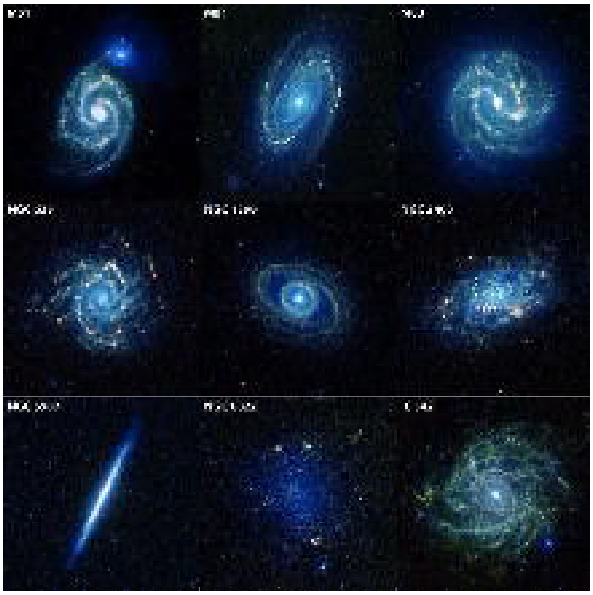
exploding stars : The burst unexpectedly with tremen dous energy that they hurl huge amounts of gas into space They are of various types

(a) Nova : Becomes 1000 times brighter than normal.

(b) Supernova is 1000 times as bright as an ordinary Nova.

(iii) Eclipsing binaries : are double star they consist of a pair of stars that move around eachother . The star move in in such a way that one periodically block the other's light. This blocking reduces the total brightness of the two stars as seen from the Earth.

Galaxies : A glaxy is a system of stars, dust and gas held together by gravity.



Cluster : It may contain two or three glaxies or even thousands.

The milky way is a member of a cluster containing over 20 galaxies.

Kinds of Galaxies :

1) Spiral Galaxy : Shaped like a disc with a central bulge Milky way is a spiral galaxy. The stars are generally young.

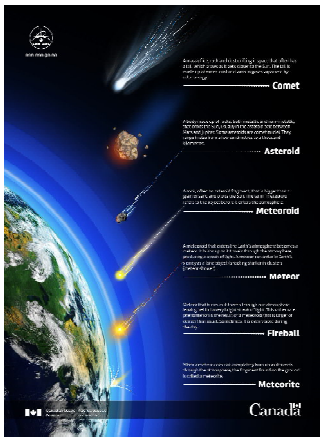
NOTES

2) **Elliptical Galaxy :** Range in shape from round to fiattened globes
The light is brightest at the centre.
The stars in it are predominantly old.

3) **Irregular galaxies :** They have no clear shape or structure glaxies form clusters and superclusters which are hundreds of millions of light years in diameter.

Some Important facts.

Difference between meteors, meteoroids and meteorites.



Meteoroids - When asteroids smash into each other, small fragments breaks off. The fragments are called meteoriods.

Meteors - When meteoroids enter the Earth's surface and varpourize with a streak of light also known as shooting stars.

Meteorites: When the meteors donot vapourize completely and strike the earth's surface, they are called meteorites.

Comet - When a rock of ice which originated from the solar system passes having a tail

Asteroids - They are samll bodies of rocks which revlolve around the sun.

The asteroid belt is found between the Mars and Jupiter.

Observing the Universe :

Space Exploration

Outer Space: It is that part of the universe which lies outside earth's atmophere.

It represent itself as a void betwen varius celestial bodies, but is not completely empty.

It contains a low density of particles as well magnetic radiations, neutrinos, dust and cosmic rays.

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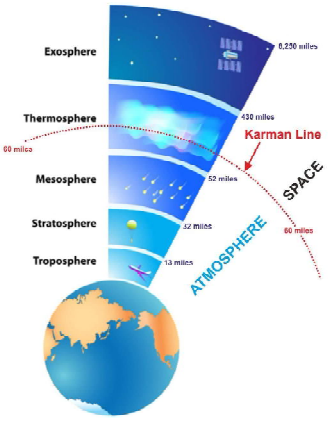
Much portion of the universe is made up of dark energy which is not well understood.



Inner Space While there is no firm boundary where outer space begins and innder space ends, but inner space could be everything inside **'Karman line'** which is at an attitude of 100 km above the sea level and is conventionally accepted as the start of outer space.

Karman line becomes the base for various space Itreaties and record - Point to ponda pint + Gravitational force of the Earth work in Inner Space Keeping purposes in aerospace. The Outer space treaty established the framework for international space law by uited nation in 1967 rejects any aim of national sovereignty and permits free exploration outer space by all states.

Satelites

There are two types of satelites :

(1) Natural Eq. Moon

(2) Artificial i.e. man made.

A moon planet or machine that orbits a planet or a star is called a satellite.

e.g. Earth is Sun's natural Satalite because it orbits the sun and moon is earth's satellite because moon is orbitting the earth.

Types of man - made satellites ;

Astronomical Satellites : The observation of distant stars and other objects in space is done with the help of astronomical satellite. Astrosat of India is as example Most famous example of it is the Hubble Telescope of ESA & NASA it was launched by Discovery space shuttle.

2. **Communication satellites :** These are greatest in number in orbit. They help in communicating over large distances because of the height at which they are placed. This height enable them to overcome the curvature of the Earth. and communicate over vast distances.

e.g GAST and INSAT of India.

