NITI Aayog Panels to Achieve Net-Zero Goal

Source: BS

Why in News?

Recently, **NITI Aayog** has formed **dedicated multi-sectoral committees** to prepare a **policy design** and **create a roadmap** for achieving its goal of becoming a **net-zero** economy **by 2070**.

- This has been started 3 years after India declared its goal to become a **net-zero economy by 2070.**

What are the Key Focus Areas of the Working Groups Formed by the NITI Aayog?

- **About:**
  - **NITI Aayog** has formed 6 working groups. These groups will focus on **developing policy formats, working models**, and **transition pathways** for core sectors like macroeconomic implications, climate finance, critical minerals, and **social aspects of energy transition.**
  - It will also form sectoral committees on transport, industry, buildings, power, and agriculture.
- **The 6 Net-Zero Working Groups:**
  - **Macroeconomic Implications:** Examine the implications of net-zero pathways on macroeconomic indicators and suggest aligned monetary and fiscal policies.
  - **Climate Finance:** Estimate India's **climate finance** needs for mitigation and adaptation, and identify potential sources of finance.
  - **Critical Minerals:** Research and development, domestic manufacturing, and supply chain for critical minerals.
  - **Social Aspects of Energy Transition:** Assess the social impacts of the energy transition and propose mitigating strategies.
  - **Policy Synthesis:** Collate the reports of the sectoral committees and prepare a consolidated policy handbook.
  - **Sectoral Committees:** Devise transition pathways for power, industry, buildings, transport, and agriculture sectors.
- **Expected Outcomes:**
  - The deadline for all the working groups to **submit their action plans is October 2024.** The NITI Aayog report is expected to become a **policy handbook for all central ministries** for drafting climate-resilient and adaptive policies to achieve India's net-zero target by 2070.
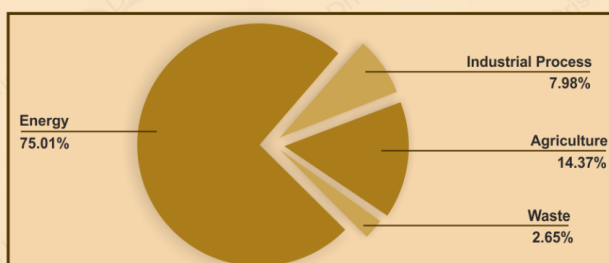
What is Net-Zero Target?

- **Net Zero** refers to achieving an **overall balance** between **carbon emissions produced** and **carbon taken out** of the atmosphere.
  - It is referred to as **carbon neutrality**, which **does not mean** that a country would bring down its emissions to zero.
  - Further, **absorption of the emissions** can be **increased by creating more carbon sinks** such as forests.
    - The removal of gases from the atmosphere requires futuristic technologies such as **carbon capture and storage.**
- More than 70 countries have promised to become **Net Zero** by 2050.

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INDIA'S CLIMATE PROFILE

Sector-wise Contribution

↪ **Key Emitting Sectors:** Energy, Transportation, Construction

Energy 75.01%
Industrial Process 7.98%
Agriculture 14.37%
Waste 2.65%

↪ **Key Climate Risks:** Floods, Droughts, Heat Waves, Cold Waves and Cyclones

↪ **Vulnerable Sectors:** Agriculture & Food, Water, Coastal, Health, Forests & other natural ecosystems

Key Initiatives for Tackling Climate Change

↪ **National Policy Framework**
- National Action Plan on Climate Change (NAPCC)
- State Action Plan on Climate Change (SAPCC)

↪ **India's Updated Nationally Determined Contributions (2022)**
- Mass movement for 'LIFE'– Lifestyle for Environment
- Adopt a climate-friendly and cleaner path for economic development
- 45% reduction in emissions intensity of GDP by 2030 compared to 2005 levels, aiming for net-zero emissions by 2070
- 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030
- Additional carbon sink of 2.5 to 3 billion tonnes of CO_2
- Better adapt to climate change by enhancing investments in specific sector

- Mobilise domestic and new & additional funds
- Build capacities, create domestic framework and international architecture

↪ **International Climate Negotiations - UNFCCC (1994) Convention and Agreements**
- Paris Agreement (2015)
- Kyoto Protocol (2005)

Bilateral and Multilateral Cooperation

Bilateral Projects

↪ **With Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ) GmbH (Germany)**
- Climate Adaptation & Finance in Rural India (CAFRI) (2020-2023)
- Nationally Appropriate Mitigation Actions (NAMAs) (2007)
- Global Carbon Market (GCM) (1997)
- Institutionalisation of Capacities on Climate Change Studies and Action (ICCC)

↪ **With European Union (EU)**
- Strategic Partnerships for the Implementation of the Paris Agreement (SPIPA) (2018-2022)
- Clean Technologies and Energy Efficiency for Eco-Cities

Multilateral Projects

↪ **UN Secretary-General (UNSG) Climate Action Summit (2019)**

↪ **Global Commission on Adaptation (GCA) (2018)**

↪ **UNDP:** Market Transformation and Removal of Barriers for Effective Implementation of the State-Level Climate Change Action

दृष्टि The Vision
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Drishti IAS

What are India's Initiatives to Achieve Net Zero Target?

- **National Action Plan on Climate Change:** **It aims at creating awareness among the representatives of the public, different agencies of the government, scientists, industry and the communities on the threat posed by climate change and the steps to counter it.**
- India has promised to **cut its emissions to net zero by 2070** at the **Conference of Parties-26 (COP)** Glasgow Summit.
- For this India outlined a **5-pronged 'Panchamitra' climate action** target:
    - Reach **500 GW Non-fossil energy** capacity by 2030.
    - **50% of its energy requirements from renewable energy** by 2030.
    - **Reduction** of total projected **carbon emissions by 1 billion tonnes** from now to 2030.
    - Reduction of the **carbon intensity of the economy by 45% by 2030**, over 2005 levels.
    - Achieving the target of **net zero emissions by 2070.**

CLIMATE FINANCE

Climate finance refers to local, national or transnational financing—drawn from public/ private/alternative sources of financing—to support mitigation and adaptation actions against climate change.

PRINCIPLES OF CLIMATE FINANCE

- Polluter Pays
- Common but Differentiated Responsibility and Respective Capability (CBDR–RC)

Multilateral Climate Funds Coordinated by UNFCCC

- **Global Environment Facility (GEF):** Operating entity of financial mechanism (1994)
- **Kyoto Protocol (2001):**
    - **Adaptation Fund (AF):** Gives developing countries full ownership of adaptation projects
    - **Clean Development Mechanism (CDM):** To carry out emission-reduction projects in developing nations
- **Green Climate Fund (GCF):** estd. - 2010 (COP 16)
    - Funds under it - **Least Developed Countries Fund (LDCF)** and **Special Climate Change Fund (SCCF)**
- **Long-Term Climate Finance:**
    - **Cancun Agreements (2010):** Mobilize and provide scaled-up funds in short and long term
    - **Paris Agreement (2015):** Developed nations agreed to establish new collective goal of at least $100 billion/year by 2025
- **Loss and Damage Fund (2023) (COP27 & COP28):** Financial assistance to nations most vulnerable and impacted by effects of climate change

Climate Investment Funds (CIFs) under World Bank

- Clean Technology Fund
- Strategic Climate Fund

INDIA'S INITIATIVES REGARDING CLIMATE FINANCE

Fund	Objective
■ **National Adaptation Fund for Climate Change** (NAFCC) (2015) ■ **National Clean Energy Fund** (2010-11) ■ **National Adaptation Fund** (2014) ■ **Intended Nationally Determined Contributions** (INDCs) (2015) ■ **Climate Change Finance Unit (2011)**	■ For vulnerable Indian states ■ Advancing clean energy (started with initial carbon tax on industrial coal use) ■ Bridging gap between required and available funds ■ Nationally binding targets adopted under UNFCCC ■ Leads on global climate finance issues

Challenges to Climate Finance

- Gap between national needs and climate finance under NDCs
- Least Developed Countries receive much less approved funding in per-capita terms from the multilateral climate funds
- Slow rate of approvals
- Failure in securing viability-gap funding

दृष्टि The Vision Drishti IAS

What Steps can be Taken by India to Achieve Net-Zero Emission Target?

- **Enhancing Carbon Sequestration:** India can enhance its **carbon sequestration** potential by

expanding its **forest and tree cover,** restoring degraded lands, promoting agroforestry, and adopting **low-carbon farming practices**.

- **Carbon sequestration can** not only offset emissions but also provide multiple co-benefits such as **biodiversity** **conservation, soil fertility improvement**, water security, livelihood support, and disaster risk reduction.

- **Building Climate Resilience:** India can build its climate resilience by strengthening its **disaster management systems**, improving its early warning and forecasting capabilities, investing in climate-proof infrastructure, developing **climate-smart agriculture,** enhancing health care services, and empowering local communities and institutions.

