Unit III Geography of India

Test- 2 (12th Geography)

20.11.21

Moonsoon, Rainfall, Weather, Climate	12th Geography	Unit -7 Sustainable Development
Resources (Water, Soil, Minerals, Natural Resources)		Unit – 3 Resources
Forest, Wildlife, Agriculture Pattern		Unit -4 Economic Activities
Transport & communication		Unit – 6 Geo Inoformatics

12th book
Unit 7 - Sustainable Development

- United Nations and Sustainable Development Sustainability was fi rst featured in the principles adopted by the United Nations Conference on the Human Environment held at Stockholm on 16 June 1972. It was now realized that development needed to be sustainable – it should not only focus on economic and social matters, but also on matters related to the use of natural resources. The United Nations commissioned a group of 22 people from both developed and developing countries to identify long-term environmental strategies for the international community. This World Commission on Environment and Development (WCED), was headed by Gro Harlem Brundtland, then the Prime Minister of Norway. This commission came to be known as the Brundtland Commission, which submitted its report, entitled Our common future, to the UN in 1987.

- The Brundtland Report focused on the needs and interests of humans. It was concerned with securing a global equity for future generations by redistributing resources towards poorer nations to encourage their economic growth in order to enable all human beings to achieve their basic needs. The report highlighted the three fundamental components of sustainable development, the environment, the economy, and society, which later became known as the triple bottom line.

- The 1992 and 2002 Earth Summits held at Rio de Janeiro and Johannesburg were the United Nations Conference on Environment and Development (UNCED), a direct result of the Brundtland Commission. An important achievement of the Rio summit was an agreement on the Climate Change Convention which led to the Kyoto Protocol which you have learned about earlier.

- The United Nations Conference on Sustainable Development (UNCSD), also known as Rio 2012, Rio+20 or Earth Summit 2012 was the third and recent International conference on sustainable development. It was hosted by Brazil in Rio de Janeiro from 13 to 22 June 2012.

Concept and Goals of Sustainable Development

- In 1980 the International Union for the Conservation of Nature introduced the term "sustainable development". Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

- A primary goal of sustainable development is to achieve a reasonable and equitably distributed level of economic wellbeing that can be continued for many human generations.

Sustainable Development Goals (SDGs)

- In 1992, the UN Conference on Environment and Development published the Earth Charter, which outlined the building of a just, sustainable, and peaceful global society in the 21st century. The action plan was known as 'Agenda 21' for sustainable development.

- In September 2015, the United Nations General Assembly formally adopted the "Universal, integrated and transformative" 2030 Agenda for Sustainable Development, a set of 17 Sustainable Development Goals (SDGs). The goals are to be implemented and achieved in every country from the year 2016 to 2030.

- Countries adopted a set of goals to end poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years.

- For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and people.

End poverty in all its forms everywhere

- One in five people in developing countries still live on less than $1.90 a day, many people risk slipping back into poverty. Economic growth must be inclusive to provide sustainable jobs and promote equality.

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

- Agriculture, forestry and fisheries can provide nutritious food for all and generate decent incomes, while supporting people-centred rural development and protecting the environment. A profound change of the global food and agriculture system is needed if we are to nourish today's 815 million hungry and the additional 2 billion people expected by 2050.

Ensure healthy lives and promote well-being for all at all ages

- Significant strides have been made in increasing life expectancy and reducing some of the common killers associated with child and maternal mortality. Major progress has been made on increasing access to clean water and sanitation, reducing malaria, tuberculosis, polio and the spread of HIV/AIDS.

Ensure inclusive and quality education for all and promote lifelong learning

- Major progress has been made towards increasing access to education at all levels and increasing enrolment rates in schools particularly for women and girls. For example, the world has achieved equality in primary education between girls and boys, but few countries have achieved that target at all levels of education.

Achieve gender equality and empower all women and girls

- Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

Ensure access to water and sanitation for all

- Clean, accessible water for all is an essential part of the world we want to live in. There is sufficient fresh water on the planet to achieve this. But due to bad economics or poor infrastructure, every year millions of people, most of them children, die from diseases

associated with inadequate water supply, sanitation and hygiene. By 2050, at least one in four people is likely to live in a country affected by chronic or recurring shortages of fresh water.

Ensure access to affordable, reliable, sustainable and modern energy for all

- Energy is central to nearly every major challenge and opportunity the world faces today. Sustainable energy is opportunity – it transforms lives, economies and the planet.

Promote inclusive and sustainable economic growth, employment and decent work for all

- Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment. Job opportunities and decent working conditions are also required for the whole working age population.

Build resilient infrastructure, promote sustainable industrialization and foster innovation

- Inclusive and sustainable industrial development is the primary source of income generation, allows for rapid and sustained increases in living standards for all people, and provides the technological solutions to environmentally sound industrialization.

Reduce inequality within and among countries

- To reduce inequality, policies should be universal in principle paying attention to the needs of disadvantaged and marginalized populations

Make cities inclusive, safe, resilient and sustainable

- Cities are hubs for ideas, commerce, culture, science, productivity, social development and much more. At their best, cities have enabled people to advance socially and economically Common urban

challenges include congestion, lack of funds to provide basic services, a shortage of adequate housing and declining infrastructure.

Ensure sustainable consumption and production patterns

- Sustainable consumption and production is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its implementation helps to achieve overall development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty.

Take urgent action to combat climate change and its impacts

- Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and may be even more tomorrow.

Conserve and sustainably use the oceans, seas and marine resources

- The world's oceans – their temperature, currents and life – drive global systems that make the earth habitable for humankind. Careful management of this essential global resource is a key feature of a sustainable future.

Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

- Forests cover 30 per cent of the Earth's surface and in addition to providing food security and shelter, forests are key to combating climate change, protecting biodiversity and the homes of the indigenous population. Thirteen million hectares of forests are being lost every year while the persistent degradation of dry lands has led to the desertification of 3.6 billion hectares.

Promote just, peaceful and inclusive societies

- This Goal is dedicated to the promotion of peaceful and inclusive societies for sustainable development, the provision of access to justice for all, and building effective, accountable institutions at all levels.

Revitalize the global partnership for sustainable development

- A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national and local level.

Paris Agreement

To address climate change, countries adopted the Paris Agreement at the COP21 in Paris on 12 December 2015. The Agreement entered into force shortly thereafter, on 4 November 2016. In the agreement, all countries agreed to work to limit global temperature rise to well below 2°C, and given the grave risks, to strive for 1.5°C.

Climate Change and Sustainability

- The Earth's climate has changed throughout history. In the last 650,000 years there have been several cycles of glacial and warm periods each lasting thousands or millions of years. Most of these climate changes are attributed to very small variations in earth's orbit that changes the amount of solar energy our planet receives. It is understood that at present the Earth's climate is getting warmer which is referred to as 'Global Warming'. Earth's temperature has gone up about one degree Fahrenheit in the last 100 years. This is a very small change but small changes in earth's temperature can have big effects. Some effects are already happening such as melting of glaciers, rise in the level of oceans, prolonged droughts, excessive rain and floods, etc.

Reasons for Climate change

- Burning fossil fuels emits gases into the atmosphere. Burning fossil fuel to provide energy, coupled with the effects of major transportation and deforestation causes a rapid increase in global temperatures. This can change the climate of a place.

- Effects **of climate change** – Scientists had predicted in the past that the result from global climate change are now occurring, loss of sea ice, accelerated sea level rise and longer, more intense heat waves.

- Temperatures **will continue to rise** - Experts agree that greenhouse gases which trap heat and prevent it from leaving the earth's atmosphere are mostly responsible for the temperature spike.

- Frost**- free season (and growing season) will lengthen -** it could actually have detrimental effects on the crops we grow. Warmer weather helps pests survive longer which can destroy crops. Rising temperatures are also expected to contribute to a shift in areas which are agriculturally most productive and the crops that grow there.

- Changes **in precipitation patterns -** The contrast between wet and dry areas will increase globally. In other words, the wet areas will get wetter and the dry areas will get drier.

- More **droughts and heat waves -** With rising temperatures and shifting rainfall patterns, heat waves and droughts are increasing in frequency and intensity.

- **Sea level rise -** Scientists have determined that global sea level has been steadily rising since 1900 at a rate of at least 0.1 to 0.25 centimeter per year. Sea level can rise by two different mechanisms with respect to climate change.

- Arctic **likely to become ice-free -** The Arctic Ocean is expected to become essentially ice free in summer before mid-century.

UNFCCC Process for Climate Change Adaptation, On17, May 2017: Policy makers, implementers, supporters and investors from all over the world met during the UNFCCC Bonn Climate Change Conference at the Technical Expert Meeting (TEM) on Adaptation to discuss 'Integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction.

Response to Climate Change

- There are two main responses to climate change.
- Mitigation **-** which addresses the root causes of climate change, by reducing greenhouse gas emissions.
- **Adaptation -** seeks to lower the risks posed by the consequences of climatic changes. Both approaches will be necessary to deal with the global changes that have already been set in motion.

Mitigation measures:

- It is important that we learn how to reduce climate change, and put them into practice now, before it is too late.
- **Cleaner alternative energy sources:** One important way to fight climate change is to reduce our reliance on and usage of fossil fuels, and depend on alternative renewable and greener sources of energy such as wind energy, solar energy, water or hydropower, biomass, and geothermal energy.
- Energy **saving tips -** we can adopt energy saving tips by investing in more expensive energy-saving appliances like the compact fluorescent light (CFL) bulbs, Air-conditioners, refrigerators etc. Switching off our electrical appliances when not in use.
- **Green driving tips -** The best strategy to reduce toxic gas emissions is definitely to reduce the use of automobiles. Use public transport, carpooling, use of electricity powered cars or two wheelers can be an alternative.

- **Reduce - Reuse - Recycle practices** - Reducing, reusing and recycling helps us conserve resources and energy, and reduce pollution and greenhouse gas emissions produced thereby.

- **Re-forestation** - The cleanest and most efficient remover of carbon dioxide from our atmosphere actually is nothing but green plants and trees. The rate at which we are cutting down our trees and forests to make way for human developments has greatly reduced the earth's ability to remove carbon dioxide from the atmosphere.

- **Organic farming** - Soils are an important sink for atmospheric carbon dioxide. Nevertheless, deforestation making way for conventional agriculture is increasingly depleting this sink. Sustainable and organic agriculture helps to counteract climate change by restoring soil organic matter content as well as reduce soil erosion and improve soil physical structure. Organic farming uses natural fertilizers and helps maintain crop yields.

Watershed management and its importance

- Watershed is a geographical area drained by a stream or a system connecting stream in which water from all over an area flow under gravity to a common drainage channel. A watershed system delivers water through rills, gullies and streams to a larger body of water.

- Watershed management is proper utilization of land and water resource for optimum production with minimum hazards to natural resources. It relates to soil and water conservation proper land uses, promote afforestation and sustainable farming practices, conserve farmland and pastureland, maintaining soil fertility, proper management of local water for farming, drainage, construct small dams for flood protection, improving individuals standard of living and thereby promote ecological balance.

Key steps in watershed management

- Watershed plans should first identify the characteristics of the watershed and inventory the watershed's natural resources. The first steps in watershed management planning are to:

- Delineate and map the watershed's boundaries and the smaller drainage basins within the watershed.

- Map and prepare an Inventory of resources in the watershed

- Prepare an Inventory and map the natural and manmade drainage systems in the watershed.

- Prepare an Inventory and map land use and land cover

- Prepare a soil map of the watershed

- Identify areas of erosion, including stream banks and construction sites.

- Identify the quality of water resources in the watershed as a baseline; and

- Prepare a map and Inventory of pollution sources, both point sources (such as industrial discharge pipes) and nonpoint sources (such as municipal storm water systems, failing septic systems, illicit discharges).

Watershed Management in India:

- Watershed development project in the country has been sponsored and implemented by Government of India from early 1970s onwards. Various watershed development programs like Drought Prone Area Program (DPAP), Desert Development Program (DDP), River Valley Project (RVP), National Watershed Development Project for Rain-fed Areas (NWDPRA) and Integrated Wasteland Development Program (IWDP) were launched subsequently in various hydro-ecological regions. Entire watershed development programs primarily focused on soil conservation and rainwater harvesting during 1980s and before.