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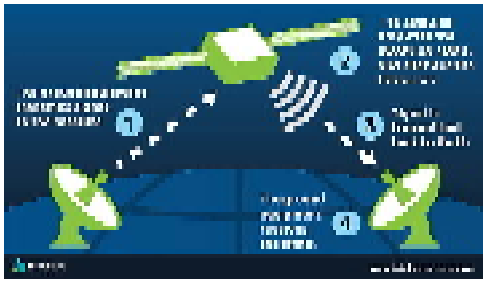
These satellites are used for point to point telecommunication links, and mobile communications are also used for direct broadcast etc.

3. Earth. Observation Satellitites.



Also known as geographical satellites, these are used for observing the earth's surface.

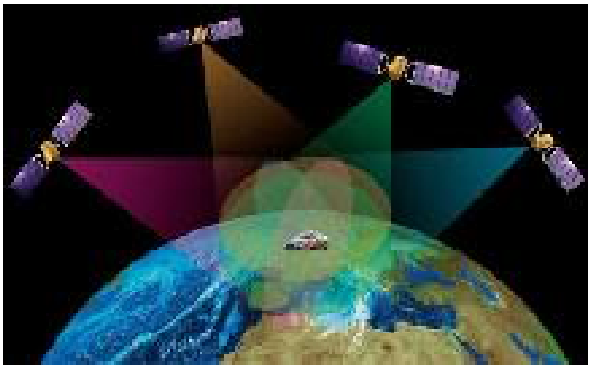
RESOURCESAT of India is an example of it.

The Data provided by them can be used for disaster management, weather forecasting, envronment protection, forestry water resource management, urban development etc.

Many geographical features become obvious at the height which they are placed which is not possible to observe from earth's surface and not even obvious at the height at which aircraft's fly.

4. Navigation satellite

They are used for accurate navigation. GPS Global positioning system - was the 1st Navigation satellite launched by USA.



IRNSS Indian Regional navigation satellite system is Indias own navigation satellite.

Reconnaissance satellite :

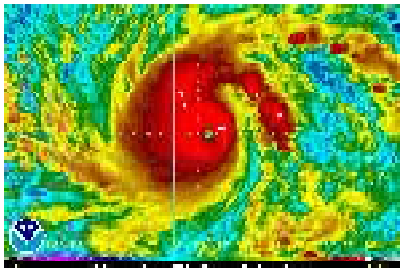
(Commonly and unofficially reffe-rred to as spy satellite) it is an earth observation or communication satellite deployed for millitary or intelligence applications. Their operations are not publicized. Drones are a part of reconnaissance sytem.

Weather satellites :

Used for monitoring the weather.

e.g. Kalpana - 1 and INSAT - 3A of India They help us not only in understanding the underlying phenomenon of weather but also predicting it.

7. Remote sensing satellite :



Remote sensing is the acquisitions of information about an object or phenomenon without making physical contact with the object and thus is in contrast to in-site observation .

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Is used in hydrology, geology, glaciology oceanography, millitary intelligence purposes etc.

''Remote sensing'' generally refers to the use of satellite or aircraft based sensor technologies to detect and classify object Earth, based on propagated signals.

8. **Student Satellites :**

ISRO has been encouraging student community to participate in ISRO missions and learn space technology as capacity building effort to prepare the future space scientists and technologists and develope future vendors who can design, develop test, space technology sub-systems and units for consumption within the country as well as to become competitors in the world market.

ISRO has established a mechnism to streamline these activities in the form of small satellites as part of Indian remote sensing programme.

e.g. Pratham, Jagnu, Anusat, Studsat, Youthsat.

Orbits.

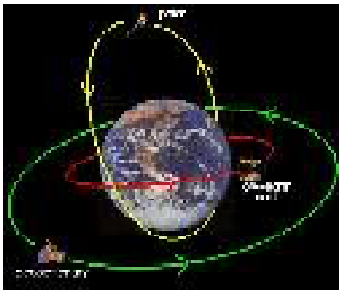
The artificial satellites that we send to space revolve around the earth in different orbits which are defined using equator as the reference. According to which there types of orbits, are there :

1. **Equatorial orbit :**

The follow equator while orbiting around the earth.

2. **Inclined orbits :** Such satellites which uses inclined orbits revolve at an angle to the equator, this angle is usually less than 90^{o}

3. **Polar orbits :**



Satellites in polar orbits revolves perpendicular to equator and pass above poles.

This classification was based on angle and the path of revolution.

Classification based on the distance from earth surface

(1) Low earth Orbit (LEO)

At a distance of 200-2000 kms from earth's surface. The international space station is in LEO.

Things placed inLEO experience atmospheric drag. The Objects are not placed below 200km because of the rapid orital decay.

LEO is the simplisand most cost effective for a satellite placement and provides high band with and low communication time lag.

2. **Middle Earth orbit :** (MEO) it is situated at a distance of 2000 kms from the surface the earth and to continues 20,000 kms.

It is sometimes called Intermediate circular orbit.

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3. **Geo-synchronour Orbit -** It is a geocentric orbit that has the same orbital period as the sideral rotation period of the earth i.e. 23 hours. 56 minutes and 4.1 seconds.

i.e. the speed of the satellite revolving is equal to the speed of rotation of Earth.

The Satellite in geosynchronous orbit appears moving in a slow oscillation alternately North & South with a period of one day so it returns to excatly the same place in the sky at excatly the same time each day henece synchronous not stationary.

This orbit is placed at distance of 35,786 kms excatly.

Synchronous Orbit : also known as helio-synchronous orbit.

This orbit is a special case of Plar orbit.

In this the orbital plane of the satellite will always be at the same constant angle relative to the sun - earth line during all seasons.

A special kind of sun-syschronous orbit is called a dawn to dusk orbit- in the satellite trails the earth's shadow.