- **Driving India's Green Transportation Revolution:** There is a need to promote **electric vehicles (EVs)** by establishing a robust charging infrastructure network and offering incentives for EV adoption.

  - Introducing **innovative public transportation solutions** such as electric buses, shared mobility services, and smart traffic management systems can reduce congestion and emissions.

- **Climate Smart Agriculture:** There is a need to **encourage sustainable farming practices** by promoting **organic farming, agroforestry,** and **precision agriculture.**

  - Integrating technology-driven solutions such as **remote sensing**, **IoT devices**, and **AI-based analytics** can optimise resource utilisation, reduce water consumption, and enhance crop productivity.

- **International Collaboration: India can leverage international collaboration by acquiring advanced clean technologies through technology transfer agreements with developed countries, securing international climate finance and sharing best practices with other developing countries.**

Drishti Mains Question:

Discuss India's pledge to achieve net zero emissions by 2070. Also, discuss the key policy measures and implications of this commitment for India's sustainable development priorities.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. The term 'Intended Nationally Determined Contributions' is sometimes seen in the news in the context of (2016)

(a) pledges made by the European countries to rehabilitate refugees from the war-affected Middle East

(b) plan of action outlined by the countries of the world to combat climate change

(c) capital contributed by the member countries in the establishment of the Asian Infrastructure Investment Bank

(d) plan of action outlined by the countries of the world regarding Sustainable Development Goals

Ans: (b)

Q. In the context of India's preparation for Climate-Smart Agriculture, consider the following statements: (2021)

1. The 'Climate-Smart Village' approach in India is a part of a project led by the Climate Change, Agriculture and Food Security (CCAFS), an international research programme.
2. The project of CCAFS is carried out under Consultative Group on International Agricultural Research (CGIAR) headquartered in France.
3. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India is one of the CGIAR's research centres.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)

Q Which of the following best describes/describe the aim of 'Green India Mission' of the Government of India? (2016)

1. Incorporating environmental benefits and costs into the Union and State Budgets thereby implementing the 'green accounting'.
2. Launching the second green revolution to enhance agricultural output so as to ensure food security to one and all in the future.
3. Restoring and enhancing forest cover and responding to climate change by a combination of adaptation and mitigation measures.

Select the correct answer using the code given below.

(a) 1 only
(b) 2 and 3 only
(c) 3 only
(d) 1, 2 and 3

Ans: (c)

Mains

Q. Describe the major outcomes of the 26th session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). What are the commitments made by India in this conference? **(2021)**

NHRC Notice to Odisha Govt Over Custodial Death

For Prelims: Article 21, Article 22, Judgements on Custodial Violence, **NHRC**, **Law Commission**, International Conventions on Human Rights and Custodial Torture

For Mains: Ethical Concerns Associated with Custodial Deaths, Measures to prevent custodial torture and deaths.

Source: TOI

Why in News?

Recently, the **National Human Rights Commission (NHRC)** issued a notice to the Odisha government, requiring an explanation as to why the Commission should not recommend a payment of monetary compensation to the next of kin of a person, who allegedly died in police custody.

What is Custodial Death?

- Custodial death refers to a **death that occurs while a person is in the custody of law enforcement officials** or a correctional facility. It can occur due to **various causes such as the use of excessive force, neglect, or abuse** by the authorities.
- According to the **Law Commission of India**, the violence committed by a public servant against the arrested or the detained person who is in custody amounts to **custodial violence.**

CUSTODIAL DEATH

CD is a death that occurs while a person is in the custody of law enforcement officials or in a correctional facility
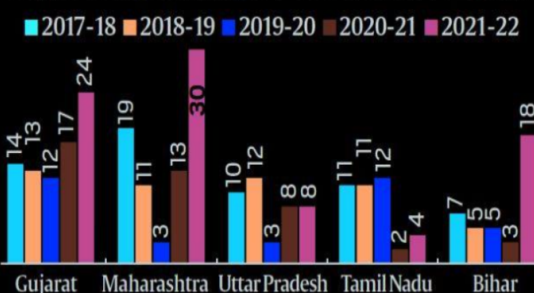
CAUSES

- Use of excessive force, (medical) neglect, abuse by authorities etc.

HIGHEST CDs IN INDIA (2017-18 to 2021-22)

- Uts: Delhi (29), J&K (4)
- States: Gujarat (80), Maharashtra (76), UP (41), TN (40) and Bihar (38)

STATES WITH HIGHEST CUSTODIAL DEATHS

■2017-18 ■2018-19 ■2019-20 ■2020-21 ■2021-22

Gujarat: 14, 13, 12, 17, 24
Maharashtra: 19, 11, 3, 13, 30
Uttar Pradesh: 10, 12, 3, 8, 8
Tamil Nadu: 11, 11, 12, 2, 4
Bihar: 7, 5, 5, 3, 18

LEGAL PROVISIONS

- CrPC Section 41 - Amended in 2009; arrests and detentions for interrogation to have reasonable grounds and documented procedures
- IPC Sec 302, 304, 304A, and 306 – Include crime of custodial torture
  - Sec 330, 331 – Punishment for injury inflicted for extorting confession

Complaints of such human rights violations are received by the NHRC under Protection of Human Rights Act, 1993

MAJOR ISSUES REGARDING CDs

- No anti-torture legislation
- Opaque, poor prison system
- Excessive force used against marginalised/ protesters
- Lengthy, expensive judicial processes

India signed the UN Convention against Torture (1985) in 1997 but hasn't ratified it yet

CD V/S FUNDAMENTAL RIGHTS

- Protection from torture (Article 21)
- Protection against arrest and detention in certain cases, Right to Counsel (Article 22)

SOLUTIONS

- Multi-pronged strategy encompassing legal enactments, technology, accountability, training and community relations
- Taking stringent action against personnel breaching the commandments issued by the SC in *D.K. Basu v. State of West Bengal (1997)* (such as - All police personnel to wear name tags clearly indicating their name, designation)

- **Judicial Pronouncements on Custodial Death:**

- **Kishore Singh Vs. State of Rajasthan (1981):** The Supreme Court held that the **use of third degree** by the police **is violative of Article 21 of the Constitution** of India.
- **Nilabati Behera vs. State of Orissa (1993):** The Supreme Court held that the **state is liable to pay compensation for custodial deaths** resulting from police **negligence or brutality,** recognizing the state's responsibility for **protecting the right to life.**
- **Joginder Kumar v. State of Uttar Pradesh (1994): The Supreme Court dealt with violation of human rights because of indiscriminate arrests. They referred to the recommendations made in the Third Report of the National Police Commission that police should avoid arrest provided only in heinous offence.**
- **D.K. Basu vs. State of West Bengal (1997):** The Supreme Court laid down specific guidelines to prevent custodial torture and deaths, including **requirements for arrest memos, the right to medical examination, and access to legal counsel.**

Note:

- **Custodial Death Guidelines Laid Down in DK Basu Case:**
  - It is the duty of the Police Officer **not to use third-degree methods while having investigation and interrogation** from the accused.
  - Attention must be required in **checking the working environment, training, and orientation of the Police Officials** with the basic human values.
  - The **legislature must adopt** the recommendations suggested by the **Law Commission Report by inserting Section 114-B.**
  - A **balanced approach** should be used by the police to extract the information from hardened criminals.
  - There must be a memo made by the Police Officer in charge at the time of arrest and at least one family member of the accused must be present when the arrest is made.
  - The requirements under the Constitution under **Article 21 and 22 (1) of Constitution of India must be followed** by Police Officers.
  - **Awareness must be created to the arrestee** so that he can understand his basic rights at the time of the arrest.
  - Also, the Court has given certain **preventive measures** that must be followed by the Police Officer in charge at the time of the arrest of an accused.
- **Section 114-B:** It was recommended in the **113th Report of Law Commission** (**however, not yet included).** It says that in a prosecution of a police officer for causing bodily injury to a person in custody, the court may presume the injury was caused by the officer if evidence shows the injury occurred during custody. In deciding this, the court will consider:

  - (a) The period of custody,

  - (b) Any admissible statement by the victim about the injury,

  - (c) Medical evidence,

  - (d) Evidence from any magistrate who recorded or attempted to record the victim's statement.

What are the Ethical Concerns Associated with Custodial Deaths?

- **Violates Human Rights and Dignity:**
  - Every person possesses inherent dignity and deserves to be treated with respect and fairness. Custodial violence violates this fundamental principle by inflicting physical and psychological harm, stripping individuals of their dignity, and denying them basic human rights.
- **Undermines Rule of Law:**
  - It undermines the core principles of the rule of law and due process. Law enforcement

officers are tasked with upholding and enforcing the law, yet engaging in violence directly contradicts the fundamental principles of justice, equality, and the safeguarding of human rights.