Rain Water Harvesting (RWH)

- Millions of people throughout the world do not have access to clean water for domestic purposes. In many parts of the world conventional piped water is either absent, unreliable or too expensive. One of the biggest challenges of the 21st century is to overcome the growing water shortage. Rain Water Harvesting (RWH) has thus regained its importance as a valuable alternative or supplementary water resource, along with more conventional water supply technologies. Water shortages can be relieved if rain water harvesting is practiced more widely.

Need for Rain Water Harvesting

- To overcome the situation of inadequacy of water supply.
- The most economical way to increase the ground water table.
- To replenish the sub soil of the urban area covered with pavements.
- To recharge the underground water table at places where the availability of rain water is higher or to overcome the situation of water logging.
- Rain water harvesting also improves the quality of underground water through a process called dilution.
- To get water for irrigation of greenbelts, farms, gardens, etc.

Rain Water Harvesting Techniques

- There are two main techniques of rain water harvestings:
- Storage of rain water on surface for future use. Recharge to ground water.
- The storage of rain water on surface is a traditional technique and structures used were underground tanks, ponds, check dams, weirs, etc. Recharge of ground water is a new concept of rain water

harvesting and the structures generally used are: Recharge pits filled with boulders, gravels, and coarse-sand, Wells, Trenches etc.

Environmental Impact Assessment

- Every country strives to progress ahead. One aspect of progress is economic development through manufacturing and trading. Every country builds industries which provide employment, serve the consumers needs and help to generate revenue. The dominant pattern of development that humankind has followed in recent decades has brought about large scale changes in the earth systems. We are already feeling the impact of these changes upon our health, livelihoods and safety. On the other hand, the fruits of development are not equally distributed. Some countries and some communities have a high standard of living, while others are not able to meet their basic needs.

- Development projects in the past were undertaken without any consideration about their environmental consequences. As a result rivers and lakes have been polluted, air pollution has reached threatening levels and pilling of domestic and industrial wastes has resulted in land degradation. Industrialization and economic growth provided material comforts but at the same time deteriorated the quality of life.

The Objective of EIA

- To identify, predict and evaluate the economic, environmental and social impact of development activities

- To provide information on the environmental consequences for decision making and

- To promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.

Steps in the EIA Process

The eight steps of the EIA process:

- Screening**:** First Stage of EIA, which determines whether the proposed project, requires an EIA and if it does, then the level of assessment required.

- **Scoping:** This stage identifies the key impacts that should be investigated. This stage also defines the time limit of the study.

- Impact **analysis:** This stage of EIA identifies and predicts the likely environmental and social impact of the proposed project and evaluates the significance

- Mitigation**:** This step in EIA recommends the actions to reduce and avoid the potential adverse environmental consequences of development activities.

- **Reporting:** This stage presents the result of EIA in a form of a report to the decision-making body and other interested parties.

- **Review of EIA:** It examines the adequacy and effectiveness of the EIA report and provides the information necessary for decision –making.

- **Decision-making**: It decides whether the project is rejected, approved or needs further change.

- **Post monitoring:** This stage comes into play once the project is commissioned. It checks to ensure that the impacts of the project do not exceed the legal standards and implementation of the mitigation measures are in the manner as described in the EIA report.

Environmental Impact Assessment in India

- EIA was introduced in India in 1978, with respect to river valley projects. On 27 January 1994, the Union Ministry of Environment and Forests (MEF), Government of India, under the Environmental (Protection) Act 1986, made Environmental Clearance (EC) mandatory for expansion or modernisation or for setting up new projects listed in Schedule 1 of the notification. Since then there have been 12 amendments made in the EIA notification of 1994. Both central and

state authorities share the responsibility of EIA's development and management. EIA is now mandatory for 30 categories of projects, and these projects get Environmental Clearance (EC) only after the EIA requirements are fulfilled.

- The MoEF recently notified new EIA legislation in September 2006. The notification makes it mandatory for all projects to get environment clearance from the central government under the following categories:
  - Industries
  - Mining
  - Thermal power plants
  - River valley projects
  - Infrastructure and CRZ (Coastal Regulation Zone)
  - Nuclear power projects.
- However, the new legislation has entrusted the decision of clearing projects on the state government depending on the size/ capacity of the project. EIA appraises the environmental health and social implications of planned developmental projects. It thus links environment with development. The goal of EIA is to ensure environmentally safe and sustainable development.

Measures for Promotion of Sustainable Development

- As discussed earlier, the United Nations 17 Sustainable Development Goals and 169 targets are part of the 2030 Agenda for Sustainable Development adopted by 193 Member States at the UN General Assembly Summit in September 2015, and which came into effect on 1 January 2016. These goals are the result of international consultations that brought national governments and millions of citizens from across the globe together to negotiate and adopt the global path to sustainable development for the next 15 year.

- The SDGs and targets will stimulate action in the following critically important areas: poverty, hunger, education, health and well-being, education, gender equality, water and sanitation, energy, economic growth and decent work, infrastructure, industry and innovation, reducing inequalities, sustainable cities, consumption and production, climate action, ecosystems, peace and justice, and partnership. This agenda recognises that it is not enough to focus on economic growth alone but in creating more equal societies, and a safer and more prosperous planet.

Baripada: A hamlet that conserves forest, promotes growth

Baripada, a small hamlet straddling the Maharashtra-Gujarat border, is a collective tribal wisdom which has taken it to the next level. With a population of barely 1,000, the village has not only helped conserve their forest but also meet the United Nations' sustainable development goals, benefiting everyone in the process.

The villagers conserved the forest. And, forest helped in conservation of water. Water enabled agriculture and farming. Farming brought prosperity, which in turn helped improve literacy. And, literacy broadened horizons and led us to total transformation.

Having developed dairy and poultry over the years, the villagers have also evolved a system for marketing their products. This ensured a steady flow of revenue and kept poverty at bay. The villagers share their common land with landless families to ensure 'zero hunger' and 'reduction of inequality'.

Besides, the villagers are game for any experiments involving water, land, forest conservations, biodiversity registration, biogas, solar power, building basic infrastructure through public participation. "Decisions on prohibition, tree plantation were made at the village meeting and immediately implemented. But, to restrict entry of humans and animals in the 445 hectares of village forest was a major task".

Which countries are achieving the UN Sustainable Development Goals fastest?

- The ultimate aim of the Sustainable Development Goals is to end poverty, protect the planet and ensure prosperity for everyone. Each goal has specific targets that need to be met by 2030.

- So how close are countries to meeting them? To find out, non-profit organization Bertelsmann Stiftung and the UN Sustainable Development Solutions Network have created a prototype index that measures their performance.

- Sweden leads the list, followed by Denmark and Finland. Among the G7 countries, only Germany and France can be found among the top ten performers. The United States ranks 42nd on the Index, while Russia and China rank 62nd and 71st respectively. Also in the top 20 were Canada (13th), the Czech Republic (15th) and Slovenia (17th). Asia-Pacific's top performers Japan, Singapore and Australia rounded off the list at 18th, 19th and 20th, respectively. The SDG Index underlines that despite achieving high percentages, all countries still have their work cut out to close the remaining gap.

- India ranks 116 out of 157 nations on a global index that assesses the performance of countries towards achieving the ambitious sustainable development goals (SDGs).

12th book
Unit 3. RESOURCE

Introduction

Have you heard about **Voyager 1** launched in 1977 still is travelling at the speed of **62140 km/ hour or 17 km/sec.?** Do you know what fuel is used in it? It is **hydrazine**. What, do you think, would be the future fuel? It is certainly going to be **hydrogen**. Think about how hydrogen stands as an important future fuel.

- A resource is a naturally occurring exploitable material that a society perceives to be useful to its economic and material wellbeing. Willing, healthy and skilled workers also constitute a valuable resource, but without access to materials such as fertile soil or petroleum, human resources are limited in their effectiveness.

- Resources are the basis of the economic development of any nation. Different countries are at different levels of economic development primarily because of the variation in the availability of natural resources. The US and west European countries are economically prosperous because they possess vast natural and human resources and technology. On the other hand, in most parts of Africa and Asia, though they are naturally rich in resources, due to their lack of knowledge, the resources are unutilized and they are not used in the service of man.

Classification of Resources

- Resources are classified on various bases. Based on the continual availability, resources are classified in to **renewable** and **non-renewable resources.**

- The resources which can always be used again and again are known as **renewable resources**. It means these resources have natural regeneration and are inexhaustible. Air, water, solar energy etc. are examples of renewable resources. **Non-renewable resources** are available in finite quantities and cannot be obtained once if they are

utilized. If these resources are used in large scale, they will get exhausted soon and as such these resources are called as **exhaustible resources.** Coal, oil and minerals are examples of this type.

- On the basis of origin, the resources are classified in to **biotic** and **abiotic resources**. When a resource is originated from living organism, the resource is known as **biotic resource**. Coal, mineral oil and forests are examples of biotic resources. **Abiotic resources** are composed of non-living inorganic matter. Air, land, water and minerals are examples of this type.

- On the basis of status of development, the resources are classified in to **potential resources** and **developed resources**. Potential resources are those which are known to exist and may be used in the future. Until the resource is extracted and put in to use, it remains a potential resource. **Developed resources** are those which have been surveyed and their quality and quantity have been determined for utilisation. The development of resources depends on technology and level of their feasibility. Petroleum resource from Mumbai High is an example of Developed resources.

- Apart from the above classifications, the resources which are available in nature are known as **natural resources** and the one created by man is known as **man-made resource**. Similarly the air like resources which exist everywhere is called as **ubiquitous resources** and the resources which are concentrated only at specific places are known as **localised resources.** This kind of resource may exercise great influence on the economic development of the respective regions.

Mineral Resources

- A homogeneous, naturally occurring substance which has a definite chemical composition is called a mineral. They can be identified by their physical properties and chemical components. Minerals exist in different types based on their formation. Minerals play an indispensable part of our daily activities. Almost everything we use, from a tiny particle to a huge building or a big ship all, is made up of minerals. Minerals are one of the most valuable resources of the earth.

All the stages of human development or progress have been named after them. For example, stone age, copper age, bronze age and Iron Age.

- They are exhaustible or non-renewable. Besides, they are distributed very unevenly. They are generally found in the form of ores. The ore contains several impurities. Minerals are separated from the ores involving a number of distinct processes.

- A country's economic development is depending on the minerals. There are several types of minerals, but according to their characteristics and commercial use.

Uses of Minerals

- Minerals are basic and essential raw materials in our daily lives and are vital for economic, social and technological development. They are used,

    - ❖ In the construction of buildings, bridges and settlement.
    - ❖ As raw materials in industries
    - ❖ As fuels
    - ❖ In the manufacture of defiance equipment's.
    - ❖ In the field of communication like manufacturing telephone, wires, cables, electronic devices etc.
    - ❖ In making of alloys for various purposes.
    - ❖ In making of ornaments.
    - ❖ In the manufacture of fertilizers, pesticide, fungicides etc.

Mode of Occurrence of Minerals

- Minerals are generally found in 'Ores'. It is actually an accumulation of any mineral mixed with other elements. Minerals generally occur in many forms. They are

1. Veins and lodes

- Minerals generally occur in the cracks, crevices, faults and joints of the igneous and metamorphic rocks. Minerals in smaller occurrence

are called a 'Vein' and a larger occurrence is called a 'lode, for example, Copper and Gold are found in lodes and veins.

2. Beds or Layers

- Minerals that are formed as a result of deposition, accumulation and concentration generally occur in horizontal layers. E.g. Coal, Potash, etc.

Residual mass of weathered particles

- When the decomposed rocks are washed away by water, the soluble particles are removed, leaving a mass containing ores. Such occurrences are called residual mass. E.g. Bauxite

3. Alluvial deposits or placer deposits

- These are the deposits found in the sands of valley floor and at the foot hills. These deposits consist of the minerals such as Gold, Silver and Platinum.

The world distribution of minerals

- Metallic Minerals The minerals which contain metal in them are called as metallic minerals.

