

A. Multiple choice questions (Attempt all the questions, 1 marks each)

1*10=10

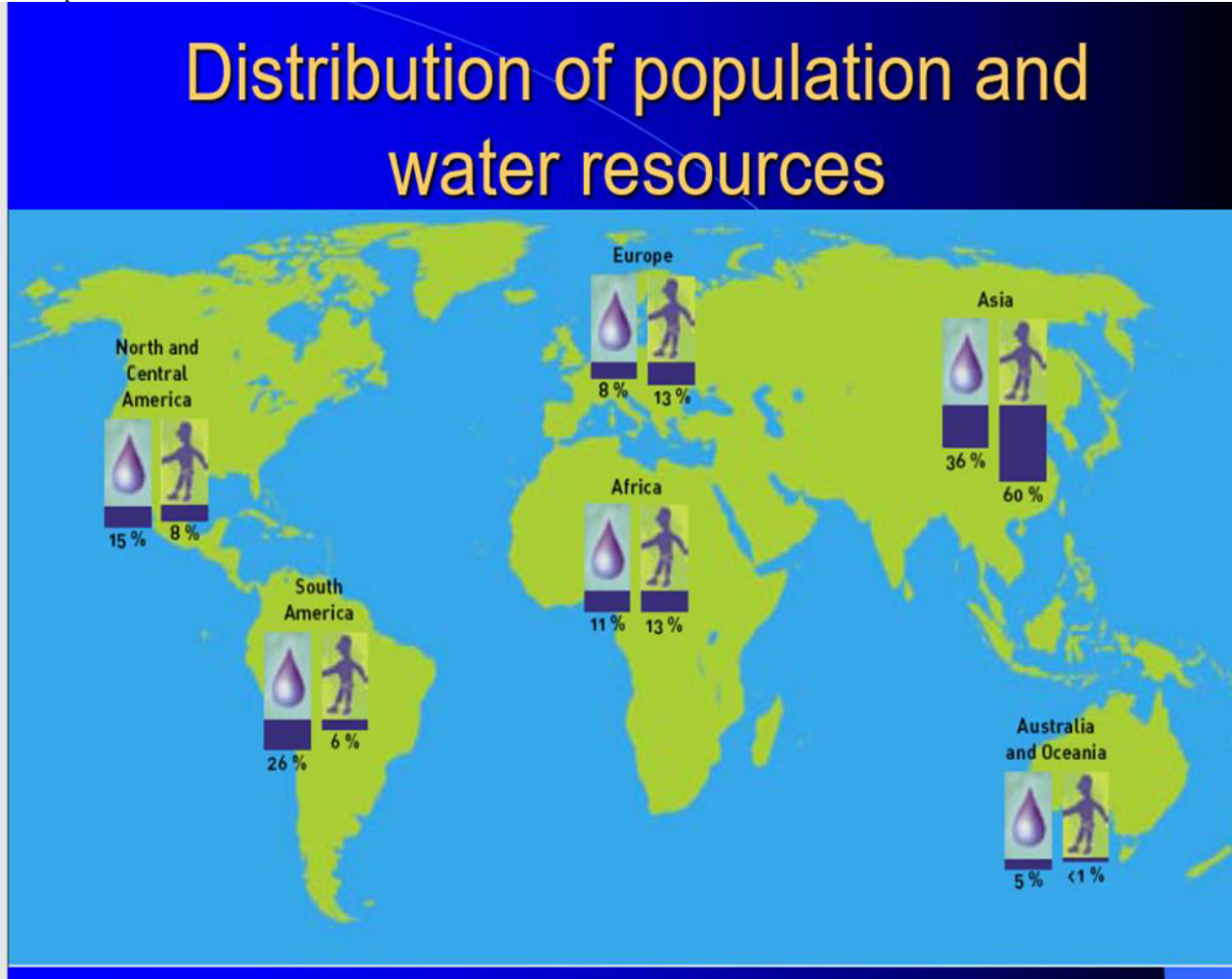
1. How Can We Trap Smaller Contaminants?
Ultrafiltration can remove viruses, proteins, and other organic molecules from water using a moderately low amount of pressure.
Nanofiltration can remove bivalent ions (ions with more than one charge).
2. Write down the resources found in Sri Lanka & Malabar coast
Spices, black pepper, Gems stone, pearls
3. Why do Aquatic Animals die?
Due to Water & thermal Pollution by industrial effluents
4. If RO Can Get Everything Out That Would Make Water Undrinkable, Justify this statement. why RO by itself might not be the best solution.
Ideas that they may entertain include: high cost (since RO requires high pressure), plugging of the RO membrane from large particles, and that not all water has salt in it that needs to be removed (e.g., fresh or lake water) so RO may be overkill in some cases.
5. What is the role of biofertilizer in prevention of soil degradation?
Increases provide nutrition to plants without reducing fertility of soil like in case of chemical fertilizer.
6. The main objective of UNESCO is to contribute to peace and security in the World.
Education & Communication 2) Science 3) Culture
7. How do you determine what filtration method to use to remove contaminants in a water sample?
Consider the size of the contaminants, the relative cost of the filtration methods, and the water use
8. What is the cause of dropping down the water table (ground water level)?
Soil degradation & erosion caused by deforestation because plant roots hold water in upper layer of soil
9. What are Coniferous Forests?
Narrow leaved with Pinus, Quercus, barberry as flora and Himalayan goat, black bear, and sheep as fauna
10. Write down the Composition of our body & air according to Ancient Indian knowledge.
Human body is made up of Panchtatva (water, soil, fire, air & sky). Human body is also controlled by panchvayu