- **Presumption of Guilt:**
  - It undermines the foundational principle of **"innocent until proven guilty".** Subjecting individuals to torture before they have been convicted of a crime violates their fundamental rights to a fair trial and due process.
- **Opposing Professionalism and Integrity:**
  - Police officers and authorities are expected to maintain high ethical standards, which include professionalism, integrity, and a commitment to respecting human rights. Custodial violence breaches these ethical principles and stains the reputation of the profession overall.

What Measures can be Taken to Prevent Custodial Torture?

- **Strengthening Legal Systems:**
  - Strengthen laws against torture and ensure that they are strictly enforced.
  - Ensuring **prompt and impartial investigations into allegations** of custodial torture.
  - Holding perpetrators accountable through fair and expeditious trials.
- **Police Reforms and Sensitisation:**
  - Improving police training programs to uphold **human rights and dignity.** Oversight mechanisms to **effectively monitor and address cases** of custodial torture.
  - Promoting a culture of accountability, professionalism, and empathy within law enforcement agencies.
    - **For example, in the [Prakash Singh Case 2006](#),** the Supreme Court issued **seven directives** to drive **police reforms in India,** acknowledging widespread issues such as politicization, **lack of accountability, and systemic weaknesses** impacting overall police performance.
- **Empowering Civil Society and Human Rights Organisations:**
  - Promoting **active advocacy by civil society organizations for victims** of custodial torture.
  - **The [National Human Rights Commission (NHRC)](#) should be allowed to inquire** into any matter **even after one year** from the date of the alleged human rights violation.
  - Providing **support and legal aid** to **victims and their families.**
  - Collaborating with international human rights bodies and organisations to seek redress and justice.

NATIONAL HUMAN Rights COMMISSION (NHRC)

According to NHRC, Human Rights are the rights relating to life, liberty, equality and dignity of the individual guaranteed by the Constitution or embodied in the International Covenants and enforceable by courts in India

- Watchdog of Human Rights in India
- **Estd:** 1993 (in conformity with Universal Declaration of Human Rights)
- **Act:** Protection of Human Rights Act (PHRA), 1993

State Human Rights Commissions
- Also constituted under the PHR Act, 1993
- **Appointment of Members:** by Governor
- **Removal of Members:** by President

Human Rights Day: 10 December

Functions
- Investigates Complains of human rights violations
- *Suo Moto* cognizance of cases
- Reviews and recommends human rights implementation
- Spreading human rights awareness
- Conduct studies, publish reports on human rights issues

Powers
- Summon individuals, examine witnesses, and receive evidences
- Inspect prisons and other institutions to ensure conditions are humane
- Intervene in court proceedings relating to human rights

Members of NHRC

Composition
- 5 full-time members and 7 deemed members
- **Chairperson:** Retired CJI/Judges of the SC
- **Administrative Head:** Secretary-General

Tenure
- 3 years / till age 70 (whichever is earlier)

Removal
- President can remove the chairman or any member
- **Ground:** Charges of proved misbehaviour or incapacity

Appointment
- All members appointed by **President** on recommendations of a **6-member** committee (PM, Speaker of LS, Deputy Chairman of RS, Union Home Minister and Leaders of Opposition of both Houses of Parliament)

Global Alliance of National Human Rights Institutions (GANHRI) Status
- **NHRC has been accredited 'A' Status since 1999**
- **Retained 'A' Status:** 2006, 2011 and 2017
- **Suspension of 'A' Status:** 2023 and 2024

Note:

- **International Conventions on Human Rights and Custodial Torture to which India is a Signatory:**

  - United Nations Convention Against Torture (UNCAT)

  - Universal Declaration of Human Rights (UDHR)

  - The International Covenant on Civil and Political Rights (ICCPR)

- The international convention on the elimination of all forms of racial discrimination.

- The convention on the elimination of all forms of discrimination against women (CEDAW)

- The convention on the rights of the child

- Convention on the Rights of Persons with Disabilities

- **The International Covenant on Economic Social and Cultural Rights (ICESCR)**

Drishti Mains Question:

Q. What are the Ethical concerns associated with Custodial Deaths? Discuss the measures that can be taken to prevent them.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. Consider the following: (2011)

1. Right to education
2. Right to equal access to public service
3. Right to food.

Which of the above is/are Human Right/Human Rights under "Universal Declaration of Human Rights"?

(a) 1 only

(b) 1 and 2 only

(c) 3 only

(d) 1, 2 and 3

Ans: (d)

Mains:

Q. Though the Human Rights Commissions have contributed immensely to the protection of human rights in India, yet they have failed to assert themselves against the mighty and powerful. Analysing their structural and practical limitations, suggest remedial measures. **(2021)**

India Grants Record Patents

For Prelims: India Grants Record Patents in 2024, **Indian Patent Office (IPO)**, **World Intellectual Property Organization (WIPO)**, **Patent Cooperation Treaty (PCT)**, **Patents Act, 1970.**

Source: HT

Why in News?

Recently, the Union Minister of **Commerce and Industry** highlighted that India issued around **one lakh patents in 2024**, reflecting the **significant increase** in patent approval.

What is a Patent?

- **About:**
    - A **patent** is a legal right to an invention given to a person or entity without interference from others who wish to replicate, use, or sell it.
    - Patent protection is a **territorial right and therefore it is effective only within the territory of India**. There is **no concept of global patent.**
    - The patent system in India is governed by the **Patents Act, 1970** with patent rules being regularly amended in consonance with the changing environment, the most recent being **Patents (Amendment) Rules, 2024.**
- **Criteria of Patentability: An invention is patentable subject matter if it is novel, non-obvious, and capable of Industrial application.**
    - Additionally, it **should not attract the provisions of section 3 and 4 of the Patents Act 1970.**
- **Patents Act, 1970:**
    - This principal law for patenting system in India came into force in the year 1972. It **replaced the Indian Patents and Designs Act 1911**.
    - The Act was **amended by the Patents (Amendment) Act, 2005**, wherein product patent was extended to all fields of technology including food, drugs, chemicals and microorganisms.
    - After the amendment, the provisions relating to Exclusive Marketing Rights (EMRs) have been repealed, and a **provision for enabling grant of compulsory license** has been introduced. The provisions relating to **pre-grant and post-grant opposition** have also been introduced.
- **Key Changes Under** Patents (Amendment) Rules, 2024:
    - **Reduced timeline for filing a Request for Examination (RFE):** From 48 months to 31 months from the priority date.
    - **Introduction of 'Certificate of Inventorship':** Acknowledge inventors' contributions by identifying them for their patented inventions.
    - **Frequency of filing statements:** Reduced from once a financial year to once every three financial years.
    - **Amendments in Pre-grant and Post-grant Opposition Procedures:** Time frame for submission of recommendations by an Opposition Board and the response time for applicants have been adjusted.

Note

- In the **Global Innovation Index (GII) 2023** rankings by WIPO, **India secured the 40th position** out of 132 countries. This marks an improvement from the 46th position in 2021 and the 81st rank in 2015.
- According to the study released by the World Intellectual Property Organisation, India **sees record 31.6% rise in patent applications** in 2022; **ahead of China, U.K.**

What is the Significance of Granting Patents?

- **Encouraging Innovation and Research: Granting exclusive rights through patents incentivizes innovation.**

- **Attracting Foreign Direct Investment (FDI):** Countries with robust intellectual property protection regimes tend to attract more FDI. A well-protected IP environment provides confidence to foreign investors that their innovations will be safeguarded, encouraging them to invest in India.

- **Creating a Knowledge-Based Economy:** Protection of copyrights and trademarks encourages the creation and commercialization of intellectual assets in fields such as literature, arts, music, and branding contributing to the development of a knowledge-based economy.

INTELLECTUAL PROPERTY RIGHTS (IPRs)

IP refers to intangible assets owned/legally protected by an individual/company from outside use or implementation without consent.