Iron - Ore

- It is the basic mineral and the backbone of industrial development of the world. Iron Ore is the most widely distributed element of the earth's crust and it rarely occurs in a free state. It is found as the composition of many rocks and minerals. Iron-ore makes up 4.6% of the earth crusts. Iron is found in the form of Iron - ore. They are classified into 4 categories.

  (i) Magnetite: It is red in colour and has 72% of pure Iron
  (ii) Hematite: It is black in colour and has 70% of pure Iron
  (iii) Limonite: Its colour varies from dark brown to yellow and has 50% of pure iron.

(iv) Siderite: It is brown in colour and contains only 30% of pure iron is present.

- The iron content of these ores is highly variable. If the iron content is less than 30% in an ore, it is considered to be uneconomical. Iron is mixed with fixed proportions of Manganese, Nickel, Chromium or Vanadium to make different varieties of steel.

Distribution of Iron ore

- Iron - ore is unevenly distributed in the world. Good quality Iron ore is found in Australia, Brazil, Russia, China, USA, Ukraine, Canada, etc. Russia has the largest proven reserves of iron ore in the world.

- Australia is the largest producer of Iron ore in the world. Other leading producers are China, Brazil, India and Russia. The Majority of Iron ore is (84%) produced by 5 countries alone.

Iron ore

Rank	Country	Production (metric ton)	Share (%)
1	Australia	531,075,350	33.72
2	China	345,841,000	21.99
3	Brazil	271,275,900	17.22
4	India	124,852,650	7.93
5	Russia	55,550,000	3.53
	Others		15.64

Major Iron Ore Fields in the World

Country	Iron ore fields
Australia	Mt. Bruce, Mt. Goldsworthy, Mt. whaleback, etc.
China	Manchuria Region, Shandong, Sinkiang region, etc.
Brazil	Itabria in south east region.
India	Chhattisgarh and Baster region, Odisha, Chitradurg, Kdermukh, Mayurbbanj, region etc.
Russia	Ural region, Kuzbas, Angara, etc.
U.S.A	Messabi range, Marquette range, cornwall, Albama,

	Appalachin region, etc.
Germany	Rhur basin.
Ukraine	Krivoi rog.

Manganese ore

- It is a kind of Ferro-alloy used to manufacture the special quality steel. A little manganese added to iron, removes gases and acts as a 'Cleanser' in the manufacturing process. Nearly 6 Kg of manganese is used for making one ton of steel.

- Manganese is used for special quality steel making; it makes steel anti - corrosive, hard and clean. It helps to increase toughness, strength and durability to resist oxidation in blast furnaces. It is used to produce alloys with Copper, Bronze, and Nickel. It is used for producing heavy machinery, tools, bleaching powder, insecticides and paints.

Distribution and production of Manganese ore

- South Africa, Australia, China, Gabon, Kazakhstan, Brazil, India, Ghana, Ukraine and Mexico are the major countries possessing manganese ore. South Africa is the largest producer of manganese ore in the world, followed by Australia. The other leading manganese producers are China, Gabon and Brazil. India is the 8th largest producer of manganese in the world though it possesses the largest reserves of manganese in the world.

Manganese-Ore Production

Rank	Country	Production (metric ton)	Share (%)
1	South Africa	4,754,560	30.84
2	Australia	2,388,500	15.50
3	China	2,150,000	13.95
4	Gabon	1,658,500	10.76
5	Brazil	1,141,684	7041
	others		21.54

Copper

Rank	Country	Production (metric ton)	Share (%)
1	Chile	5,552,600	27.20
2	Peru	2,353,859	11.53
3	China	1,851,000	9.10
4	United states	1,430,000	7.00
5	Congo	1,035,631	5.07
	Others		40.13

Copper

- It is a non - ferrous, soft brown metal. It is a good conductor, with high luster, density and melting point. Copper occurs in three forms as native metal in its pure state, as oxides and as sulphide.

- The chief ore of copper is copper pyrite. It yields nearly 76% of the world production of copper. Copper is extracted by the process of crushing, concentration, roasting, smelting and refining. It was discovered in the earliest stage of civilization. Copper is one of the first metals known and used by man. It is found in the igneous and metamorphic rocks. Copper is unfortunately very soft, but by mixing with tin, bronze can be obtained and mixing with zinc, brass can be obtained which is harder and tougher than pure copper. Copper is used in

  (i) Electrical Engineering

  (ii) Metallurgical Industries

  (iii) Making of alloys and making tubes, pipes, pumps, radiators and boilers. They are also used in the production of a wide range of ornamental materials.

Production and distribution of Copper

- Copper deposits are found in almost every country. The main producers are Chile, Peru, China, USA and Congo. Chile is the largest producer of Copper in the world. It produces 27.20% of the world Copper, followed by Peru, which produces 11.53%. India holds 35th rank and it produces only 0.15% of the world's production.

Bauxite

- Bauxite is an important ore which is the main source of Aluminum. It is an impure raw material. It generally occurs as an ingredient of chemical compounds in highly complex minerals such as Cryolite, Corundum and Kaolin. Bauxite occurs quite near the surface and is generally mined by open cast method. It has a wide range of applications which include construction of buildings, utensils and airplane parts.

Production and world distribution of Bauxite

- The main Bauxite producers are Australia, China, Brazil, Guinea and India. The World's greatest Bauxite producers and exporters are the countries located in the tropical and sub-tropical region. Australia is the largest producer of bauxite in the world. India is the 5th largest producer of bauxite in the world.

BAUXITE (ORE)

Rank	Country	Production MT	Share in %
1	Australia	83,516,578	29.31
2	China	65,000,000	22.81
3	Brazil	39,244,200	13.77
4	Guinea	31,117,131	10.92
5	India	24,644,632	8.66
	others		14.53

Gold

- Gold is a precious metal which occurs in alluvial or placer deposits or as reefs or lodes in the underground. Gold is used extensively for jewellery and also in dentistry, glass and porcelain dyes, in medicines and other industries. The purity of gold is expressed in terms of carat. China, Australia, Russia, USA and Canada are the leading producers of gold in the world. India ranked 33rd position in the gold production in 2016.

GOLD

Rank	country	Production	Share in %
1	China	453,500	14.11
2	Australia	282,421	8.79
3	Russia	262,380	8.16
4	United states	222,211	6.91
5	Canada	165,034	5.13
	Others		56.90

Do you know?
Fool's Gold refers to pyrite of Iron Sulphide because of its similarity in shape and colour to actual gold.

Platinum

- Platinum is a rare metal. It is costlier than gold. It has a very high melting point. It is a heavy, malleable, ductile, highly inactive, silverish, white transaction metal. It is one of the densest metal almost twice as dense as lead. Platinum is found with other rare metals such as osmium, Palladium, Iridium and rhodium. Platinum is also used in industrial applications. South Africa is the largest producer of platinum in the world. The other leading producers are Russia, Zimbabwe, Canada and USA.

Platinum

Rank	Country	Production Kg	Share in%
1	South Africa	133,241	71.75
2	Russia	21,860	11.77
3	Zimbabwe	15,110	8.14
4	Canada	9,300	5.01
5	USA	3,891	2.10
	Others		1.33

Non- metallic minerals

- The minerals which do not contain metal in them are called as non-metallic minerals.

Mica

- Mica is a Latin word micare means to shine, to flash or to glitter. Mica has a crystalline and layered structure and can be split into very thin sheets. It does not react to water, acids, oil or solvents. It is lightweight, flexible and strong. It can resist extremely high temperatures or sudden changes in temperature and is able to withstand high voltages and insulate with low power loss. It can absorb or reflect light, which enables a decorative effect and protects against ultra-violet (UV) light.

Major Uses of Mica

- Mica has several applications. There are several main sectors where the use of mica is identified. They are the paint and coatings sector, Cosmetics and personal care companies, Plastics and printing ink manufactures the electronics sector, the automotive sector, the construction industry and the oil industry.

Phosphate

- Phosphate occurs in the sedimentary rocks or as phosphate nodules. Another source is bird dropping of Guano. It is the most important

source of phosphorus. It is mainly used in fertilizer. China is the largest producer of Phosphate in the world. The other leading producers are Morocco, USA, Russia and Peru. The Guano deposits are found in Peruvian and Chilean deserts in South America. India is the 20thlargest producer of Phosphate in the world.

Phosphate (2016)

Rank	Country	Production MT	Share in %
1	China	43,319,400	51.58
2	Morocco	8,601,000	10.24
3	USA	7,615,000	9.07
4	Russia	48,36,00	5.76
5	Peru	4,103,220	4.78
	Others		18.57

Do you know?
Agencies involved in the exploration of minerals in India. GSI, ONGC, MECL, NMDC, IMB, BGML, HCL, NALCO are the departments involved in mining in different states of India.

Energy Resources

- Resources may be classified into renewable and non-renewable resources. Mineral resources like coal, Petroleum and natural gas are the exhaustible or non-renewable resources. They cannot be replaced once they are consumed. Coal and petroleum are the fossil fuels, on which the modern culture relies so much.

- Energy gives motion to our industrial machines and vehicles. It is the primary input in the production of goods and services. The wheel of progress moves with the flow of energy. The energy resources may be classified into two types.

(i) Nonrenewable sources of Energy

- Once these resources are used, they cannot be regained again. In other words, they are exhaustible. They are coal, Petroleum natural gas and atomic fuels.

Coal

- Coal is a fossil fuel. It is a flammable, black or brown sedimentary rock and is mainly composed of carbon. It is the altered remains of prehistoric vegetation that originally accumulated in swamps and peat bogs. The dense forest plants were converted into coal due to intense pressure and heat inside the earth by the process of carbonization. Most of the coal resources of the world were formed during the carboniferous period (280 to 350 million years ago). The quality of the coal is determined by its carbon content. The following types of coal have been identified on the basis of their physical properties. They are,

(i) **Peat** is the first stage of transformation of wood into coal and it has only 30 to 35% of carbon.

(ii) **Lignite or Brown** coal is the inferior quality and contains 35-45% carbon

(iii) **Bituminous or coking coal** is the second best variety of coal and contains 70-90% of carbon. It is the most widely spread and most widely used variety of coal. It is the most popular coal in commercial use.

(iv)**Anthracite** is the best quality coal, which contains more than 95% of carbon. It is very hard but emits very less smoke and leaves very less ash. However its deposits are limited.

Production and world distribution of Coal

- Coal reserves are found in more than 70 countries of the world but the major coal reserves occur in the USA, Russia, China and South Africa. China is the largest producer of steam coal in the world followed by India. The other leading producers of steam coal are USA, Indonesia, and South Africa etc.

Steam coal – It is used for producing steam and it has high sulphur content.

Steam Coal

Rank	Country	Production (metric ton)	Share in %
1	China	2,49,793,000	47.42
2	India	601,131,000	11.44
3	United states	553,936,000	10.54
4	Indonesia	459,469,000	8.74
5	South Africa	253,452,000	4.82
	others		17.04

HOTS

Why is hydrogen used as fuel in rockets?

China was the largest producer of coking coal in the world in 2016 followed by Australia. The other leading producers of coking coal are Russia, India and USA.

Cooking Coal

Rank	Country	Production MT	Share in %
1	China	591,998,000	54.67
2	Australia	189,302,000	17.48
3	Russia	83,800,000	7.74
4	India	61,661,000	5.69
5	United states	50,645,000	4.68
	Others		9.74

Major Coal Mining Centres

Country	Mining centers
China	Shansi, shantung, Fushun, Shenyang, etc.
India	Bokaro, jaria, korba, ranikanch, singerni, etc.

U.S.A	Arkansas, colorodo, illionions, Indiana, Michigan etc.
Australia	Bowen basin, Brisbane, Canberra, Sydney, New-castle, Tasmania, etc.
Russia	Moscow-Tula region, Chokot, basin, Ob basin, etc.

Trade

- The main exporters of coal in the world are Australia, Indonesia, Russia, Colombia and South Africa and the main importers are China, India, Japan, Korea and Germany.

Uses of Coal

- Man has used coal for hundreds of years. But it has gained importance only after industrial revolution. It contributes about 25% of global energy demand. Coal is used for various purposes. It is used as a source of steam energy, electrical energy, domestic fuel, metallurgical coke, chemical industries and byproducts such as Ammonium sulphate, Naphthalene, Phenol, Benzene, etc.