Section B (Conceptual Knowledge- attempt any 4 questions, 4 marks each). 4x4

1. List out and discuss the urban problems related to energy. Do you think electric vehicles offer solutions to urban environmental problems? Discuss about Photovoltaic device & its application
2. Identify the major environmental problems in your region. Also, specify the role of you as an individual solving the issue.
3. (a) What is GPS? (b) Explain How GPS works?

4. Show distribution of population & water resources on Map. Locate all the spots on World Map. Name of Countries are given here

1. North & Central America
2. South America
3. Europe
4. Africa
5. Asia
6. Australia & Oceania



5. Explain role of environment in Biodiversity.

Ecosystem biodiversity refers to the variety of ecosystems and ecological processes that exist within a given area. An ecosystem is a community of living organisms (plants, animals, and microorganisms) interacting with each other and their physical environment (such as air, water, soil, and climate). Ecosystems can range in size from a small pond or forest patch to an entire biome, such as a tropical rainforest or a coral reef.

or

Ecosystem biodiversity includes the variety of different ecosystems present within a region, such as forests, grasslands, wetlands, deserts, and oceans, as well as the diversity of ecological processes that occur within those ecosystems, such as nutrient cycling, energy flow, and ecological succession. It also includes the diversity of species that inhabit those ecosystems, from the smallest microorganisms to the largest mammals.

Speciation, an evolutionary process by which new species form, is ultimately responsible for the incredible biodiversity that we observe on Earth every day. Such biodiversity is one of the critical

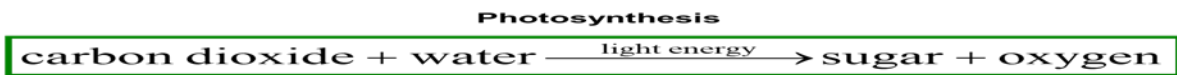
features which contributes to the survivability of biospheres and modern life. Oparin proposed that the diverse coacervates, or different species, would undergo natural selection based on their stability in given environments. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7922636/>

6. What are two benefits that nanomembranes bring to the filtration of water?

Nanofiltration can remove bivalent ions (ions with more than one charge). Several nanofiltration plants have been built worldwide, Nanofilter is operated at low operating cost

7. “Describe energy flow in a ecosystem.
Sun Energy flows through producer & consumers in a food chain.

Photosynthesis and Cellular Respiration



Notice Anything?



The organism uses this energy to do everything. All the organism are connected via food chain Energy is derived from sun & used by plants(Producer) then transferred to Consumers.

Section C (based on Procedural Knowledge- Attempt any 2 questions, 7 marks each).