NEED FOR IPR

- Encourages Innovation
- Economic growth
- Safeguard rights of creators
- Enhances ease of doing business

RELATED CONVENTIONS/TREATIES (INDIA SIGNATORY TO ALL)

- WIPO Administered (first recognised IPR under):
  - Paris Convention for the Protection of Industrial Property 1883 (**Patents, Industrial Designs**)
  - Berne Convention for the Protection of Literary and Artistic Works 1886 (**Copyrights**)
- WTO - TRIPS Agreement:
  - Ensures adequate standard of protection
  - Argues for incentives for technology transfer to developing countries
- Budapest Treaty 1977:
  - International recognition of the deposit of micro-organisms for the purposes of patent procedure
- Marrakesh VIP Treaty 2016:
  - Facilitate access to published works by visually impaired persons and persons with print disabilities
- IPR also outlined in **Article 27** (Universal Declaration of Human Rights)

INDIA AND IPRS - INITIATIVES

- National IPR Policy 2016:
  - **Motto:** "Creative India; Innovative India"
  - Compliant with TRIPS Agreement
  - Brings all IPRs to single platform
  - Nodal Dept - Department of Industrial Policy & Promotion (Ministry of Commerce)
- National (IP) Awareness Mission (**NIPAM**)
- Kalam Program for Intellectual Property Literacy and Awareness Campaign (**KAPILA**)

World Intellectual Property Day: 26th April

Intellectual Property	Protection	Law in India	Duration
Copyright	Expression of Ideas	Copyright Act 1957	Variable
Patent	Inventions- New Processes, Machines, etc.	Indian Patent Act 1970	20 years Generally
Trademarks	Sign to distinguish business goods or services	Trade Marks Act 1999	Can last Indefinitely
Trade Secrets	Confidential Business Information	Protected without Registration	Unlimited time
Geographical Indication (GI)	Sign used on specific geographical origin and possess qualities due to site of origin	Geographical Indication s of Goods(R & P) Act, 1999	10 years (Renewable)
Industrial Design	Ornamental or aesthetic aspect of an article	Design Act, 2000	10 years

Drishti IAS

What are the Challenges in the Patenting System?

- **Lengthy Approval Process:** Patent offices can **take months or even years** to examine applications. This can be problematic for inventors waiting to secure their rights.
- **Backlog of Patent Applications: Patent offices often deal with a high volume of**

applications, leading to a backlog that can further extend approval times.

- **Limited Awareness & Education:** Many inventors, especially small businesses and individuals, **lack sufficient knowledge** about patents and the process. This can hinder their ability to effectively protect their inventions.

- **Resource Constraints:** The patenting process can be **expensive, involving patent attorney fees,** application fees, and potential maintenance fees. This can be a barrier for inventors with limited resources.

- **Stringent Patentability Criteria:** India has **specific provisions under Section 3** of the Patents Act that exclude certain inventions from patentability. This can be a hurdle for innovations in these areas.

- **Enforcement Issues:** Even with a patent, **enforcing patentee rights against infringers can be costly** and time-consuming, requiring legal action.

- **Biopiracy & Traditional Knowledge Issues:** Ensuring fair access to genetic resources and protecting traditional knowledge associated with them can be complex issues in the patent system.

What are Steps Needed to Improve the Patenting System?

- **Simplifying Procedure: Streamline application process with online filing and user-friendly interfaces.**

  - Offer clear and accessible guidelines for patent drafting and prosecution.

- **Simplify Approval Process:** Increase **manpower and resources** in patent offices for faster examination.

  - Offer expedited examination options for critical inventions.

- **Clearing Backlog: Clear the backlog** through efficient case management and disposal strategies.

- **Creating Awareness:** Integrate intellectual property (IP) education in academic **curriculums (STEM fields).**

  - Establish IP support centers and pro bono legal services for small businesses.
- **Provision of Subsidies: Introduce government subsidies and fee reductions for individual inventors and startups.**
  - **Promote patent pools** and collaborative research to share costs.
- **Relaxing Patentibility Criteria: Review and harmonise patentability criteria with international standards.**
  - **Offer pre-filing consultations** to assess invention's patentability.
- **Strengthen Legal Mechanism: Strengthen IP enforcement mechanisms, including specialised courts and faster adjudication.**
  - **Promote alternative dispute resolution (ADR)** for cost-effective enforcement.
- **Protecting Traditional Knowledge: Implement stricter regulations and effective enforcement against biopiracy.**
  - Develop a **national database** of traditional knowledge for better protection.

Drishti Mains Question:

Q. Discuss the potential socio-economic benefits of an increased number of patents granted in India and

suggest strategies to effectively harness these benefits for societal advancement.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. What is/are the recent policy initiative(s)of Government of India to promote the growth of manufacturing sector? (2012)

1. Setting up of National Investment and Manufacturing Zones
2. Providing the benefit of 'single window clearance'
3. Establishing the Technology Acquisition and Development Fund

Select the correct answer using the codes given below:

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)

Q. With reference to the 'National Intellectual Property Rights Policy', consider the following statements: (2017)

1. It reiterates India's commitment to the Doha Development Agenda and the TRIPS Agreement.
2. Department of Industrial Policy and Promotion is the nodal agency for regulating intellectual property rights in India.

Which of the above statements is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (c)

Q. Consider the following statements: (2019)

1. According to the Indian Patents Act, a biological process to create a seed can be patented in India.
2. In India, there is no Intellectual Property Appellate Board.
3. Plant varieties are not eligible to be patented in India.

Which of the statements given above is/are correct?

(a) 1 and 3 only
(b) 2 and 3 only
(c) 3 only
(d) 1, 2 and 3

Ans: (c)

Mains:

Q. How is the Government of India protecting traditional knowledge of medicine from patenting by pharmaceutical companies. **(2019)**

CJI Advocates for More SAT Benches

Source: IE

The **Chief Justice of India** has emphasised the need for **additional Securities Appellate Tribunal (SAT) benches** to keep up with **India's growing markets and financial transactions,** during the inauguration of new SAT premises in Mumbai.

- CJI stressed the importance of filling vacancies in the SAT without delay to allow the tribunal to work effectively and at full capacity.
- The CJI emphasised that a **legal system with adequate safeguards and effective dispute resolution** is crucial for building investor confidence in India's markets and business landscape, leading to better economic outcomes.
- SAT is a **statutory body** established under the **Securities and Exchange Board of India Act, 1992** to hear and dispose of appeals against orders passed by the **Securities and Exchange Board of India.**
- The SAT consists of a **Presiding Officer and two other members.** The Presiding Officer of SAT is appointed by the Central Government in consultation with the CJI or his nominee.
  - It also has jurisdiction to hear appeals against orders passed by the **Pension Fund Regulatory and Development Authority (PFRDA)** and the **Insurance Regulatory Development Authority of India (IRDAI)** under their respective acts, rules, and regulations.

Read more: Securities Appellate Tribunal

Sensex Touches 80,000 Mark

Source: IE

Recently, the **Bombay Stock Exchange (BSE) Sensex** has crossed the 80,000 mark for the first time on **4th July 2024**, hitting a new peak of 80,074 during intraday trades.

- The Sensex has **doubled in the last 5 years**, after taking 12 years to climb from 20,000 to 40,000.
  - It has crossed its first 10,000 level in 2006, the 20,000 level in 2007, and the 40,000-mark in 2019.
- **Sensex (Stock Exchange Sensitive Index):**
  - It is a **stock market index** that **tracks the performance of the 30 largest and most actively traded companies** listed on the **Bombay Stock Exchange (BSE)** in India.
    - A stock exchange is a centralised location where the **shares of publicly traded companies are bought and sold**. BSE is the **oldest stock exchange** in Asia established in 1875.
  - The Sensex was launched in **1982** by the BSE.
  - It is used by **analysts and investors to track India's economic cycles** as well as the

growth and decline of specific sectors.
- The Sensex is **re-evaluated two times a year,** one in June and the next in December.
  - Another stock market index named **Nifty 50** tracks the performance of 50 companies that are listed on the **National Stock Exchange (NSE)**. It was introduced in **1996**.

Read more: Indian Stock Market is Fourth-largest Globally.

SCO Summit 2024

For Prelims: Shanghai Cooperation Organisation, Line of Actual Control, Make in India, BRICS grouping

For Mains: Significance of the Shanghai Cooperation Organisation, Economic relations of India with SCO

Source: IE

Why in News?

Recently the 2024 **Shanghai Cooperation Organisation (SCO) Summit** was concluded in **Astana, Kazakhstan** and brought together leaders from across the region.

- India played a prominent role, with the External **Affairs Minister** delivering the Prime Minister's message that highlighted **combating terrorism and addressing climate change as key priorities.**

Note

People's Republic of China will assume the SCO chairmanship for the next term, and Qingdao, China will be appointed the SCO's tourism and cultural capital for 2024-2025.

What are the Key Highlights of SCO Summit 2024?

- **New Membership: Belarus has become the 10th member state of the SCO. The Indian External Affairs Minister met with Belarusian counterpart to strengthen bilateral ties.**

- **Astana Declaration:** The 24th SCO Summit in Astana adopted the **Astana Declaration** and approved 25 strategic agreements on energy, security, trade, finance, and information security.

  - The Council of Heads of State– Members of the SCO adopted the **SCO Development Strategy until 2035,** including resolutions on **combating terrorism, separatism, and extremism,** anti-drug strategy, energy cooperation, economic development, and cooperation in protected areas and eco-tourism.
  - Commitments also included signing a **memorandum to combat illicit drug trafficking** and an interaction plan on international information security issues.
- **India-China Relations: India's External Affairs Minister met the Chinese Foreign Minister on the margins of the SCO Summit in Astana, Kazakhstan. Both ministers**

emphasised the need for **"complete disengagement" of troops and restoring peace along the** Line of Actual Control (LAC).