Petroleum (or) Mineral oil

- Petroleum is a mineral that exists under the surface of the earth in liquid, solid and gaseous forms. Liquid petroleum may be in the form of crude oil. The solid form may be mineral waxes or asphalts. The gaseous form is natural gas. It is a main source of energy in the World due to its multiple uses. The human activities are directly or indirectly depend on the use of petroleum or its sub products.

Formation and occurrence of mineral oil

- It is formed by slow chemical and bio chemical decomposition of the remains of organic matter in sedimentary rocks. It is found in the pores of the sedimentary rocks. Oil is lighter than water hence, floats over water. Drilling of oil wells is the hole drilled in the earth's crust and when it reaches the rock cap, the natural gas comes out first with a great pressure. When the pressure of gas subsides, petroleum starts flowing out when the pressure of natural gas is released.

Petroleum reserves of the world

- The west Asia or Middle East is has the largest petroleum reserves, which is about 60% of the world's oil reserve. The total estimated world's oil reserves in 2008 were 1,243 (109 bbl). Saudi Arabia, Canada, Iran, Iraq and Kuwait have large reserves of petroleum.

Production and world distribution of petroleum

- The petroleum producing countries of the world can be grouped in to five geographical regions:

    1. West Asia (or) Middle East region
    2. American region
    3. Russian region
    4. East & south Asian region and
    5. African region

- Saudi Arabia is the largest oil producer of the world with 13.62% of the world output of oil. Russia is the second largest producer in the world. India is placed at 24th position in petroleum production in the world. The distribution of oil is naturally uneven; Middle East contains 60% of global reserves and rest of the world only 40%.

Petroleum

Rank	Country	Share in %
1	Saudi Arabia	13.62
2	Russia	12.72
3	USA	12.62
4	Iraq	5.09
5	Iran	5.03
6	china	4.64
	Others	46.28

Trade

- The world leading exporters of petroleum are Saudi Arabia, Russia, Iraq, UAE and Canada and the main importers are USA, China, India, Japan and Korea.

Do you know?
OPEC is the short form of the "Organisation of Petroleum Exporting Countries. It was formed in 1960 at Bagdad convention. Initially it comprised of Saudi Arabia, Iran, Iraq, Kuwait and Venezuela. Later on added in eight countries Libya, Algeria, Qatar, UAE, Nigeria, Ecuador and Angola, Indonesia left from OPEC in recently.

Major Petroleum Production Centres

Country	Production centres
Saudi Arabia	Ghawar, Abquiaq, Abuhadriya, etc.
Russia	Volga-Caspin region, Kamchatka- Sakhalin region, Ob Lena basin.
U.S.A	Tennessee- new york, ohino, Indiana, Pennsylvania, Texa, Mississippi, gulf of California, etc.
Iraq	Kirkuk, Mosul, Daura, etc.
China	Taching, Chinchou, Yemen, south china sea, etc.

Natural Gas

- It is the cheapest source of energy. It is found along with or without petroleum. It is considered as an environment friendly fuel because of its low carbon dioxide emissions. Therefore, this is the only fuel for the present century and it is also called green energy. A powerful odorant, ethanethiol is added, so that leaks can be detected easily. It is prepared by refining petroleum or wet natural gas.

Natural gas reserves and Production

- The known natural gas reserve in the world is about 6254 trillion cubic feet. Most of these reserves are found in Russia, Iran, Qatar, UAE, Saudi Arabia, USA etc. USA has the largest reserve and is the leading producer of natural gas in the world followed by Russia. India is the 28th producer of natural gas in the world. It is widely used as a fuel in industries and domestic cooking purposes. Petrochemical industries use it as fuel and raw material. It is also

used in chemical industries, artificial rubber, plastic, fertilizers, ink, and carbon and as artificial lighting.

Natural Gas

Rank	Country	Production (metric ton)	Share (%)
1	United states	755,010	20.56
2	Russia	641,000	17.45
3	Iran	202,440	5.51
4	Qatar	181,250	4.94
5	Canada	157,179	4.28
	Others		47.28

Trade

- Russia, Qatar, Norway, Canada and Algeria are the leading exporters of Natural gas in the world. Japan, Germany, China, Italy and Turkey are the leading importers of natural gas.

Nuclear Energy

- It is commonly said, this energy holds the key of future. Energy contained within the nucleus of an atom is called nuclear energy. Heavy metals like Uranium, Thorium, Radium, Plutonium and Lithium are the main sources of nuclear energy. However Uranium is the most important source of nuclear energy. The nuclear energy production was started first in USA in 1950. Nuclear energy now provides about 11% of the World's electricity. At present there are more than 450 operable fission reactors in the world. The world's first commercial nuclear power station Calder Hall at Wind scale, England was opened in 1956.

Uranium (U3O8)

Rank	Country	Production (metric ton)	Share (%)
1	Kazakhstan	29,113	38.89
2	Canada	16,666	22.26
3	Australia	7,352	9.82

4	Namibia	4,302	5.75
5	Niger	4,101	5.48
	Others		17.80

Do you know?
Most devastating nuclear accidents
1. Three mile Island- March 28, 1979 USA
2. Chernobyl - April 29, 1986, Russia
3. Fukushima Daiich- March 11, 2011, Japan

Renewable sources of Energy:

- All regions of the world are facing the twin problems of fast increasing demand for energy and limited supplies and rapidly depleting conventional sources of energy. Under these circumstances, non-conventional sources of energy are getting more importance. These sources are renewable, clean and non-polluting. They are solar, wind, geothermal, wave, tidal energy, bio-gas etc.

Hydel Power

- Hydro electricity is produced by using the potential energy of water falling from a certain height. The falling water spins the turbine blades and energy is produced. It is a clean eco-friendly and renewable source of energy. It contributes nearly 7% of the world electricity production. China has the largest potential followed by Brazil, Indonesia, Canada and Zaire. China is the largest producer of Hydroelectricity in the world, followed by Canada.

Solar energy

- It is based on mechanical conversion of solar energy into electricity. It is available in abundance but only in the recent period it gets more importance due to technological development. Solar energy is used for various purposes.

Do you know?
Noor Complex is the world's largest concentrated solar power (CSP) plant, located in the Sahara Desert.

Kamuthi, the world`s largest single solar power plant

Kamuthi Solar Power Project is a photovoltaic power station spread over an area of 2,500 acres (10 km2) in Kamuthi, Ramanathapuram district. The project was commissioned by Adani Power. With a generating capacity of 648 MW at a single location, The Kamuthi Solar Power Project was completed on 21 September 2016. Around 8,500 workers installed an average of 11 MW of capacity per day to complete the project within 8 months. The entire solar park is connected to a 400 kV substation of the Tamil Nadu Transmission Corp. The solar panels are cleaned daily by a self-charged robotic system.

- USA is the major producer of solar cells at present. It is simply the energy provided by the sun, which makes production of solar electricity possible. **Solar power in India** is a fast developing industry. The country's solar installed capacity reached 26 GW as of 30 September 2018. India expanded its solar-generation capacity 8 times from 2,650 MW on 26 May 2014 to over 20 GW as on 31 January 2018. The country added 3 GW of solar capacity in 2015-2016, 5 GW in 2016-2017 and over 10 GW in 2017-2018, with the average current price of solar electricity dropping to 18% below the average price of its coal-fired counterpart.

Wind Energy

- The wind is a clean, free and readily available renewable energy source. Wind turbines are capturing the wind's power and converting it to electricity. Wind power has become a pillar in their strategies to phase out fossil and nuclear energy. Wind energy is now the second fastest growing source of electricity in the world. It fulfills about 5% of world's electricity demand. The world's largest wind farm is in Altamont pass in California. India is emerging as a major wind power producer of world. The important wind farms in India - (i).The largest wind farms in India are Muppandal in Kanyakumari District of Tamil Nadu and Jaisalmer wind park in Rajasthan. They are the first and second largest wind farms of India. Based on the location of its generation it is classified into:

  1. Onshore wind energy and
  2. Offshore wind energy

1. Onshore wind energy –Energy generated from the plants located on the land is known as onshore wind energy. Onshore wind has the advantage of being one of the most affordable renewable energy sources. It is cheaper than any other renewable source of energy but it requires more area to install than any other energy.

2. Offshore wind energy –It refers to the use of wind farms developed in seas and oceans. The largest offshore wind farms are currently in the U.K and Germany. These two countries installed 2/3 capacity. London Array is the largest offshore wind farm in the world. The first offshore wind farm is planned near Dhanuskodi in Tamil Nadu.

Tidal **energy** - It is a renewable energy powered by the natural raise and fall of ocean water. Its production is very small. The first tidal power station was located in La Rance in France. The largest tidal power station is at Sihwa Lake in South Korea and it is the largest tidal power producer in the world. There are three different category of sources from which the tidal energy is generated. The sources are tidal streams, barragesandtidallagoons.

- India's first attempt to harness tidal power for generating electricity would be in the form of a 3MW plant at the Durgaduani creek in sunderbans delta of West Bengal. The Gulf of Kutch and Cambay in Gujarat and the Ganges delta in sunderbans, the world's largest mangrove, are the 3 sites identified as potential areas for tidal power generation in India.

Geo Thermal Energy

- Geo thermal energy is derived from the natural heat of the earth. The United States is the world's largest producer, and the largest geothermal development in the world is The Geysers north of San Francisco in California, the U.S.

- In India, exploration and study of geothermal fields started in 1970. The GSI (Geological Survey of India) has identified 350 geothermal energy locations in the country. The most promising of these is in Puga valley of Ladakh. The estimated potential for geothermal energy in India is about 10000 MW. There are seven geothermal

provinces in India: the Himalayas, Sohana, West coast, Cambay, Son-Narmada-Tapti (SONATA), Godavari, and Mahanadi.

Conservation of Resources

- It takes millions of years for the formation of minerals. Compared to the present rate of consumption, the replenishment rate of minerals is very slow. Hence, mineral resources are finite and non- renewable. Due to this, it is important to conserve the mineral resources.

Ways of Conserving Resources

- ❖ Controlling population growth will reduce the demand for resources.
- ❖ Creating social awareness regarding the importance of conservation of resources
- ❖ Reusing and recycling of resources.
- ❖ Using the renewable source of energy as an alternative to non-renewable resources.
- ❖ Developing the usage methods which minimize the wastages.
- ❖ Propagating the environmental ill effects caused by various products.
- ❖ Choosing the products with less packaging.

12th Book
Unit 4. Economic activities

INTRODUCTION

Waymo car

Have you heard about Waymo car? A car without brakes, accelerators or steering wheel – a driverless car is indeed a dream come true.

Google started testing self-driving technology with the Toyota Prius on freeways in California in 2009.

A new development was the unveiling of a new prototype vehicle in 2014, capable of being a fully self-driving car. These intelligent cars use sensors and software to detect objects like pedestrians, cyclists and can safely drive around them. According to Google, the car can process both map and sensor information to find out its exact location - precisely which street or lane it is driving in. The sensors are so powerful that it can detect all kinds of objects. What's more interesting, the software can predict what these objects around the car will do next and take action accordingly.

In an instance, where the traffic signal turned green and the car was about to move forward, the car sensed an ambulance coming from the right side and it stopped, making way for the ambulance. Google calls its cars, 'experienced drivers'. Each car's speed is capped safely at 25 mph (40 km/hr). The cars halt for 1.5 seconds after the signal turns green at a junction as many accidents happen during this time.

But the cars can travel as fast as 161 km/hr. To ensure safety, the front side has about 2 feet of foam and the windshield is made of plastic instead of glass. This is the amazing product of secondary industries which we learn about as part of economic activities in this lesson

- **Economic activity** refers to the activity of making, providing, purchasing and selling goods or services. Economic activities exist at all levels within a society. Human beings are engaged in various kinds of economic activities. In general all the economic activities are broadly categorised into Primary, Secondary and Tertiary activities. The Tertiary activities are further sub divided into Quaternary and Quinary activities.

- Let us first understand the meaning and concept of the different categories of economic activities.

Types of Economic system:

1. **Subsistence economy:** Goods and services which are created for the use of the producers and their kinship groups.