Attempt Any two question

7 x2

1. a) Make Model of Smart cities where you can live with your with Environmental Ethics & move towards Sustainable development? (b) Discuss about role of technological integration in Smart city management using a suitable example. (c)What are new technologies used to implement this model in the current time.

1(a) Model of Smart Cities with Environmental Ethics and Sustainable Development

A smart city model prioritizing environmental ethics and sustainable development would include:

- **Green Infrastructure:** Incorporating green buildings, urban forests, rooftop gardens, and sustainable drainage systems.

P.T.O.

- **Renewable Energy Sources:** Dependence on solar, wind, and biomass energy to reduce carbon footprints.
- **Waste Management:** Efficient recycling, composting, and waste-to-energy initiatives.
- **Sustainable Transport:** Promoting public transport, electric vehicles, cycling, and pedestrian-friendly pathways.
- **Water Conservation:** Rainwater harvesting, wastewater recycling, and efficient irrigation systems.
- **Community Participation:** Engaging residents in environmental decision-making and ethical practices.

Such a model aligns with sustainable development goals (SDGs), ensuring economic growth, social inclusion, and environmental conservation.

1(b) Role of Technological Integration in Smart City Management

Technological integration is pivotal for efficient resource management, urban planning, and enhancing the quality of life.

- **Example: Singapore's Smart Nation Initiative** integrates sensors, IoT, and AI for real-time monitoring of traffic, energy use, and waste management.
 - **Traffic Management:** Smart traffic lights reduce congestion by adapting to real-time vehicle flow.
 - **Energy Efficiency:** Smart meters monitor electricity consumption, optimizing usage patterns.
 - **Waste Monitoring:** Sensors in bins signal collection requirements, reducing unnecessary waste pickup trips.
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1(c) New Technologies for Smart City Implementation

Some advanced technologies used today for smart cities include:

1. **Internet of Things (IoT):** Enables connected devices for real-time data on utilities, traffic, and environmental monitoring.
2. **Artificial Intelligence (AI):** Powers predictive analytics for energy use, traffic flow, and disaster management.
3. **Big Data Analytics:** Facilitates informed decision-making by analyzing large datasets from urban sensors and systems.
4. **Blockchain:** Ensures transparent and efficient transactions for energy trading or public services.
5. **Geospatial Technologies:** GIS mapping helps in urban planning and disaster management.
6. **5G Networks:** Enhances connectivity for IoT devices, enabling faster data transmission.
7. **Smart Grids:** Promotes efficient energy distribution and integration of renewable energy.

These technologies collectively improve resource efficiency, urban resilience, and citizen engagement, driving smart cities toward sustainable development.

2. What is renewable energy? Draw Energy Map of India. Discuss about Solar Energy ,wind Energy, Geothermal Energy & Tidal Energy Conversion Methods.

Energy Resources

All energy sources ultimately come from the sun, the moon or the earth.

Sources of Energy

Solar energy drives the following:

The global climate system which give as wind power.

Wave power

Hydroelectric power

Solar heating and Solar lighting

The global ecosystems which give as biomass power such as wood or muscle.

The ancient ecosystem whose energy is now stored as fossil fuels.

The moon's gravitational energy is responsible for the tidal effect, which give rise to tidal power.

The earth itself is the key source of energy such as the following:

Gravitational energy for hydroelectric power

Chemical energy for nuclear power, electro- chemical reaction and hydrogen fuel cells.

Geothermal power from the heat of lower crust.

Other exciting energy sources are currently untapped, such as energy in the earth's magnetic field, the energy potential caused by temperature differences in different layers of the ocean and the energy contained in combustible deposits of methyl hydrates in the sediments of the continental shelves.

Non Renewable Energy Sources:

Environmental Impacts of fossil fuels in general

Fossil fuels- (coal, oil, gas, peat, lignite, etc.)

Extraction of fuel by mining, drilling, quarrying and/ or excavation leads to significant impacts on the surrounding environment and landscape (habitat modification and destruction, pollution etc.)

Spoil and solid wastes from mining and extraction have both visual and environmental impacts.

Wastewater and leachates from mining, drilling and excavation, and gas leaks from pipelines can pollute surrounding waters, air and land.

Purification or modification of raw products for use as fuels requires energy, and may lead to secondary sources of pollution.