- The two ministers agreed to expedite efforts through diplomatic and military channels to resolve remaining issues in Eastern Ladakh.

- **Make in India and Global Economic Growth:** The 'Make in India' initiative was highlighted as it has the potential to become a significant engine for global economic growth.

  - India expressed openness to partnering with other nations, particularly those in the Global South, for capacity building and economic development.
- **Combat Terrorism:** At the SCO summit, the External Affairs Minister of India urged the global community to **isolate countries that harbour terrorists and condone terrorism.**
  - He emphasised the need to **counter cross-border terrorism** and highlighted the importance of combating terrorism as a foundational goal of the SCO.
  - India has been proactive in enhancing its security-related cooperation within the SCO framework, particularly through the **Regional Anti-Terrorism Structure (RATS),** which focuses on security and defence issues.
  - The Russian President emphasised the SCO's role in promoting a **fair, multipolar world order**.

What is the Shanghai Cooperation Organisation?

- **Origins:** The SCO originated from the **"Shanghai Five,"** formed in 1996, consisting of China, Russia, Kazakhstan, Kyrgyzstan, and Tajikistan.
  - It was created to address **concerns about extremist religious groups and ethnic tensions** following the dissolution of the USSR in 1991.
- **Establishment:** SCO was established on 15th June 2001, in Shanghai, adding **Uzbekistan as a sixth member.**
  - Before the inclusion of Belarus, **it had nine members: India, Iran, Kazakhstan, China, Kyrgyzstan, Pakistan, Russia, Tajikistan, and Uzbekistan.**
  - **Afghanistan and Mongolia hold Observer Status**.
- **Significance: Addresses security issues in Asia with primarily Asian members.**
  - The SCO is significant because it is one of the **few international organisations focused on security issues** and primarily consists of Asian members.
    - Russia and China view it as an alternative to the **"Western" international order** and are positioning themselves against US influence, alongside the **BRICS grouping** and seeking to counterbalance US influence.
  - The SCO represents 40% of the world's population, and member countries contribute approximately over USD 23 trillion to global GDP.
- **Relevance of SCO for India**:
  - **Regional Cooperation:** SCO membership allows India to enhance cooperation with Central Asian countries, improving relations since their formation in 1991. Facilitates communication with major regional actors on common security issues.
  - **Counter-Terrorism Efforts:** The RATS is a significant permanent structure within the SCO. It has helped countries like India with counter-terrorism exercises, intelligence analysis, and sharing information on terrorist movements and drug trafficking.
- **Challenges for India: While SCO membership enhances regional engagement, challenges in managing bilateral ties remain, influencing India's participation and stance on initiatives like the** Belt and Road Initiative (BRI).
  - India faces challenges in the SCO including balancing ties with **China and Russia,** addressing regional security concerns, managing **relations with Pakistan,** ensuring economic benefits, maintaining strategic autonomy, dealing with the issue of sovereignty, and increasing bilateral trade with SCO countries.

Member states of the Shanghai Cooperation Organisation

Belarus became 10th member state of SCO in 2024

Drishti Mains Question:

Q. Describe the SCO's role in addressing security challenges in Asia and its impact on regional stability.

UPSC Civil Services Examination Previous Year's Question (PYQs)

Mains

Q. Critically examine the aims and objectives of SCO. What importance does it hold for India? **(2021)**

Extension of Smart Cities Mission

For Prelims: **Smart Cities Mission**, **Centrally Sponsored Scheme**, **Sustainable development**, **Special Purpose Vehicle (SPV)**, **Public-Private Partnership (PPP)**, **Atal Mission for Urban**, **Rejuvenation and Urban Transformation (AMRUT)**, **Pradhan Mantri Awas Yojana-Urban (PMAY-U)**, **Climate Smart Cities Assessment Framework 2.0**, **TULIP-The Urban Learning Internship Program**

For Mains: Smart Cities Mission: Significance & Challenges

Why in News?

Recently, the Central Government has decided to extend the deadline for **Smart Cities Mission** till **31 st March 2025.**

- Initially planned for completion by 2020, **the mission had already been extended twice.**

What is the Smart Cities Mission (SCM)?

- **About:**
  - It is a **Centrally Sponsored Scheme**, **launched in June 2015** to transform 100 cities to provide the necessary core infrastructure and clean and sustainable environment to enable a decent quality of life to their citizens through the application of **"Smart Solutions"**.
  - It aimed to improve the quality of life for citizens through sustainable and **inclusive development**.
- **Components of the SCM:**

  - **Area-based Development:**

    - **Redevelopment (City Renewal):** Renewal of existing urban areas to improve infrastructure and amenities. E.g. Bhendi Bazar, Mumbai.
    - **Retrofitting (City Improvement):** Upgrading infrastructure in existing areas to make them more efficient and sustainable. E.g. Local Area Development (Ahmedabad).
    - **Greenfield Projects (City Extension):** Development of new urban areas with a focus on sustainability and smart technologies. E.g. New Town, Kolkata, Naya Raipur, **GIFT City (Gujarat International Finance Tec-City)**.
  - **Pan-City Solutions:**
    - Implementation of **Information and Communication Technology (ICT)** solutions across various sectors such as **e-governance**, **waste management, water management, energy management, urban mobility**, and **skill development**.
- **Governance Structure:**
  - To enhance effectiveness, a new governance model was adopted.
    - A **Special Purpose Vehicle (SPV)** was created under the **Companies Act, 2013** led by a bureaucrat or a representative of a **Multinational Corporations (MNC).**
- **Financing of Smart Cities:**
  - The SCM receives **Rs. 48,000 crores over 5 years** from the Central Government, averaging **Rs. 100 crore per city per year**.
  - States and **Urban Local Bodies (ULB)** are required to **contribute an equal amount**, resulting in a total of nearly Rs. 1 lakh crore for Smart Cities development.
- **Convergence with Other Government Schemes:**
  - The SCM can be strategically converged with other Central and State Government programs to utilise its full potential.
  - **Benefits of Convergence:**
    - Combining resources and objectives of SCM with schemes like **AMRUT (urban transformation)**, **Swachh Bharat Mission (cleanliness)**, **HRIDAY (heritage city development)**, **Digital India**, **Skill Development**, and **Housing for All** leads to a **more comprehensive approach.**
    - Existing funds and infrastructure from various schemes can be leveraged to **achieve common goals** within the SCM framework.
    - Convergence ensures **social infrastructure** (health, education, culture) is **addressed alongside physical infrastructure development** in smart cities.

What is a Smart City?

- A Smart City is a concept that refers to the **use of technology, data, and innovative solutions** to **improve the efficiency, sustainability, and quality of life** in urban areas.
- Core Infrastructure Elements of a Smart City include:
    - Adequate water supply,
    - Assured electricity supply,
    - Sanitation, including solid waste management,
    - Efficient urban mobility and public transport,
    - Affordable housing, especially for the poor,
    - Robust IT connectivity and digitalisation,
    - Good governance, especially e-Governance and citizen participation,
    - Sustainable environment,
    - Safety and security of citizens, particularly women, children and the elderly, and
    - Health and education.

ILLUSTRATIVE LIST

Smart Solutions

E-Governance and Citizen Services
1. Public Information, Grievance Redressal
2. Electronic Service Delivery
3. Citizen Engagement
4. Citizens - City's Eyes and Ears
5. Video Crime Monitoring

Waste Management
6. Waste to Energy & fuel
7. Waste to Compost
8. Waste Water to be Treated
9. Recycling and Reduction of C&D Waste

Water Management
10. Smart Meters & Management
11. Leakage Identification, Preventive Maint.
12. Water Quality Monitoring

Energy Management
13. Smart Meters & Management
14. Renewable Sources of Energy
15. Energy Efficient & Green Buildings

Urban Mobility
16. Smart Parking
17. Intelligent Traffic Management
18. Integrated Multi-Modal Transport

Others
19. Tele-Medicine & Tele Education
20. Incubation/Trade Facilitation Centers
21. Skill Development Centers

Note:

Cities accommodate nearly 31% of India's current population and contribute 63% of **Gross Domestic Product (GDP)** as per **Census 2011**. Urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030.

What are the Challenges Faced by the Smart Cities Mission?

- **Lack of Clarity in Definition: The SCM has acknowledged the lack of a universal**

definition for the term "smart city." This recognition reflects the understanding that each city's vision for a smart city is shaped by its unique local contexts and aspirations. However, this ambiguity in the conceptualisation of a smart city poses a challenge in effectively allocating resources and prioritizing projects.

- The conceptualisation of a Smart City **varies significantly from one city to another, and even from country to country**. These differences are influenced by factors such as the level of development, the willingness to embrace change and reform, the availability of resources, and the aspirations of the city's residents.