2. **Commercial economy:** Goods and services which are produced mainly for sale. Market competition is the primary force determining the production and distributions.

3. **Planned economy:** Goods and services created are controlled by government agencies. Supply and price are controlled by the state. It was practiced earlier by the Communist controlled societies.

Primary activities

- Primary activities help man to fulfill his needs and desires, by using resources which are gifted to man by nature. These activities are directly connected with nature. Hunting, Gathering, Pastoralism, Fishing, Forestry, Mining and Agriculture are the primary activities.

Hunting and Gathering

- Until 12,000 years ago, all humans lived as hunters and gatherers. At present only 0.0001% human live as hunters and gatherers. Gathering and hunting are the oldest known economic activity in the world. It often involves primitive societies which collect both plants and animals to satisfy their needs for food, shelter and clothing. These primitive activities are being carried out still in a very few parts of the world. Gathering is practiced in the areas of High altitude zones of Northern Canada, Northern Eurasia and Southern Chile and in the low altitude zones of the Amazon Basin, Tropical Africa, Northern fringe of Australia and interior parts of South East Asia. Present day gatherers and hunters are confined to a few pockets. Inuit in the Arctic region, Pygmies of Kalahari, Pintupi, Aborgines of Australians, and Paliyan of South India are the examples of foragers.

Pastoralism

- Pastoralism is the process of grazing and rearing of different types of animals like cattle, sheep, goats, etc. in an organised manner to get animals products. The animals rearing can be primitive which is carried on by nomads or highly scientific means on a commercial scale. So, animal grazing and rearing can be divided into two broad categories as Nomadic Herding and Commercial Livestock Rearing.

Nomadic Herding (or) Pastoral Nomadism

- It is a primitive subsistence activity in which the herders rely on animals for food, clothing, shelter, tools and transport. They move from place to place along with their livestock, depending on the availability of pastures and water. These people do not lead a settled life but keep on moving from place to place. Pastoral nomadism is commonly practiced in regions with little arable land, typically in the developing world. They are mostly found in central and western Asia, Northern and Western regions of Africa and some parts of southern Africa and Tundra regions.

Transhumance

- Transhumance is the seasonal movement of people with their livestock between fixed summer and winter pastures. In mountain region it implies movement between higher altitude pastures during summer and valleys in winter.

- Gujiars, Bakarwals, Gaddis and Bhotiyas in the Himalayan region migrate from plains to the mountain in summer and to the plains from the high altitude pastures in winter. In the tundra regions, herders move from south to north in summer and from north to south in winter. The number of pastoral nomads has been decreasing and the areas operated by them shrinks due to developments and spreading of other economic activities.

Commercial Livestock Rearing

- Commercial livestock rearing is more organised and capital intensive activity in comparison with the Nomadic pastoralism. It is generally practiced in permanent ranches. Ranches refer to the large stock farms, usually fenced in, where animals are breed and reared on a commercial scale. Animals are grazed over large areas which are known as ranches in Prairies and estancia in Pampas. Most modern technology is used for commercial grazing, great emphasis is laid on breeding, genetic improvement, disease control and health of the animals. Products such as meat, wool, hides and skin are processed and packed scientifically and exported to different world markets. New Zealand, Australia, Argentina, Uruguay and USA are the major countries where commercial livestock rearing is practiced.

Do you know?

Employees of the economic activity	
Economic activity	**Name**
Primary	Red collar
Secondary	Blue collar
Tertiary	Pink collar
Quaternary	White collar
Quinary	Gold collar

Agriculture

- Agriculture is the most fundamental form of human activity and includes not only cultivation of crops but also the domestication of animals. The following are the major agricultural types and their characteristic features.

Shifting Cultivation

- Shifting Cultivation is a kind of traditional farming practiced by tribes in the hilly and forest regions. It is practiced especially in tropical Africa. In this farming an area of ground is cleared of vegetation and cultivated for a few years and then abandoned for a new area until its fertility has been naturally restored. They are called

with different names in different regions as follows Shifting Cultivation in Northeast India.

S.No	Name	Region
1	Jhuming/Bewar	North eastern states of India
2	Ladang	Malaysia
3	Chengin/Kaingin	Philippines
4	Milpa	Central America and Mexico
5	Konuko	Venezuela
6	Roca	Brazil
7	Masole	Congo
8	Ray	Vietnam
9	Humah	Indonesia
10	Taungya	Myanmar
11	Chen	Sri Lanka

Subsistence agriculture

- Subsistence Agriculture is a type of farming in which output is consumed almost entirely by the farmers and their families leaving only a small proportion for sale. Farmers follow traditional method of cultivation in this kind of farming.

Intensive agriculture

- Intensive Agriculture is the one in which the agricultural land is utilised intensively. Farmers prefer the cultivation of short duration crops which enables the cultivation of two or three crops in the same piece of land in a year. Generally it is practiced wherein the size of the agricultural land holding is small.

Plantation Agriculture

- Plantation agriculture is a form of commercial farming where crops are grown for profit. Large land areas are needed for this type of agriculture. Countries that have plantation Agriculture usually experience high annual temperatures and receive high annual rainfall. Plantation is mainly found in countries that have a tropical

climate. The important plantation crops are tea, coffee, cocoa, rubber, oil palm, sugarcane, bananas and pineapples.

Extensive Farming

- It is a kind of farming practiced in the regions where the size of the land holding is very large. It is practiced in the Interior parts of semi-arid lands of the mid-latitudes. Wheat is the major crop of this region and the farming is highly mechanized.

Mixed Farming

- It is an agricultural system in which a farmer conducts different agricultural practice together, such as crops, fishing and livestock. The aim is to increase income through different sources and to complement land and labour demands across the year.

Do you know?
Pomology – the study of growing fruits.
Olericulture – science of vegetable growing.
Floriculture – refers to cultivation of flowers.
Sericulture – refers to Rearing of Silkworms

Mediterranean Agriculture

- Mediterranean agriculture is highly specialised commercial agriculture. It is practised in the countries on either side of the Mediterranean Sea in Europe and in North Africa from Tunisia to Atlantic coast, southern California, central Chile, south western parts of South Africa and south and south western parts of Australia. This region is an important supplier of citrus fruits. Viticulture or grape cultivation is a speciality of the Mediterranean region. Best quality wines in the world with distinctive flavours are produced from high quality grapes in various countries of this region. The inferior grapes are dried into raisins and currants. This region also produces olives and figs. The advantage of Mediterranean agriculture is that more valuable crops such as fruits and vegetables are grown in winters when there is great demand in European and North American markets.

Horticulture

- Specialised cultivation of flowers, vegetables and fruits is called horticulture. It is also termed as "truck farming". These crops are grown on small farms which are well connected to the markets by cheap and efficient means of transportation. It is labour and capital intensive crops. The main areas are northwest Europe, northern eastern USA and Mediterranean region. The study of grape cultivation is known as viticulture.

Von Thunen model of agriculture

- The Von Thunen model of agricultural land use was created by the farmer, landowner, and economist Von Thunen in 1826 in a book called The Isolated State. Von Thunen model was created before industrialization and is based on the following limiting assumptions:

- The city is located centrally within an "Isolated State" that is self-sufficient and has no external influences.
  - The Isolated State is surrounded by an unoccupied wilderness.
  - The land of the State is completely flat and has no rivers or mountains to interrupt the terrain.
  - The soil quality and climate are consistent throughout the State.
  - Farmers in the Isolated State transport their own goods to market via ox cart, across the land, directly to the central city. Therefore, there are no roads.
  - Farmers act to maximize profits.

- In an Isolated State with the foregoing statements being true, Von Thunen hypothesized that a pattern of rings around the city would develop based on land cost and transportation cost.

The Four Rings

- **Ring 1:** Dairying and intensive farming occur in the ring closest to the city. Because vegetables, fruit, milk, and other dairy products must get to market quickly, they would be produced close to the city. The first ring of land is also more expensive, so the agricultural products would have to be highly valuable ones and the rate of return is maximized.

Ring 2: Timber and firewood would be produced for fuel and building materials in the second zone. Before industrialization and coal power, wood was a very important fuel for heating and cooking. Wood is very heavy and difficult to transport, so it is located as close to the city as possible.

Ring 3: The third zone consists of extensive field crops such as grains for bread. As grains last longer than dairy products and they are much lighter than fuel, to reduce transport costs, they can be located farther from the city.

Ring 4: Ranching is located in the final ring surrounding the central city. Animals can be raised far from the city because they are self-transporting.

What the Model Tells Us?

- Even though the Von Thunen model was created in a time before factories, highways, and even railroads, it is still an important model in geography. The Von Thunen model is an excellent illustration of the balance between land cost and transportation costs. When one gets closer to a city, the price of land increases. The farmers of the Isolated State balance the cost of transportation, land, and profit and produce the most cost-effective product for market. Of course, in the real world, things do not happen as they would in a model.

Mining

- The process of extracting minerals from the earth crust is known as mining. The discovery of minerals in the history of human

development is reflected in many stages in terms of copper, Bronze and Iron Age. The use of minerals in ancient times was largely confined to making of tools, utensils and weapons. The actual development of mining began with the industrial revolution and its importance is continuously increasing.

Types of Mining

Open-pit or opencast mining

- Open pit mining involves mining minerals ore that can be found near the surface layer of the site. Some quarries can be over 1000 meters deep. This form of mining doesn't require tunneling into the earth and is a simple method of mining that yields high production.

Surface Mining

- Surface mining is the process of mining the ores found on the surface of the earth. In this process, any unwanted soil is stripped off from the land and the ore beneath is extracted. Surface mining often leaves behind large areas of infertile land and waste rock as 70% of the mined earth is waste materials.

Underground or sub surface mining/Shaft mining

- Sub-surface mining involves the digging of a network of shafts and tunnels into the earth to reach and extract the deposit of mineral ore beneath the earth. In comparison to other methods, underground mines impacts are less on the environment and are more harmful to those working within them. In modern practice, underground mines are pre-assessed for oxygen toxicity levels and a system of ventilation machines and protocols are in place to ensure workplace safety.

In-Situ Mining

- It is a rarely used method of mining material. It is also called as solution mining. It is the process of pumping a solution into the ore body, which dissolves the ore and is then extracted by a second pump. This method is used most in mining uranium deposits.

Secondary Activities

- Secondary sector transforms the raw materials obtained from the primary sector into consumer goods. So it consists of manufacturing and industrial activities. Since it adds value for the raw materials, it is also called as value addition sector. Industries consume large quantities of energy and require factories and machinery to convert the raw materials into goods and products. The secondary sector supports both the primary and tertiary sectors.

Factors affecting location of Industries

1. Availability of raw-materials or nearness to raw-materials: Availability of raw materials or nearness to raw materials is a primary factor which governs location of industries. An industry is located in a place where raw materials are available in abundance and at cheaper rates. It is more so for the weight loosing and bulky raw materials. For example, oil refinery factories are established at Visakhapatnam because oil is imported through Vizag port.

2. Availability of power: Availability of power is another important factor of concentration or location of industries. In olden days steam was used for running industries. As a result industry is established near the coal mines. But with the invention of electricity, today industries are located in any place where electricity is available. Industries like aluminum units are located near the hydroelectric projects.

3. Transport costs: Transport costs also influence the location of industries. Industries incur transport costs for bringing raw-materials and for sending the finished goods into the markets. It is economical to start an industry near the area where transport costs are minimum and low. Raw-materials which are heavy and occupy large place, require huge cost for transporting them. So an industry must be located near the area where the transport costs are minimal.

4. Nearness to the market: This is a chief factor governing the location of an industry in modern period. Several advantages are secured when an industry is established near the market. Production can be carried on in accordance with the changes in the consumers' tastes. Economies of transport can be secured in importing raw-materials.

5. Availability of labour: Labour is required for organizing the productive affairs of an industry. The entrepreneurs like to start industries in those areas where labour is abundantly available. The growth of cotton textile industry near Bombay is due to the availability of cheap labour.

6. Government policy: The policy of government also influences the location of industries. The Government may establish an industry on political considerations by giving several incentives. It provides finance, land, water, and transport and communication facilities in backward regions with a view to developing them. It also provides tax concession, marketing consultancy, export and import facilities.