Transportation of fuels to energy production sites uses fuel (causes air pollution) and possibly a pollution risk, eg.oil tankers are at risk from accidents and may lead to oil spills at sea.

Combustion of fuels to produce energy leads to air pollution (carbon, nitrogen and sulphur oxides) and in some cases, the production of solid wastes (in the form of ash).

Renewable Energy:

Renewable energy systems use resources that are constantly replaced and are usually less polluting. Ex: hydropower, solar, wind, and geothermal (energy from the heat inside the earth). We also get renewable energy from burning trees and even garbage as fuel and processing other plants into biofuels. Renewable energy technologies will improve the efficiency and cost of energy systems. We may reach the point when we may no longer rely mostly on fossil fuel energy.

Hydroelectric Power:

This uses water flowing down a natural gradient to turn turbines to generate electricity known as 'hydroelectric power' by constructing dams across rivers. Between 1950 and 1970, Hydropower generation worldwide increased seven times.

Advantages:

- o The long life of hydropower plants,
- o the renewable nature of the energy source
- o very low operating and maintenance costs, and
- o absence of inflationary pressures as in fossil fuels

Environmental impact / Drawbacks: Although hydroelectric power has led to economic progress around the world, it has created serious ecological problems.

To produce hydroelectric power, large areas of forest and agricultural lands are submerged. These lands traditionally provided a livelihood for local tribal people and farmers. Conflicts over land use are inevitable.

Silting of the reservoirs (especially as a result of deforestation) reduces the life of the hydroelectric power installations.

The reservoir drown large areas of farm land, wild life habitats and places of historical & cultural importance

Water is required for many other purposes besides power generation. These include domestic requirements, growing agricultural crops and for industry. This gives rise to conflicts.

The use of rivers for navigation and fisheries becomes difficult once the water is dammed for generation of electricity.

Resettlement of displaced persons is a problem for which there is no ready solution.

The opposition to many large hydroelectric schemes is growing as most dam projects have been unable to resettle people that were affected and displaced.

Solar Energy:

Sun is the primary source of energy. Sun's energy each day is 600 times greater than produced from all other sources (1/5 of known reserves of fossil fuels). If it was possible to harness this colossal quantum of energy, humanity would need no other source of energy. Several methods were developed for collecting this energy for heating water and generating electricity. Solar energy is Readily available source of energy and is free;

Is PV cells are environment friendly? PV cells are environmentally benign, i.e. they do not release pollutants or toxic material to the air or water, there is no radioactive substance, and no catastrophic accidents. Some PV cells, however, do contain small quantities of toxic substances such as cadmium and these can be released to the environment in the event of a fire. Solar cells are made of silicon which, although the second most abundant element in the earth's crust, has to be mined. Mining creates environmental problems. PV systems also of course only work when the sun is shining, and thus need batteries to store the electricity.

Biomass Energy:

Biomass is organic material which has stored sun light in the form of chemical energy. Because plants and trees depend on sunlight to grow, biomass energy is a form of stored solar energy. Although wood is the largest source of biomass energy, we also use agricultural waste, sugarcane wastes, and other farm by products to make energy.

Half a kilo of dry plant tissue – produce as much as 1890 Kcal of heat – equivalent to quarter kilo of coal A typical biogas sample contains 68% methane, 31% CO₂, 1% Nitrogen and calorific value is 5871 Kcal/m³ (i.e. 80% natural gas).

Biogas is produced from plant material and animal waste, garbage, waste from households and some types of industrial wastes, such as fish processing, dairies, and sewage treatment plants. It is a mixture of gases which includes methane, carbon dioxide, hydrogen sulphide and water vapour. In this mixture, methane burns easily. With a ton of food waste, one can produce 85 Cu. M of biogas. Once used, the residue is used as an agricultural fertilizer.

Energy is defined as ‘the capacity to do work’. Sun is the primary source of energy.

Wind Power:

Wind was the earliest energy source used for transportation by sailing ships. Wind energy produces electricity at low cost; capital costs are moderate and there are no emission. The power in wind is a function of the wind speed and Wind speed increases with height.