- **Delay in Project Completion:** Despite the extension of the deadline, a significant number of projects **(around 10%) are still incomplete**, indicating delays in execution. This can be attributed to factors such as **inadequate planning, lack of technical expertise,** and **issues in land acquisition and clearances.**

- **Inadequate Funding and Its Utilisation: While 74 cities have received 100% of their central share, 26 cities are yet to get the full funding due to the slow progress of projects.**
  - The SPV model adopted for smart city projects has faced objections due to its misalignment with the **74th Constitutional Amendment**. This has **resulted in criticism of the top-down governance structure of the smart city initiatives**.

- **Lack of Coordination:** Effective coordination between the central, state, and local governments has been a challenge due to **differences in priorities, bureaucratic hurdles,** and **lack of clarity in roles and responsibilities** that have hindered the seamless implementation of the mission.

- **Sustainability Concerns:** There are doubts about the **long-term sustainability** of the smart city projects, as many of them focus on **technology-driven solutions** rather than addressing the **fundamental issues of urban planning and governance**.

- **Displacement and Social Impact:** According to the **World Bank**, in urban areas of India more than **49% of the population live in slums.**
  - The execution of smart city projects **has led to the displacement of residents in poorer areas, such as street vendors**, disrupting the fabric of urban communities. Infrastructure development in certain towns has contributed to the increased urban flooding due to disruptions in water channels and contours.

What Should be the Steps Taken to Strengthen Smart Cities Mission?

- **Effective Governance and Implementation: Appointing CEOs with fixed tenures ensures continuity and attracts qualified professionals. Stakeholder representation, including experts and** Member of Parliaments (MPs)**, fosters inclusive decision-making.**

- **Strategic Project Focus:** The SCM digital infrastructure is expected to generate and utilise vast amounts of data from diverse sources. Therefore, it is necessary that a robust system should be implemented to protect these platforms from cyberattacks and guarantee adequate protection for sensitive public and private data.

- **Data Security and Upgradation:** Establish robust digital infrastructure protection to counter cyber threats and safeguard data privacy.
  - Develop comprehensive **Operation and Maintenance (O&M) strategies** to maximise infrastructure lifespan and ensure timely upgrades.

- **Building Capacity and Funding:** Strengthen **Urban Local Bodies (ULBs)** in smaller cities through capacity building programs. Central government assistance can be crucial for organisational restructuring and skill development.

- **Ensuring Project Completion:** The Ministry's role should extend beyond fund allocation. **Active monitoring and providing expertise** for timely project execution are essential.

- **Global Knowledge Sharing:** India's focus on sustainable urban development positions it to guide similar projects in developing nations (Example: **Gelephu Smart City Project** in **Bhutan**).
  - The Gelephu Smart City Project aims to create an economic corridor connecting **South Asia with Southeast Asia** through **India's northeastern States**. It will prioritise environmental standards and sustainability, seeking quality investment from specially screened international companies.

SMART CITIES MISSION

About

- **Launched:** 2015
- **Nature:** Centrally Sponsored
- **Nodal Ministry:** Ministry of Housing & Urban Affairs
- **Implemented through:** Special Purpose Vehicles (SPVs) at city level
- **Mission Deadline:** Extended to June 2023
- **Coverage:** Developing 100 selected cities as Smart Cities

Six Fundamental Principles

- Citizen at the core
- More from Less
- Cooperative and competitive federalism
- Integration, innovation & sustainability
- Technology as means, not the goal
- Convergence

SMART SOLUTIONS

E-Governance and Citizen Services

- Public Information, Grievance Redressal
- Electronic Service Delivery
- Citizen Engagement
- Citizens-City's Eyes and Ears
- Video Crime Monitoring

Energy Management

- Smart Meters & Management
- Renewable Sources of Energy
- Energy Efficient & Green Buildings

Waste Management

- Waste to Energy & fuel
- Waste to Compost
- Waste Water Treatment
- Recycling and Reduction of Waste

Urban Mobility

- Smart Parking
- Intelligent Traffic Management
- Integrated Multi-Modal Transport

Water Management

- Smart Meters & Management
- Leakage Identification, Preventive Maintenance
- Water Quality Monitoring

Others

- Tele-Medicine & Tele Education
- Incubation/Trade Facilitation Centers
- Skill Development Centers

60% projects have been completed so far

Challenges

- **Managing Finance:** Difficulty in mobilising funds, transferring them to SPVs, and using them efficiently
- **Urban Problems:** Like air pollution, road congestion & decline in public transport
- **Policy Issues:** Like hindrances in getting environment clearances
- **Data privacy and security**
- **Lack of Center-State Co-ordination**

Way Ahead

- **Decentralisation:** Planning at Municipal & state level for better implementation
- **Policy Issues:** Like red-tapism, environmental clearances need to be taken care of
- **PPP Model:** For better administrative & technological capabilities
- **Integrated Approach:** For holistic development of transportation, energy, housing
- **Promote Citizen Engagement**

Drishti IAS

Drishti Mains Question:

Q. What is the Smart Cities Mission? What are the challenges faced by this and suggest the measures to address these challenges.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Mains:

Q. With a brief background of quality of urban life in India, introduce the objectives and strategy of the 'Smart City Programme.' **(2016)**

Satellite-Based Communication

Why in News?

Recently, **satellite-based communication** for internet connectivity has gained traction, although its evolution has shifted away from being user-centric, raising questions about its **viability** for users in India.
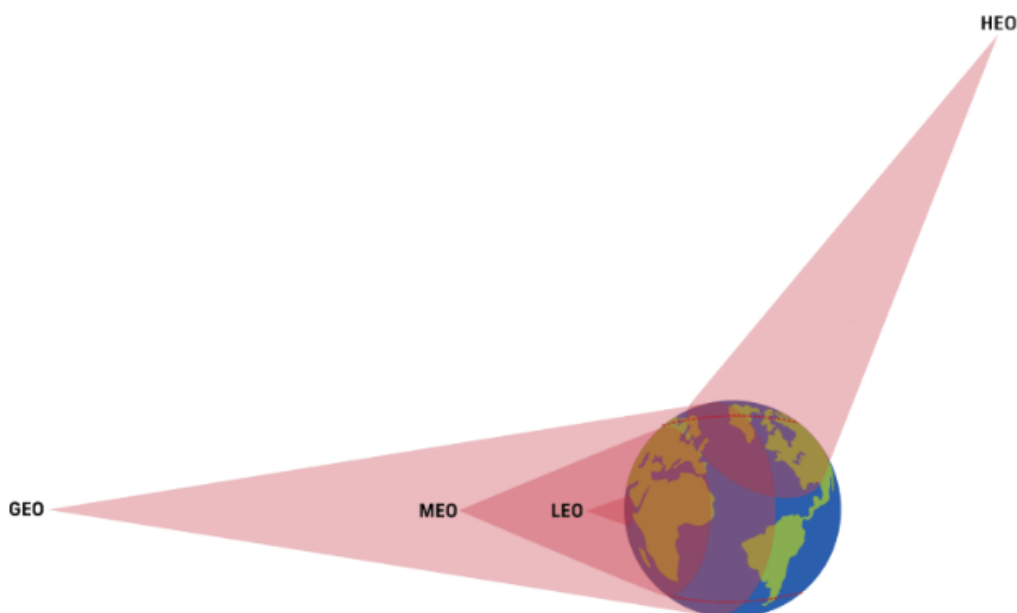
What is Satellite Based Communication?

- **About:**
  - A communications satellite is a **type of artificial satellite** placed in Earth's orbit to send and receive communication data **between a source and a destination.**
  - With over three thousand communication satellites in multiple orbits today, millions worldwide rely on satellite communications to deliver radio, television, and military applications.
  - Satellite communications have **opened access to voice and data communication services across the globe** in places where terrestrial cellular and **broadband connectivity** is not available or network coverage is patchy.
- **Types:**
  - Based on the orbit, communication satellites fall into **one of four categories:**
    - Geostationary Earth orbit (GEO)
    - Medium Earth orbit (MEO)
    - Low Earth orbit (LEO)
    - Highly elliptical orbit (HEO)

The 4 different satellite orbit paths. LEO, MEO, GEO & HEO. All providing coverage to different areas of the earth for various applications.

- **Working:**

- Satellite communications use orbiting satellites and ground stations to transmit and relay information via **microwaves** between points on Earth.
- There are **three stages in the process:**
  - Uplink
  - Transponder
  - Downlink
- For example, in live television, a broadcaster sends a signal to a satellite (uplink), which then boosts and changes the frequency of the signal (transponder), before sending it back to Earth stations (downlink).