7. Availability of capital: Capital is the most essential factor for the establishment of an industry in a locality.

Weber's Theory of Location

Weber has developed an industrial location emphasising the least cost principle. This is based on assumptions relating to transport costs and other conditions. From his theory, industrial locations for three different situations are made clear.

Assumptions:

1. Some resources are available only in certain regions. Yet, resources such as water are ubiquitous (present everywhere).

2. Markets are found only in specific places.

3. Transport costs are determined based on the weight of the raw materials and distance of transfer.

4. There is competition in the markets for the commodities produced at the industry.

5. Humans use their discretion in their consumer behavior in relation to the industrial commodities.

- Based on these assumptions, together with the notion of high profits with least costs and imagination, Weber describes his theory of industrial location.

- Weber uses a triangular structure to elaborate on his theory of industrial location using least transport cost principle. The two corners of the triangle defined by the base line represent the places where raw materials are found (R1 and R2). The market (M) is at the apex of the triangle. In the figure below, R1 and R2 are resource locations, consisting of two types of resources. M is the market and P is the industrial location.

- As the logic behind Weber's location indicates, some industries produce finished products which lose weight (weight losing raw materials). In this case, the transport cost for raw materials transfer to the industrial location is higher than the transport cost of moving finished products from industrial location to market. It is because the waste from raw materials at the industrial site will be high. Hence, it is profitable to have industry at the raw materials' locations.

- If industry is located at the raw material source R1, then raw material R2 must be transported to industrial location R1 and the finished products must be transported to the market M. This results in transport costs. Likewise the industry could be located at R2, too. But if it is located at M, R1 and R2 resources must be transported to market M. This would also involve transport costs. If on the other hand, the industry is located half way between R1 and R2, and then the transport cost to bring the raw materials from R1 and R2 is equal. Transport cost involved in transporting the finished products to the Market decreases because of small distance to market M (if transport cost is assumed to increase with distance).

- In the final analysis, the transport cost for raw materials to the industrial location P and the finished products to market M from P together is the least when industry is located at P. There is thus a chance for increased profit for the industry.

- The triangle at top left represents a location where distance to be covered by transport is at minimum, the triangle at the top right

illustrates the location of a 'weight – losing industry' and the triangle at the bottom left represents the location of a 'weight – gaining industry'. Hence, the location of industry at P is an 'optimal industrial location'.

- As the industry is located at a point between the raw materials locations, transport cost to transfer bulky raw materials is reduced considerably. The transport cost for transferring the finished products from the industry to the market is also small. In such a context, Weber believes that it is profitable to set up the industry at a location in between the industry.

- There are some industries which manufacture finished products gaining weight in the process. The transport cost between raw materials location and industry is lower than the transport cost of finished products from industrial location to the market. It is logical therefore to locate the industry at the market. According to Weber, this location is more profitable to the industry than any other. The Weber's location theory is that it is based on the transport cost. Nevertheless, this theory of industrial location is considered superior to other industrial location theories for its logical conclusion.

On the Basis of Labour

Large Scale Industries

- Industries which employ a large number of labourers with huge capital are called large-scale industries. Cotton and jute textile industries are large scale industries.

Small Scale Industries

- Industries which employ a small number of labourers with small investments are called small scale industries. They include nut & bolt making, coir making, plastic bags industries, dying industry, match box making, weaving industry are some examples for small scale industries

Cottage Industries

- Those industries whose labour force consists of family units or individuals working at home with their own equipments are called cottage industries. It is a small and often informally organized industry. The industries like weaving and pottery are the examples this category. On the Basis of size of raw-Material and Finished Goods

Heavy Industries

- Industries which use heavy and bulky raw-materials and produce products of the same category are called heavy industries. Iron and steel industry presents a good example of heavy industries.

Light Industries

- The light industries use light raw-materials and produce light finished products. Electric fans, sewing machines are light industries.

On the basis of Ownership
Private Sector Industries

- Industries owned by individuals or firms such as Bajaj Auto or TISCO situated at Jamshedpur are called private sector industries.

Public Sector Industries

- Industries owned by the state and its agencies like Bharat Heavy Electricals Ltd., or Bhilai Steel Plant or Durgapur Steel Plant are public sector industries.

Joint Sector Industries

- Industries owned jointly by the private firms and the state or its agencies such as Gujarat Alkalies Ltd., or Oil India Ltd. fall in the group of joint sector industries.

Co-operative Sector Industries

- Industries owned and run co-operatively by a group of people who are generally producers of raw materials of the given industry such as a sugar mill owned and run by farmers are called co-operative sector industries.

On the Basis of Source of Raw Materials

Agro Based Industries

- Agro based industries are those industries which obtain raw-material from agriculture. Cotton textile, jute textile, sugar and vegetable oil are representative industries of agro-based group of industries.

Mineral Based Industries

- The industries that receive raw materials primarily from minerals such as iron and steel, aluminum and cement industries fall in this category.

Pastoral-Based Industries

- These industries depend upon animals for their raw material. Hides, skins, bones, horns, shoes, dairy, etc. are some of the pastoral-based industries.

Forest Based Industries

- Paper card-board, lac, rayon, resin, tanning of leather, leave- utensils, basket industries are included in this type of industries.

Classification based on Nature of products

- Based on the nature of products it is classified into basic industries and consumer goods. Basic industries are manufacturing goods by using them as raw materials are basic industries. For example Iron and steel machines for textile industry. Consumer industries are

producing goods for consumers. For example, Television, soap, biscuits, etc.

Tertiary activities

- The tertiary industry provides services to its consumers. It is also known as service industry/sector.
- All types of services and special skills provided in exchange of payments are called tertiary activities. Health, education, law, governance and recreation etc.; require professional skills. These services require other theoretical knowledge and practical training. Most of the tertiary activities are performed by skilled workers and professionally trained experts and consultants.

- Tertiary activities involve commercial output of services rather than the production of tangible goods. Expertise provided by service relies more heavily on special skills, experience and knowledge of the workers rather than on the production techniques, machinery and factory processes. Trade and commerce, transport, communication and services are the categories of tertiary sector. Tertiary sector is further divided into quaternary and quinary sector.

Quaternary Activities

- The quaternary sector of the economy consists of intellectual activities, example, libraries, scientific research, education, and information technology. The workforce who is readily involved in this sector is typically well-educated, and people are often seen earning well through their participation in this industry.

Quinary Activities

- The professions of the people working in this industry are generally referred to as "gold collar" professions since the services included in the sector focus on interpretation of existing or the new ideas, evaluation of new technologies, and the creation of services. It involves highly paid professionals, research scientists, and government officials. The people are designated with high positions and powers, and those who make important decisions that are

especially far-reaching in the world around them often belong to this category.

Division of the world

- For analytical purposes, World Economic Situation and Prospects classifies (WESP) all countries of the world into one of three broad categories: developed countries, countries in transition (South-Eastern Europe Commonwealth of Independent States and Georgia) less developed countries and developing countries.

- The classification of countries is based on the economic status such as Gross Domestic Product (GDP), Gross National Product (GNP), per capita income, industrialization, the standard of living, etc. Developed Countries refer to the sovereign state, whose economy has highly progressed and possess great technological infrastructure, as compared to other nations.

Developed countries

- A developed country, industrialized country, more developed country, or more economically developed country (MEDC), is a country that has a developed economy and advanced technological infrastructure relative to other less industrialized nations. Most commonly, the criteria for evaluating the degree of economic development are gross domestic product (GDP), gross national product (GNP), the per capita income, level of industrialization, amount of widespread infrastructure and general standard of living.

- Developed countries have generally post-industrial economies, meaning the service sector provides more wealth than the industrial sector. As of 2015, advanced economies comprise 60.8% of global GDP based on nominal values and 42.9% of global GDP based on purchasing-power parity (PPP) according to the International Monetary Fund. In 2017, the ten largest advanced economies by GDP in both nominal and PPP terms were Australia, Canada, France, Germany, Italy, Japan, South Korea, Spain, the United Kingdom, and the United States.

Countries in transition

- A country in transition economy or transitional economy is an economy which is changing from a centrally planned economy to a market economy. Transition economies undergo a set of structural transformations intended to develop market-based institutions. These include economic liberalization, where prices are set by market forces rather than by a central planning organization. The process has been applied in the former Soviet Union and Eastern bloc countries of Europe and some Third world countries, and detailed work has been undertaken on its economic and social effects.

The Least Developed Countries

- The Least Developed Countries is a list of countries that, according to the United Nations, exhibit the lowest indicators of socioeconomic development, with the lowest Human Development Index ratings of all countries in the world. A country is classified among the Least Developed Countries if it meets three criteria.

    - ❖ Poverty – adjustable criterion based on GNI per capita averaged over three years. As of 2018 a country must have GNI per capita less than US$1,025 to be included on the list, and over $1,230 to graduate from it.

    - ❖ Human resource weakness (based on indicators of nutrition, health, education and adult literacy).

    - ❖ Economic vulnerability (based on instability of agricultural production, instability of exports of goods and services, economic importance of non-traditional activities, merchandise export concentration, handicap of economic smallness, and the percentage of population displaced by natural disasters).

The world's 10 biggest economies in 2017

- The economy of the United States is the largest in the world. At $18 trillion, it represents a quarter share of the global economy (24.3%), according to the latest World Bank figures.

- China follows, with $11 trillion, or 14.8% of the world economy. Japan is in third place with an economy of $4.4 trillion, which represents almost 6% of the world economy. European countries take the next three places on the list: Germany in fourth position, with a $3.3 trillion economy; the United Kingdom in fifth with $2.9 trillion; and France in sixth with $2.4 trillion. India is in seventh place with $2 trillion, and Italy in eighth with an economy of over $1.8 trillion. Ninth place goes to Brazil, with an almost $1.8 trillion economy. And in 10th is Canada, with an economy of over $1.5 trillion. The economy of the United States is larger than the combined economies of numbers three to 10 on the list.

Fastest-growing economy

- Although China trails the US by $7 trillion, it's catching up. China's economy grew by 6.7% in 2016, compared with America's 1.6%, according to the IMF. It has also overtaken India as the fastest-growing large economy. The IMF's World Economic Outlook estimated China's economy grew at 6.7% in 2016, compared with India's 6.6%. The chart above shows the world's 40 biggest economies individually, but grouped by colour into continents. The Asian bloc clearly has a larger share than anywhere else, representing just over a third (33.84%) of global GDP. That's compared to North America, which represents just over a quarter, at 27.95%. Europe comes third with just over one-fifth of global GDP (21.37%). Together, these three blocs generate more than four-fifths (83.16%) of the world's total output.

6. Geoinformatics

Introduction

Geoinformatics is the integration of remote sensing, Global Navigation Satellite System and Geographic Information System dealing with spatial information. The advent of remote sensing, Global Navigation Satellite System and Geographic Information System has made significant changes in surveying and map making. A basic understanding of these components is crucial for carrying out various types of surveys, navigation, hydrology, disaster management, etc.

Remote sensing

- Remote sensing is an integrated discipline encompassing some branches of arts, science and technology of collecting information about the terrestrial objects using camera and sensor system. The field of Remote Sensing and GIS has become exciting with rapidly expanding opportunities. Geoinformatics has three major components namely remote sensing, GIS and GNSS.

Elements of Remote Sensing

1. Energy Source

- The primary requirement for remote sensing is to have an energy service, which provides electromagnetic energy to the target of interest. The sun being a major source of energy, radiation and illumination having a sharp power allows capturing reflected light with conventional cameras and films.

2. Radiation and the Atmosphere

- The energy is required to illuminate the target. This energy is in the form of Electromagnetic radiation. Electromagnetic radiation is a dynamic form of energy that propagates as wave motion at a velocity in space.

3. Interaction with the target

- The interaction of Electromagnetic radiation with the target is important to remote sensing for two main reasons. First, information carried Electromagnetic radiation reflected by the earth's surface is modified while traversing through the atmosphere. Second, the interaction of Electromagnetic radiation with the atmosphere can be used to obtain useful information about the atmosphere itself. The total energy is subjected to modification by the several physical process, scattering, absorption and refraction. Scattering is the re-direction of Electromagnetic radiation by particles suspended in the atmosphere or by large molecules of atmospheric gases. The amount of scattering depends upon the size of the particles and their abundance. The wave length of radiation, depth of the atmosphere through which the energy is travelling. Absorption is the process by which the gas molecules present in the atmosphere strongly absorb the Electromagnetic radiation through the atmosphere in certain spectral bands.