Tidal and Wave Power:

The energy of waves in the sea that crash on the land of all the continents is estimated at 2 to 3 million megawatts of energy. Water flows from a higher level to lower level, greater the difference

between high and low tides more energy can be extracted. Tidal power is tapped by placing a barrage across an estuary and forcing the tidal flow to pass through turbines.

Geothermal Energy: It is the energy stored within the earth (“geo” for earth and “thermal” for heat). Core of the earth is very hot – as high as 60000C, temperature rises with depth @ 300C per Km. Geothermal energy starts with hot, molten rock (called magma) deep inside the earth which surfaces at some parts of the earth’s crust (volcanoes). With modern technology, wells are drilled deep below the surface of the earth to tap into geothermal reservoirs

6. Mention water distribution on China.

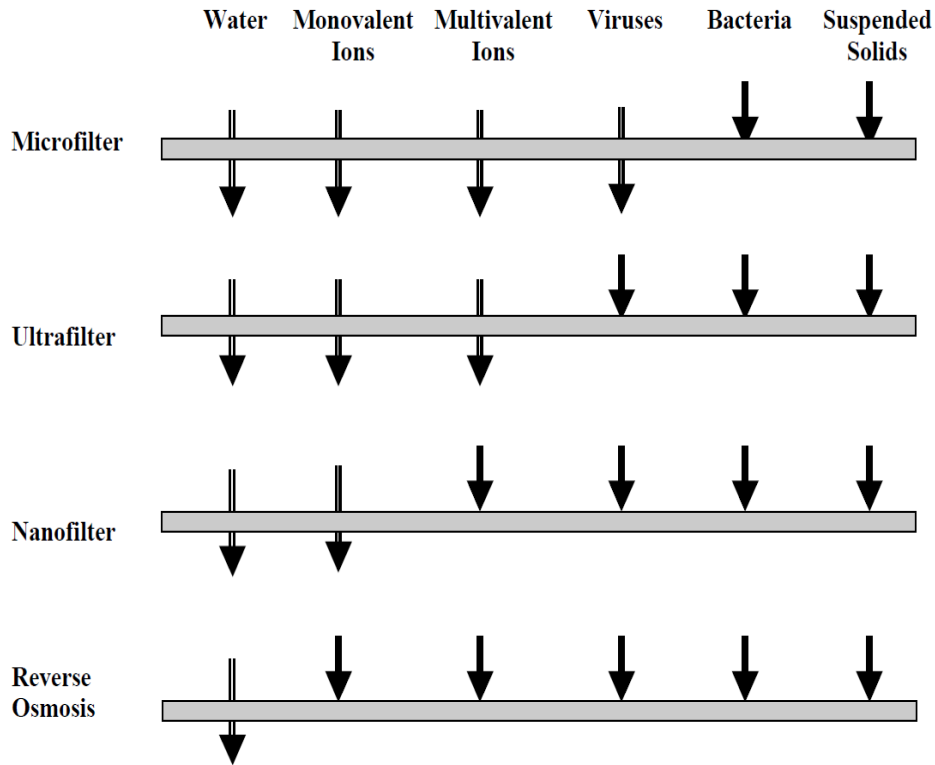
The areas south of the Yangtze River, China's longest, which account for only 36.5 per cent of the country's total territory, have 80.9 per cent of its total water resources. However the areas north of the Yangtze, which make up 63.5 per cent of China, possess only 19.1 per cent of total water resources.

3. Discuss about application of membrane in waste water treatment, describe aerobic biological treatment with membrane separation. How can Nanofiltration method help in the water scarcity problem of Asian Countries?

A **membrane** is a semi-permeable thin layer of material capable of separating contaminants as a function of their physical/chemical characteristics.

Membrane Filtration Uses in Water Treatment.

- Desalination of salt water to produce potable water remains the primary use of membrane filtration.
 - Although this is an expensive process, it is practiced in areas with limited sources of fresh water.
- Filtration of surface or ground water under the direct influence of surface water (GUDI) can be accomplished using membranes with the largest pore sizes.
 - Tighter membranes (those with smaller pore sizes) are used for other applications such as softening or the removal of dissolved contaminants.