Satellite

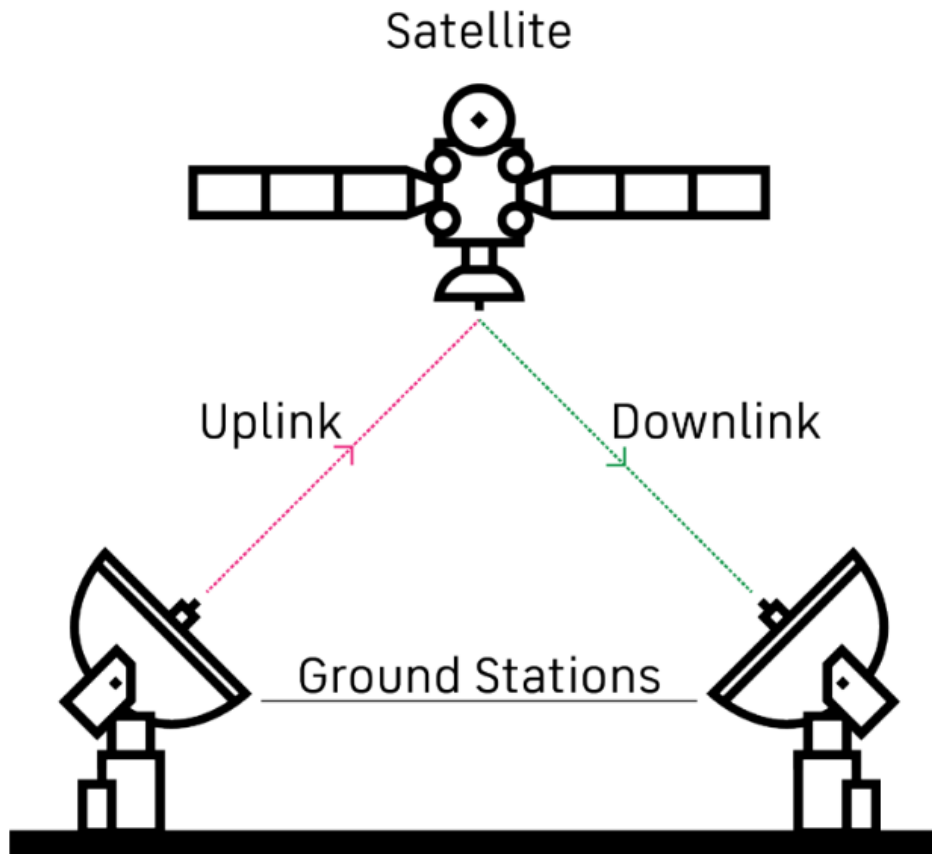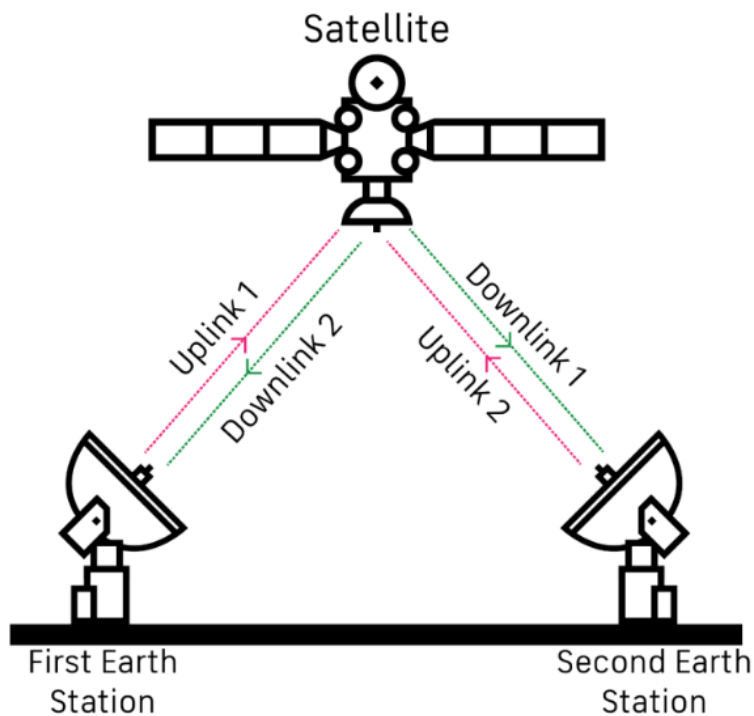Uplink   Downlink

Ground Stations

Diagram of a one way communication satellite network consisting of three stages: uplink, transponder and downlink..

TWO-WAY SATELLITE COMMUNICATIONS

Two way communication satellite network displaying information relayed between the same ground stations via the same satellite.

- **Current Status of Satcom Services in India:**
  - Even though technology is ready for India, Satcom **services are not yet operational in India** primarily due to pending allocation of satellite bandwidth by the government.
    - Recently, Reliance Industries' Jio Platforms has **received approval from India's space regulator, IN-SPACe**, to deploy satellites for gigabit fibre internet services, pending additional clearances from the telecom department to commence operations.
- **Target Audience and Services:**
  - Satcom operators plan to target both individual consumers and enterprises.
  - **Starlink is known for its consumer-focused approach** with portable routers, while **Airtel and Reliance Jio are looking at both consumer and enterprise markets.**

Modern satellites support a variety of " beam" types to allow the satellite to focus its power at various levels to locations.

| Maritime navigation signals | Navigation aids (e.g. loran-C) | AM maritime radio | Shortwave radio, radiotelephony | VHF TV FM radio, navigation aids | UHF TV cell phones, GPS | Satellite/microwave telecommunications | Radio Astronomy, radar landing systems |

| 100km | 10km | 1km | 100m | 10m | 1m | 10cm | 1cm | 1mm |

← Increasing wavelength   Increasing frequency →

| 3KHz | 30KHz | 300KHz | 3MHz | 30MHz | 300MHz | 3GHz | 30GHz | 300GHz |

SATELLITE FREQUENCY

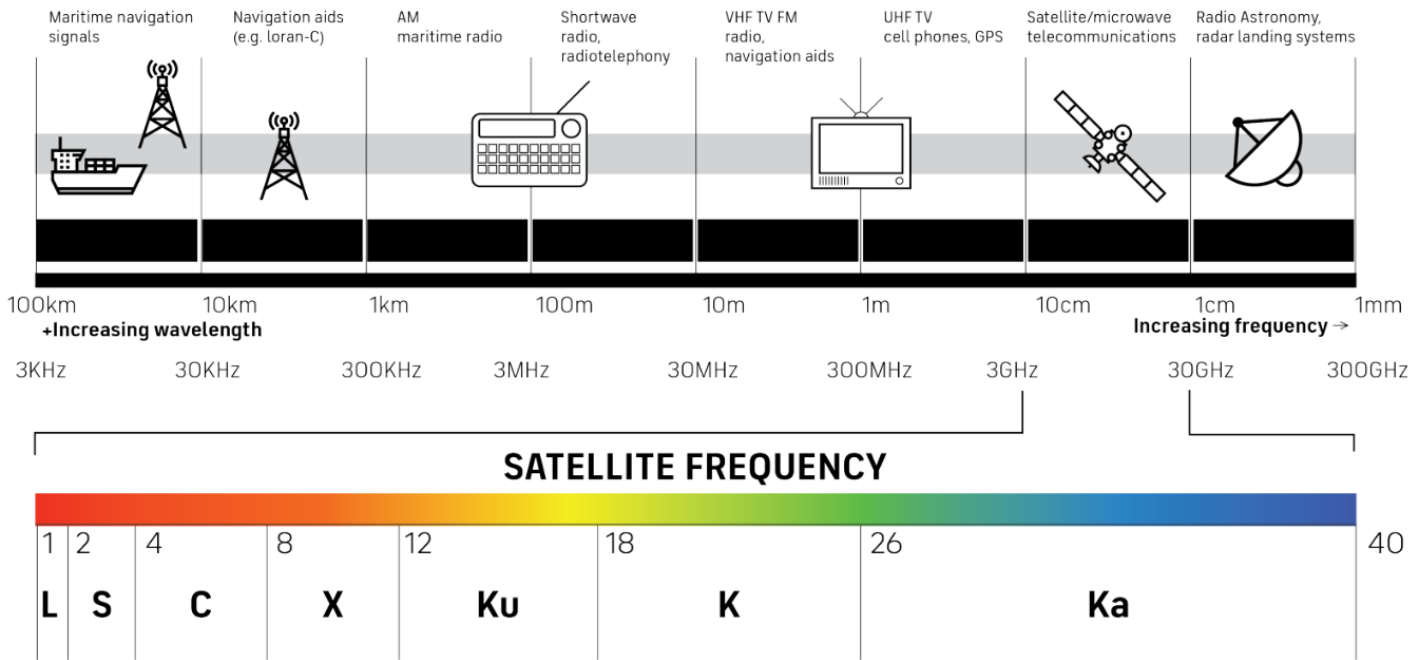| 1 | 2 | 4 | 8 | 12 | 18 | 26 | 40 |
| L | S | C | X | Ku | K | Ka |

Chart of the Radio Frequency spectrum (RF) displaying the different frequency bands and relevant applications used within satellite communication networks

- **Technological Readiness**:
    - **Device compatibility is an issue** as specialised antennas are required to receive satellite signals. This adds to the cost for consumers.
    - Moreover, **mainstream integration** of satellite receivers in consumer devices has been **limited** so far, despite efforts by companies like Apple and Qualcomm.
- **Challenges and Limitations**:
    - Satcom services face challenges such as **high setup costs**, especially for consumer applications.
    - The **cost of equipment, including specialised antennas**, remains a barrier. Pricing is another concern as satcom services are perceived as expensive compared to terrestrial broadband.
- **Future Outlook**:
    - The future of satcom in India **hinges on regulatory approvals**, technological advancements, and addressing cost concerns. The entry of new players like Project Kuiper could potentially intensify competition and innovation in the market.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. The terms 'Event Horizon', 'Singularity', 'String Theory' and 'Standard Model' are sometimes seen in the news in the context of (2017)

(a) Observation and understanding of the Universe

(b) Study of the solar and the lunar eclipses

(c) Placing satellites in the orbit of the Earth

(d) Origin and evolution of living organisms on the Earth

Ans: (a)

Genome Sequencing

Source: TH

Why in News?