4. Recording of energy by the sensor

- After the energy has been scattered by or emitted from the target, we require a sensor (remote not in contact with the target) to collect and record the electromagnetic radiation. A sensor is highly sensitive to all the wave lengths yielding spatially detailed data on absolute brightness. On the basis of the source of electromagnetic energy, the sensor can be classified into two ways. They are active sensor or passive sensor. Active sensor generates and uses its own energy to illuminate the target and records the reflected energy. It operates in the microwave regions of the electromagnetic spectrum. Their wave lengths are longer than 1 mm.

5. Transmission, Reception and Processing

- The energy recorded by the sensor has to be transmitted in electronic form, to a receiving and processing station where the data processed into an image. The Image processing methods may be grouped into three functional categories such as Image Restoration, Image Enhancement and Information Extraction.

Image Restoration: Restoration processes are designed to recognize and compensate for errors, noise and geometric distortion introduced into the data during the scanning transmission and recording processes. The objective is to make the image resemble the original scene. Image restoration is relatively simple because the pixels from each band are processed separately.

Image Enhancement: Enhancement is the modification of an image, to alter its impact on viewer. General enhancement distorts the original digital values; therefore enhancement is not done until the restoration processes are completed.

Information extraction: Image restoration and enhancement process utilize computers to provide corrected and improved images for study by human interpreters. The computer makes no decision in these procedures. The human operator must instruct the computer and must evaluate the significance of the extracted information.

6. Interpretation and Analysis

- Image interpretation is defined as the act of examining images to identify objects and judge their significance. An interpreter studies remotely sensed data and attempts through logical process to detect, identify, measure and evaluate the significance of environment and cultural object pattern and spatial relationship.

- The quality of an image is based on the inherent characteristics of the objects. Further it depends on the following aspects.

    - Sensor characteristics
    - Season of the year, time of the day when the photo is taken
    - Atmospheric effects
    - Resolution of the image on scale.
    - Image motion etc.

- Image interpretation is essential for the efficient and effective use of the data. The elements of image interpretation such as image tone, shape, size, pattern, image texture, shadow and association are helpful to identify the exact target and to analyze.

Classification of remote sensing

- On the basis of the sources of electromagnetic energy, the remote sensing can be classified as passive and active remote sensing. In a simple way, we can understand that the passive remote sensing is similar to taking a picture with an ordinary camera where as active remote sensing is analogous to taking picture with camera having built-in flash.
- On the basis of the energy source, the active remote sensing generates and uses its own energy to illuminate the target and records the reflected energy whereas the passive remote sensing depend on solar radiation to illuminate the target. On the basis of region of spectrum in which they operate, the active remote sensing operates in the microwave region of the electromagnetic spectrum whereas the passive remote sensing operates in the visible and infrared region of the electromagnetic spectrum. The wave lengths of the active remote sensing are longer than 1 mm whereas the passive remote sensing, the wave length range from 0.4 to 1.0 mm.

- Some examples of active sensors are fluorosensor and Synthetic Aperture Radar (SAR). Passive sensors record radiation reflected from the earth's surface. The source of this radiation must come from outside the sensor; in most cases, this is solar energy. Because of this energy requirement, passive solar sensors can only capture data during daylight hours. Active sensors are different from passive sensors. Unlike passive sensors, active sensors require the energy source to come from within the sensor. A laser-beam remote sensing system is an active sensor that sends out a beam of light with a known wavelength and frequency. This beam of light hits the earth and is reflected back to the sensor, which records the time it took for the beam of light to return.

Remote sensing platform

- The platform is a stage to mount the camera or sensor to acquire the information about a target under investigation. Based on the altitude above the earth surface, the platform can be classified as Ground borne platform, Air borne platform and Space borne platform.

Ground borne platform

- Ground based platforms are used to record detailed information about the surface which is compared with information collected from aircraft or satellite sensors. They are close to the ground. These sensors may be placed on a ladder, scaffolding tall-building, crane etc.

- A wide variety of ground based platforms are used in remote sensing. Some of the more common ones are hand held devices, tripods, towers and cranes. Instruments that are ground-based are often used to measure the quantity and quality of light coming from the sun or for close range characterization of objects Permanent ground platforms are typically used for monitoring atmospheric phenomenon although they are also used for long-term monitoring of terrestrial features.

Air borne platform

- Aircrafts are generally used to acquire aerial photographs for photo interpretation and photogrammetric purposes. They are classified into two types. They are
  - Low altitude aerial remote sensing
  - High altitude aerial remote sensing

Balloon

- Balloons are used for remote sensing observation (aerial photography) and nature conservation studies. The first aerial images were acquired with a camera carried aloft by a balloon in 1859. Balloon floats at a constant height of about 30 km.

Drone

- Drone is a miniature remotely piloted aircraft. It is designed to fulfill requirements for a low cost platform, with long endurance, moderate payload capacity and capability to operate without a runway or small runway. Drone includes equipment of photography, infrared detection, radar observation and TV surveillance. It uses satellite communication link. An onboard computer controls the payload and

stores data from different sensors and instruments. The unique advantage is that it could be accurately located above the area for which data was required and capable to provide both night and day data.

Aircraft

- The first known aerial photograph was taken in 1858 by French photographer and balloonist, Gaspar Felix Tournachon, known as "Nadar". In 1855 Special aircraft with cameras and sensors on vibration less platforms are traditionally used to acquire aerial photographs and images of land surface features. While low altitude aerial photography results in large scale images providing detailed information on the terrain, the high altitude smaller scale images offer advantage to cover a larger study area with low spatial resolution.

Space borne platform

- The satellites are normally used for the space borne remote sensing. The satellite moves in their orbit. The closed path of a satellite around the earth is called its orbit. These platforms are freely moving in their orbit around the earth and the entire earth or any part of the earth can be covered at specified intervals. The coverage mainly depends on the orbit of the satellite. It is through these space borne platforms, we get the enormous amount of remote sensing data. In space borne remote sensing, sensors are mounted on-board a spacecraft (space shuttle or satellite) orbiting the earth. Space borne remote sensing provides the following advantages:
    1. Large area coverage.
    2. Frequent and repetitive coverage of an area of interest.
    3. Quantitative measurement of ground features using radio metrically calibrated sensors.
    4. Semi-automated computerised processing and analysis.
    5. Relatively lower cost per unit area of coverage.

Types of satellite orbits

- Satellite orbits are designed according to the capacity and objective of the sensors they carry. Depending on their altitude, orientation and rotation relative to the earth satellites can be categorized as
  1) Geostationary satellite
  2) Polar Orbiting and Sun-Synchronous satellite
  3) Spy satellite

Geostationary Satellites

- Geostationary Satellite is an equatorial west to east satellite orbiting the earth at an altitude of 35000 km, the altitude at which it makes on revolution in 24 hours. These platforms are covering the same place and give continuous near hemispheric coverage over the same area day and night. These satellites are put in equatorial plane orbiting from west to east. Its coverage is limited to 70°N to 70°S latitudes and one satellite can view one-third globe. These are mainly used for communication and meteorological applications viz. GOES, METEOSAT, INTELSAT, and INSAT satellites. On June 19, 1981 India launched its first geostationary satellite called APPLE. It was an experimental communication satellite launched by the Indian Space Research Organisation (ISRO) with a C-band transponder.

The Ariane Passenger Payload Experiment (APPLE) was ISRO's first indigenous, experimental communication satellite.

Do you know?
India is the only one country which has reached to the mars in its first attempt.

Sun-synchronous satellites

- As the satellite orbits the Earth from pole to pole, its east-west position would not change if the Earth did not rotate. However, as seen from the Earth, it seems that the satellite is shifting westward because the Earth is rotating (from west to east) beneath it.

- This apparent movement allows the satellite swath to cover a new area with each pass. All the remote sensing resource satellites may be

grouped in this category. Few of these satellites are LANDSAT series, SPOT series, IRS series, NOAA SEASAT, TIROS, HCMM, SKYLAB, and SPACE SHUTTLE etc.

Spy satellites

- Spy satellites are robotic observational platforms that orbit the Earth in order to image its surface and to record radio signals for military and political purposes. They transmit their data to Earth, where it is interpreted by specialists in centralised, secretive facilities such as the U.S. National Photographic Interpretation Centre in Washington, D.C. Spy satellites have been essential not only to military operations and the formation of national policy but to the verification of arms control treaties such as SALT I, SALT II, etc.

- The four basic types of spy satellite are: (1) photo reconnaissance systems that take pictures in visible and infrared light, (2) infrared telescopes designed to detect missile launches, (3) radars that image sea or land even through cloud cover and in darkness, and (4) signals intelligence (SIGINT) satellites (also termed "ferrets"), which are optimised either for characterising ground-based radar systems or for eavesdropping on communications. Sometimes photo reconnaissance and SIGINT functions are combined in single, massive platforms such as the U.S. Keyhole-series satellites.

- Although a number of nations have launched spy satellites, the U.S. and the Soviet Union are responsible for by far the greatest number. The Russian Federation, which inherited most of the Soviet Union's space system after 1991, has been unable to afford the cost of adequately updating its spy satellite network. In contrast, the U.S. has continued to deploy ever-more-sophisticated systems in a steady stream. Thus, the majority of spy satellites in orbit today, including all the most capable units, are U.S.-owned. Early U.S. Spy Satellites: Corona, MIDAS, SAMOS.

Do you know?

The Gaofen 4 is the world's most powerful GEO spy satellite (launched in 2015) which can provide instant coverage of earthquake or typhoon hit areas to support humanitarian relief. It will also allow China

to monitor strategic foreign sites such as WMD facilities and naval bases inside its observation box.

Applications of remote sensing

1. Agriculture

The satellites have ability to image individual fields, regions and countries on a frequent revisit cycle. Customers can receive field-based information including crop identification, crop area determination and crop condition monitoring (health and viability). Satellite data are employed in precision agriculture to manage and monitor farming practices at different levels.

2. Forest Management

The forest - fire, sudden deforestation, encroachment of forest-land are recent challenges to the ecologist. It can be easily identified and curbed with the help of remote sensing satellite pictures.

3. Geology

Various fields Remote sensing techniques used in geology are

- Lithological mapping
- Structural mapping
- Geomorphological mapping
- Mineral exploration
- Hydrocarbon exploration
- Sedimentation mapping and monitoring
- Geo-hazard mapping

NASA launches world's lightest satellite designed by 18-year-old Tamil Nadu student.

India once again broke a global space record by launching the world's lightest satellite weighing a mere 64 grams, called Kalamsat. It was designed and developed not by professional space scientists and engineers, but by 18-year-old Tamil Nadu student Rifath Sharook and his team. The tiny satellite, named after Abdul Kalam, was flown by a NASA sounding rocket on 22 June, 2017 and Kalamsat was the only Indian payload in the mission. Mission director Srimathy Kesan that the total flight time of the rocket was 240 minutes. The satellite, assembled at her T.Nagar residence in Chennai. The satellite was separated from

the rocket after spending 125 minutes in the space's micro-gravity environment. Sharook's project, the first to be manufactured via 3D printing, got selected through a competition, 'Cubes in Space', sponsored jointly by NASA and 'I Doodle Learning'. The project aims to take the performance of new technology to space.

4. Oceanography

Satellite remote sensing plays an important role in coastal zone management. There it allows us to locate and regularly monitor various aspects such as bathymetry (the measurement of the depth of water in water bodies), chlorophyll content, suspended sediment concentration, etc.

5. Cartography

Remote sensing aids in extensive surveys that are made from high altitudes to show the urban development, rural development, mountain areas, desserts, etc. which help the cartographers. High-resolution satellite cameras located at altitudes of several hundred kilometers can record details as small as a few meters on the surface of the Earth.

6. Meteorology

The radar system is basically used to collect the weather data. It collects meteorological data from unmanned land/ ocean based Data collection platforms and serves as a communication satellite for rapid exchange of meteorological data among centres and for rapid dissemination of weather forecasts warnings etc, to user agencies.