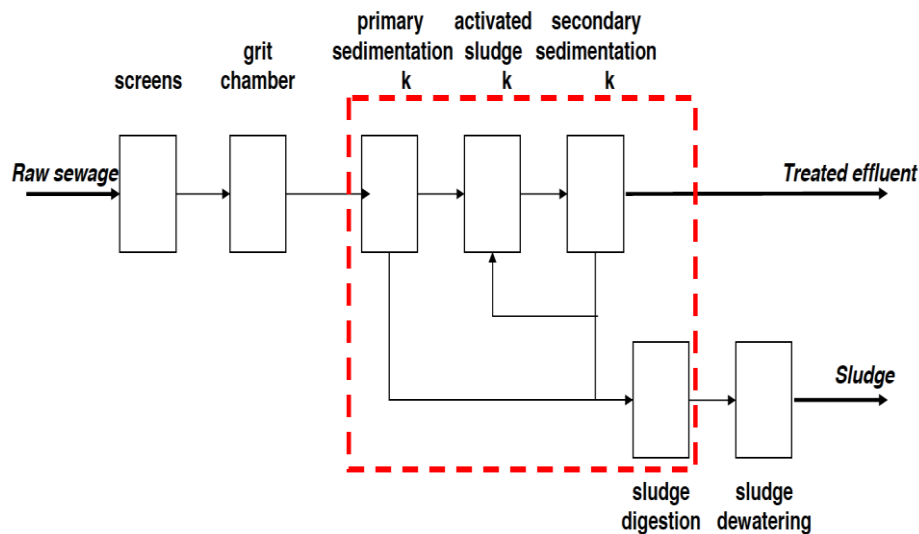


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- Biological treatment is very effective at reducing high-strength biodegradable components
- Broadly speaking, divided to aerobic and anaerobic technologies
- Majority of leachate treatment schemes that have been successfully installed in landfill sites are anaerobic biological processes.
- The drawbacks generally experienced in biological treatment originate from operational problems such as foaming, metal toxicity, nutrient deficiency and sludge settling.
- Among the various biological treatment processes, Sequencing Batch Reactors (SBRs) has been to be proved a reliable and robust method for leachate treatment.

Introduction

1. Introduction



Advantages of Nanofiltration

The pores in nanomembranes are close in size to those in RO filters, so can they be used more often as a cheaper alternative to RO? Yes, mainly due to recent advances in nanotechnology.

Nanomembranes have been around for decades, and were usually composed of a homogenous material throughout the fabric of the membrane. Recently, however, scientists have been able to build nanomembranes in layers, inserting substances with a particular chemistry and specific purpose. For example, new nanomembranes can not only filter based on *size* but also based on *charge*. In other words, the membrane can stop very small particles with a particular electrostatic charge while allowing water through. Such advances have been made possible because of new tools and methods. Emphasize that engineering membranes to be uniquely designed for a specific purpose is a characteristic of nanofiltration and nanotechnology in general.

4. (a) What is GIS? (b) How GIS works with other navigation system? (c) discuss about various components(databases) & application of GIS.

A Geographical Information System (GIS) is a powerful tool that integrates hardware, software, and data for capturing, managing, analyzing, and displaying geographically referenced information. GIS allows users to visualize, question, analyze, and interpret spatial and geographic data to understand relationships, patterns, and trends. Here's an overview of GIS, its components, applications, and benefits:

Components of GIS

1. **Hardware:**
 - Computers and servers for processing and storing spatial data.
 - Devices like GPS units, scanners, and sensors for data collection.
2. **Software:**
 - GIS software such as ArcGIS, QGIS, and MapInfo for analyzing and visualizing spatial data.
 - Databases for managing large sets of spatial data.
3. **Data:**
 - Spatial data: Geographic locations and shapes of natural and man-made features (e.g., maps, satellite imagery).

- Attribute data: Information about these features (e.g., population statistics, land use types).
4. **People:**
 - GIS professionals who design, implement, and manage GIS projects.
 - End-users who use GIS for decision-making and analysis.
 5. **Methods:**
 - Procedures and techniques for data collection, analysis, and visualization.
 - Best practices for managing and sharing GIS data.