Recently, a report published in the journal Nature revealed that a team of archaeologists and scientists from Germany, Mexico, Spain, the U.K. and the US has **sequenced genetic material** obtained from the **human remains found from an ancient burial place**.

What is Genome Sequencing?

- **About:**
  - **Genome sequencing** is a process of determining the complete **DNA** sequence of an organism's genome.
    - A genome is a complete set of **DNA** that contains all of the genes of an organism.
  - It involves figuring out the order of bases (**Adenine, Cytosine, Guanines, and Thymine)** that make up an organism's DNA. It is supported by automated DNA sequencing methods and computer software to assemble the massive sequence data.

Gene Editing

- Gene editing, also known as genome editing, is a technology that **allows for the precise modification** of the **genetic material (DNA or RNA)** of an organism.
- It involves the **use of specialised tools** to add, remove, or alter specific DNA sequences within a genome.
- **Methods:**

  - CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats):

    - It is the most widely used and versatile gene editing tool.
    - It uses a guide RNA (gRNA) to direct the Cas9 enzyme to the target DNA sequence,

where it can make a double-strand break. The cell's natural DNA repair mechanisms are then used to either disrupt the target gene or insert a desired DNA sequence.

- **Zinc Finger Nucleases (ZFNs):**

  - ZFNs are composed of a DNA-binding domain (zinc finger proteins) and a DNA-cleaving domain (FokI endonuclease).

  - The zinc finger proteins are designed to recognize and bind to specific DNA sequences, and the FokI domain then cleaves the DNA. ZFNs can be engineered to target and edit specific genomic regions.

- **Difference Between Gene Editing and Gene Sequencing:**

Characteristics	Gene Sequencing	Gene Editing
Definition	The process of determining the precise order of nucleotides (A, T, C, G) in a DNA or RNA molecule.	The process of making targeted modifications to the DNA sequence of a gene or genes.
Purpose	To obtain the complete or partial sequence of a gene, a set of genes, or an entire genome.	To introduce desired changes, such as correcting genetic defects, modifying gene expression, or introducing new genetic traits.
Techniques	Sanger sequencing, Next-Generation Sequencing (NGS), and others.	**CRISPR-Cas9**, zinc finger nucleases, TALENs, and other specialised tools.
Outcome	Provides information about the genetic makeup and composition of an organism.	Allows for the direct manipulation and alteration of the genetic code.
Modification	Does not directly modify the genetic material.	Enables the addition, removal, or alteration of specific DNA sequences.

- **Methods of Genome Sequencing:**

  - Clone-by-Clone Approach:

    - In this approach, the genome is first broken up into relatively large segments called clones, which are typically around 150,000 base pairs (bp) in length. Genome mapping techniques are then used to determine the location of each clone within the overall genome.

      - Next, each clone is further fragmented into smaller, overlapping pieces of around 500 bp in size, which are suitable for sequencing.
      - Finally, the individual sequenced pieces are assembled using the overlapping regions to reconstruct the complete sequence of the entire clone.

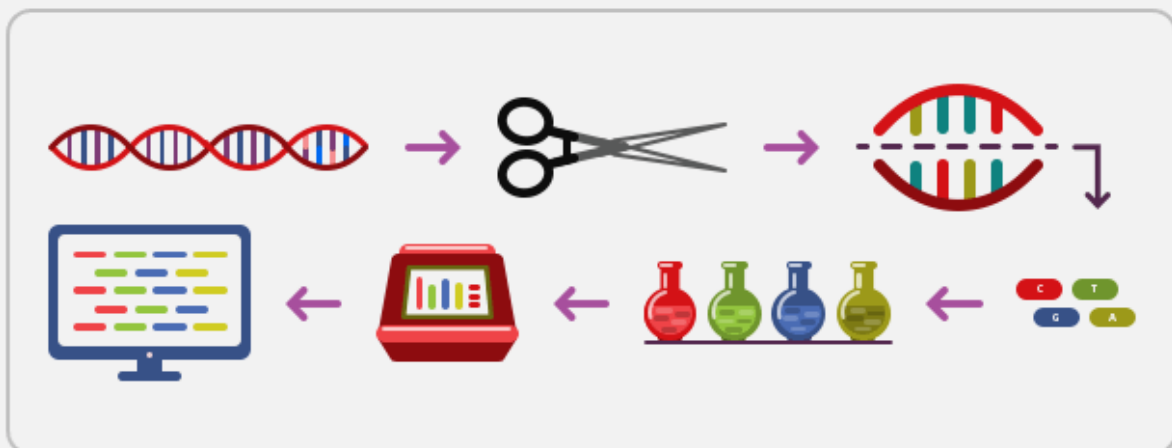 - **Whole-Genome Shotgun Approach:**

    - This method involves randomly fragmenting the entire genome into small pieces.

      - These small fragments are then **sequenced**, without any prior knowledge

of their genomic location.
- The sequenced fragments are then **computationally reassembled** into the full genome sequence by identifying and aligning the overlapping regions between the fragments.
    - The **clone-by-clone approach** is often used for **large and complex genomes**, while the **whole-genome shotgun** method is **more suitable for smaller** and less complex genomes.
- **Applications:**
    - **Finding origin of Epidemics:** Genome sequencing helps researchers understand the genetic makeup of pathogens, tracing the source and spread of outbreaks like SARS-CoV-2.
    - **Controlling Disease Spread:** Genome analysis allows monitoring pathogen evolution and identifying mutation patterns, incubation periods, and transmission rates to inform prevention strategies.
    - **Healthcare Applications: It enables personalised treatments, guides targeted public health interventions, reveals genetic underpinnings of diseases like cancer, and informs drug efficacy and safety for diverse populations.**
    - **Agricultural Advancements**: Crop genome sequencing can enhance understanding of genetic susceptibility to pests and environmental stressors.
    - **Evolutionary Studies**: Genome data can contribute to mapping species' migrations and evolution, furthering our knowledge of human origins and life's history.

GENOMIC SEQUENCING

What is Genomic Sequencing?

GENOMIC SEQUENCING

Genomic sequencing refers to methods of determining the entire DNA sequence of an organism's genome. In simpler terms, it determines the order of As, Ts, Cs and Gs that make up an organism's DNA. A genomic sequence is depicted by a very long line of these letters arranged in a specific order.

Important genome sequencing initiatives

- **Human Genome Project:**
    - The **Human Genome Project (HGP)** from **1990 to 2003**, was a landmark international effort to **map and sequence the entire human genome**.
        - It was coordinated by the US National Institute of Health (NIH) and the U.S.

Department of Energy.
- The project revolutionised medicine and advanced DNA sequencing technology.
- Developments like Her2/neu for breast cancer treatment and CYP450 for antidepressant response resulted from the project.
- **Genome India Project:**
  - It was launched in **2020** as a flagship initiative aimed at comprehensively **deciphering the genetic makeup of the Indian population**.
  - It is funded and coordinated by the Department of Biotechnology (DBT), Government of India.

- **IndiGen Project**
  - It was undertaken by CSIR in April 2019.
  - It aims to undertake whole genome sequencing of diverse ethnic groups from India.
  - The objective is to **enable genetic epidemiology** and **develop public health technologies applications** using population genome data.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q1. With reference to agriculture in India, how can the technique of 'genome sequencing', often seen in the news, be used in the immediate future? (2017)

1. Genome sequencing can be used to identify genetic markers for disease resistance and drought tolerance in various crop plants.
2. This technique helps in reducing the time required to develop new varieties of crop plants.
3. It can be used to decipher the host-pathogen relationships in crops.

Select the correct answer using the code given below:

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)