7. Topography

Topography specifically involves the recording of relief or terrain, the three-dimensional quality of the surface, and the identification of specific landforms. Topographic maps usually portray both natural and manmade features. They show and name works of nature including mountains, valleys, plains, lakes, rivers, and vegetation. They also identify the principal works of man, such as roads, boundaries, transmission lines, and major buildings.

8. Urban Planning

These information systems also offer interpretation of physical (spatial) data with other socio-economic data, and thereby providing an important linkage in the total planning process and making it more

effective and meaningful. Digitization of planning base maps has facilitated updating of base maps wherever changes have taken place in terms of land development etc. Superimposition of any two digital maps which are on two different scales is feasible.

Geographic Information System (GIS)

- The Geographic information systems have emerged in the past two decades as an essential tool for urban and resource planning and management. It includes the functions of data entry, data display, data management, information retrieval and analysis. While GIS deals with entire geography of the earth including land, ocean and atmosphere, the art, science and technology dealing with the acquisition, storage, processing, production, presentation and dissemination of the earth's information is called the Geoinformatics. It is the popular means of studies in recent decades which cater the real and useful information to the field of Geography, Environmental Studies, Town planning, rural development studies, and Defense and Agricultural promotion.

Generation of the computers

1940 – 1956: First Generation – Vacuum Tubes
1956 – 1963: Second Generation – Transistors
1964 – 1971: Third Generation – Integrated Circuits
1972 – 2010: Fourth Generation – Microprocessors
2010 – Fifth Generation – Artificial Intelligence

Components of GIS

- The components of GIS can be broadly classified into five types. They are mentioned below.

A. Hardware

Hardware is Computer on which GIS software runs. Nowadays there are a different ranges of computer, it might be Desktop or server based. ArcGIS Server is server based computer where GIS software runs on network computer or cloud based. For computer to perform well all hardware components must have high capacity. Some of the hardware components are: Motherboard, Hard driver, processor, graphics card,

printer and so on. These all component function together to run GIS software smoothly.

B. Software

Next component is GIS software which provides tools to run and edit spatial information. It helps to query, edit, run and display GIS data. It uses RDBMS (Relational Database Management System) to store the data. Few GIS software list: ArcGis, ArcView 3.2, QGIS, SAGA GIS. Software Components: GIS Tools, RDBMS, Query Tools, GUI and Layout.

C. Data

Geographic data and related tabular data can be collected in-house compiled to custom specifications and requirements (or) purchased from a commercial data provider.

- A GIS can integrate spatial data with other existing data resources often stored in a corporate data base management System. The data can be broadly classified as
    i. Attribute data
    ii. Spatial data
    iii. Remote sensing data
    iv. Global data base.

You will learn in detail about each of the above classification of data in higher studies.

D. People

The GIS technology is used by a huge number of industrialists and agencies to help plan, design, engineer, build and maintain information infrastructures that affects our everyday lives.

E. Methods or Procedures

Methods here refer to well-defined, consistent procedures that are required to produce accurate, reproducible result. A neatly conceived implementation plan and business rules are the models and operating practices are unique to each organization. There is need to properly integrate the sophisticated tool through bringing out well-defined procedures in well documented form into the entire business strategy and operation to make the technology effective. Meta data i.e., (data about the data) is the key for documenting these processes.

Functions of GIS

- The functions of GIS describe the steps that have to be taken to implement a GIS. These steps have to be followed in order to obtain a systematic and efficient system. The steps involved are data capture, data storage (GIS Data Models), manipulation and analysis.

Data Capture

- The input of data into a GIS can be achieved through many different methods of gathering. For example, aerial photography, scanning, digitizing, GNSS is just a few of the ways a GIS user could obtain data. Digitization: A conversion process which converts paper maps into numerical digits that can be stored in the computer. Digitizing simplifies map data into sets of points, lines or cells that can be stored in the GIS computer. In this stage, digitization is carried out. There are two basic methods of digitization: Manual digitizing & scanning.

Data Storage

- Some data is stored such as a map in a drawer, while others, such as digital data, can be as a hardcopy, stored on CD or on your hard drive. Once the data have been digitally compiled, digital map files in the GIS are stored on magnetic or other digital media. Data storage is based on a Generic Data Model that is used to convert map data into a digital form. The two most common types of data models are Raster and Vector. Both types are used to simplify the data shown on a map into a more basic form that can be easily and efficiently stored in the computer.

Data Manipulation

- The digital geographical data can be edited, this allows for many attribute to be added, edited, or deleted to the specification of the project. Once data are stored in a GIS, many manipulation options are available to users. These functions are often available in the form of "Toolkits." A toolkit is a set of generic functions that a GIS user can employ to manipulate and analyse geographical data. Toolkits provide processing functions such as data retrieval measuring area and perimeter, overlaying maps, performing map algebra, and

reclassifying map data. Data manipulation tools include coordinate change, projections, and edge matching, which allow a GIS to reconcile irregularities between map layers or adjacent map sheets called Tiles.

Query and Analysis

- GIS was used widely in decision making process for the new commission districts. We use population data to help establish an equal representation of population to area for each district. The heart of GIS is the analytical capabilities of the system.

Global Navigation Satellite System (GNSS)

- GNSS refers to the collection of the world's global satellite based positioning systems. It includes GPS (United States) GLONASS (Russia) GALILEO (European Union) BEODOU (China) IRNSS (India) QZSS (Japan). GNSS can provide centimeter level accuracy with a low-cost receiver, if an error correction technique is used. GNSS are recognized to be the systems of choice in outdoor environments and, to a great extent, one of the most accurate source of position (and precise timing) information when it is available.

- The first satellite navigation system was Transit, a system deployed by the US military in 1960's. Transit's operations were based on the Doppler Effect: the satellites travelled on well-known paths and broadcast their signals on well-known radio frequency. The received frequency will differ slightly from the broadcast frequency because of the movement of the satellite with respect to the receiver. The satellite broad cast signals that contains orbital data (from which the position of the satellite can be calculated) and the precise time, the signals is transmitted. There are multiple constellations of GNSS satellites orbiting the earth. GNSS satellites' orbit situated about 20,000 km above the earth's surface. They are moving very fast, several kilometers per second. The latest generation of GNSS satellites (Block IIF) weight over 1,400 kg.

GNSS system operated in different countries

- The following are the Global Navigation satellite Systems:

GPS (United States)

- GPS was the first GNSS system. GPS was launched in the late 1970s by the United States Department of Defence. It uses a constellation of 24 satellites, and provides global coverage.

GLONASS (Russia)

- The premier Soviet military navigation network was to be comprised of Uragan satellites. At the end of the Cold War, the constellation was unclassified under the name GLONASS -- a Russian abbreviation of Global Navigation Satellite System. Global Navigation Satellite System by Russian Aerospace Defense Forces is a space-based satellite navigation system.

- The life style of GNSS satellites 5-7 years and new satellites are to be launched after a specific time interval in order to fill the gap due to ageing satellites. GLONASS proves very beneficial for Russian territory by 2010. In 2011, restoration of system is improved to enable full global coverage.

GALILEO (European Union)

- Galileo is Europe's own global navigation satellite system, providing a highly accurate, guaranteed global positioning service under civilian control. Currently providing Initial Services, Galileo is interoperable with GPS and Glonass, the US and Russian global satellite navigation systems. By offering dual frequency as standard, Galileo is set to deliver real-time positioning accuracy down to the meter range. The Galileo constellation in space will comprise 30 satellites in total. There will be 24 operational satellites, plus 6 spare satellites, circulating in medium Earth orbit on three orbital planes.

BEIDOU (China)

- BeiDou Navigation Satellite System (BDS) is a Chinese satellite Navigation system. It consists of two separate satellite constellations. The first BeiDou system is officially called the BeiDou Satellite Navigation Experimental System and also known as BeiDou-1.

- On December 27, 2018, Beidou-3 officially began to provide global services. The Beidou-3M/G/I satellites represent the orbital segment of the third phase of the Chinese Beidou navigation system which uses satellites in Medium Earth Orbit and Geosynchronous Orbit and is also known as the Compass Navigation Satellite System.

Japan Aerospace Exploration Agency (QZSS Japan)

- QZSS is a regional navigation satellite system that provides service to Japan and the Asia-Oceania region. QZSS (nickname of Michibiki - meaning to 'guide' or 'show the way') QZSS is a Japanese satellite positioning system composed mainly of satellites in quasi-zenith orbits (QZO). However, the term "Quasi-Zenith Satellite (QZS)" can refer to both satellites in QZO and geostationary orbits (GEO). For that reason, the name "QZO satellite" is used when it is necessary to specifically refer to satellites in QZO. Satellite positioning systems use satellite signals to calculate position information. The QZSS is sometimes called the "Japanese GPS."

IRNSS (Indian Regional Navigational Satellite System)

- IRNSS is an autonomous regional satellite navigation system being developed by ISRO (Indian Space Research Organization). It is designed to provide geospatial positioning information within the Indian sub-continent. It enables users to map out their location (altitude, longitude and latitude). The objective of developing IRNSS was to cut down India's dependency on foreign navigation satellite systems.

- It provides location information service to users in India and the region extending for up to 1,500 km from the Indian boundary. This is the primary service area of IRNSS information service to users in India and the region extending up to 1500 km from Indian boundary.

IRNSS aims to provide the following services:

1. Standard Positioning Service (SPS) for civilian, research & commercial use,
2. Restricted Service (RS) for authorized users. For example in defense, IRNSS is used for ground, aerial and marine navigation,

disaster management, mobile phone integration, mapping and visual & voice navigation for drivers, among others.

The battle for the world's fastest supercomputer has a new victor: Summit
According to IBM, Summit is able to achieve 200 peta flops of performance, or 200 quadrillion calculations per second. This power marks a significant gain on Sunway TaihuLight, which performs a still-staggering 87 petaflops. Summit holds more than 10 peta bytes of RAM, and its funding came as part of a $325 million program funded by the United States Department of Energy. Each of Summit's 4,608 nodes holds two IBM Power9 chips that run at 3.1 GHz.

Applications of GNSS

- GNSS applications are widely used to get the quick information about a particular field. Some of the commercial applications are Consumers, Transportation, GIS, Machine Control Port Automation, Precision Agriculture, Construction, Marine Mining, Unmanned Vehicles Surveying, Defence, and Aerial Photogrammetry, etc.

Consumer

- GNSS technology has been adopted by the consumer market, in an ever-increasing range of products. GNSS receivers are now routinely integrated into smart phones, to support applications that display maps showing the location of and best route to stores and restaurants.

Transportation

- In rail transportation, GNSS is used to track the location of locomotives and rail cars, maintenance vehicles and wayside equipment, for display at central monitoring consoles. Knowing the precise location of rail equipment reduces accidents, delays, and operating costs, enhancing safety, track capacity, and customer service. In aviation, GNSS is being used for aircraft navigation from departure, en route, to landing.

Port Automation

- Using GNSS, shipping hubs can improve their operating efficiency by tracking the movement and placement of containers about their yards. Many cranes are equipped with GNSS based steering devices that determine the crane's position and keep it travelling in the desired path, improving accuracy and productivity as well as the safety of operators and workers on the ground.

Machine Control

- GNSS technology is being integrated into equipment such as bulldozers, excavators, graders, pavers and farm machinery to enhance productivity in the real-time operation of this equipment, and to provide situational awareness information to the equipment operator.

Precision Agriculture

- In precision agriculture, GNSS-based applications are used to support farm planning, field mapping, soil sampling, tractor guidance, and crop assessment. More precise application of fertilizers, pesticides and herbicides reduces cost and environmental impact.

Surface Mining

- GNSS information is being used to efficiently manage the mining of an ore body and the movement of waste material. GNSS equipment installed on shovels and haul trucks provides position information to a computer-controlled dispatch system to optimally route haul trucks to and from each shovel.

Survey

- Using GNSS, it is possible for a single surveyor to accomplish in one day what might have taken a survey crew of three people a week to complete. Determining a new survey position once required measuring distances and bearings from an existing (known) survey point to the new point.