Applications of GIS

1. **Urban Planning:**
 - Analyzing land use patterns, zoning, and infrastructure development.
 - Planning new developments and public services based on spatial analysis.
2. **Environmental Management:**
 - Monitoring natural resources, biodiversity, and ecosystems.
 - Assessing environmental impacts and managing conservation efforts.
3. **Transportation:**
 - Optimizing routes and managing transportation networks.
 - Analyzing traffic patterns and improving public transit systems.
4. **Disaster Management:**
 - Identifying hazard-prone areas and planning emergency response.
 - Mapping disaster impacts and coordinating relief efforts.
5. **Public Health:**
 - Tracking disease outbreaks and planning healthcare services.
 - Analyzing spatial patterns of health-related issues.
6. **Agriculture:**
 - Monitoring crop health and managing agricultural resources.
 - Analyzing soil data and planning efficient land use.
7. **Utilities and Infrastructure:**
 - Managing water, electricity, and communication networks.
 - Planning maintenance and expansion of infrastructure.

Benefits of GIS

1. **Enhanced Decision Making:**
 - Provides a visual representation of data that aids in understanding complex spatial relationships.
 - Supports evidence-based decision making by integrating various data sources.
2. **Improved Efficiency:**
 - Automates data collection, analysis, and reporting processes.
 - Enhances resource allocation and management through spatial analysis.
3. **Better Communication:**
 - Creates maps and visualizations that are easy to interpret and share.
 - Facilitates communication between different stakeholders and the public.
4. **Cost Savings:**
 - Reduces costs associated with data collection and analysis.
 - Helps in planning and optimizing operations to save resources.
5. **Data Integration:**
 - Combines data from multiple sources into a single, coherent system.
 - Enables comprehensive analysis by integrating spatial and non-spatial data.

Conclusion

GIS is a versatile and powerful tool that enhances the ability to analyze and visualize spatial data, supporting a wide range of applications across various fields. By leveraging GIS technology, organizations can make more informed decisions, improve efficiency, and better understand and manage their geographic and spatial data. As GIS technology continues to evolve, its applications and benefits are likely to expand further, offering even more opportunities for innovation and improvement in spatial data analysis and management.

5. Discuss about Rehabilitation & Resettlement Policy of India/Government in respect to protect Scheduled Tribes' population, Water, Forest & Land resources.

RESETTLEMENT AND REHABILITATION ISSUES:

Various development projects often lead to displacement of native or tribal people who are poor and very often not educated. Their rehabilitation is a major socio economic issue.

Problems and concerns:

Displacement problems due to dams:

- The big river valley projects have one of the most serious socio economic impacts due to large scale displacement of local people from their ancestral home and loss of their traditional profession or occupation.
- In India due to big dam construction, more than 20 million people are estimated to have been directly or indirectly affected by these dams
- The Hirakund dam has displaced more than 20,000 people residing about 250 villages.
- The Bhakra Nangal dam was constructed during 1950's and till now it has not been possible to rehabilitate even half of the displaced persons.
- Tehri dam and Sardar sarovar dam also have same issues.

Displacement due to mining:

- Mining is another developmental activity which causes displacement of the native people.
- Several thousands of hectares of land area is covered in mining operation and the native people are displaced.
- Sometimes displacement of local people is due to accidents occurring in mined areas like subsidence of land that often leads to shifting of people.
- Jharia coal fields, Jharkhand have been posing big problems to the residents due to underground fires and they are asked to vacate the area.
- According to latest estimation, about Rs.18,000 crores will be spent for shifting the population while the cost of extinguishing the fire would be around 8,000 crore.

Displacement due to creation of national parks:

- When some forest area is covered under a national park, it is welcome step for conservation of natural resources.
- However it also has a social aspect associated with it.
- A major portion of the forest is declared as core area where the entry of local people is restricted.
- So they start destruction activities

The major issues related to displacement and rehabilitation are

- Tribals are usually most affected amongst the displaced who are already poor
- Break up of families and women are the worst affected.
- The tribals are not familiar with market policies and trends
- Kinship systems, marriages, social and cultural functions, their folk songs, dances and activities vanish with their displacement

- Loss of identity and loss of intimate link between the people