Current Affairs 04-06-2025

Credit - Drishti Ias

Money Laundering in Online Gaming

★ ★ ★ ☆ ☆

For Prelims: Real money gaming , Games of skill , Goods and Services Tax , Mule bank accounts , Reserve Bank of India

For Mains: Money Laundering and the Prevention of Money Laundering Act, Regulation of Digital Platforms and Online Gaming in India

Source:BL

Why in News?

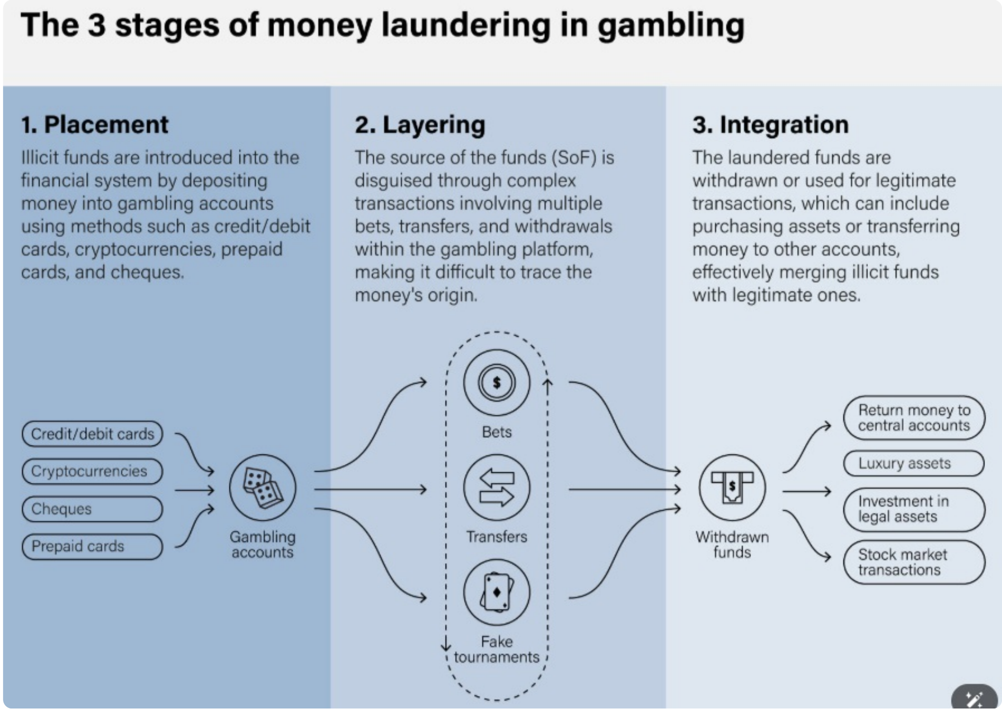
In a move to ensure financial integrity and protect users, India is planning to bring online **real money gaming (RMG)** under the ambit of the **Prevention of Money Laundering Act, 2002 (PMLA).**

What is the Landscape of Online Real Money Gaming in India?

- **Definition:** RMG platforms allow users to stake real money for potential winnings in games like fantasy sports, poker, and skill-based contests.
- **Market Momentum:** India became the **world's largest gaming market** in 2023 with 568 million gamers and 9.5 billion app downloads. The market was valued at **USD 2.2 billion in 2023, projected to reach USD 8.6 billion by 2028.**
- **Key Growth Drivers: Cheap internet data** and increasing **smartphone penetration** have made online gaming more accessible, especially to India's large and young population.
  - The **rise of digital payments** has made transactions seamless, while domestic gaming studios have flourished with technological advancements.
  - Due to **high unemployment and limited earning opportunities,** many seek quick money, making betting apps highly attractive.
  - Additionally, **popular sporting tournaments** like the **Indian Premier League** , combined with **celebrity promotions,** lure gullible youth into these platforms. **Poor digital literacy** (only **38% of households in India are digitally literate**) further increases their vulnerability.
- **Regulation:** In India, **State legislatures** have the exclusive authority to make laws on gaming, betting, and gambling under **Entry 34 of the List II (State List) of the Seventh Schedule of the Indian Constitution** .
  - At the national level, the **Public Gambling Act, 1867 exempts skill-based games** from penalties, while the Prize Competitions Act, 1955 regulates prize-based competitions.
  - The **Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Amendment Rules, 2023** introduced definitions for key terms such as online game, online gaming intermediary, online real-money games (RMG), permissible games, and self-regulatory bodies, aiming to bring more structure to the rapidly evolving digital gaming landscape.
  - In India, foreign investment and technology collaboration are **completely banned** in the lottery, gambling, and

betting sectors.

- **Taxation:** A **28% Goods and Services Tax (GST)** is levied on legal RMG firms, Under the Income Tax Act, 1961, winnings above Rs 10,000 from lotteries, card games, or any game (including skill-based games) are taxed at 30% (excluding surcharge and cess).
- **Money Laundering Mechanism in RMG:** The money laundering process in online gaming typically unfolds in three stages.
  - The first stage, **Placement** , involves **injecting illicit funds** into the gaming ecosystem through deposits or virtual credit purchases.
  - This is followed by **Layering** , where the origins of the funds are obscured using in-game transfers, currency conversions, and a series of complex transactions.
  - Finally, in the **Integration stage,** the "cleaned" money is withdrawn as **legitimate earnings,** such as winnings or refunds, often through cryptocurrency channels or cross-border payment systems.



The 3 stages of money laundering in gambling

1. Placement

Illicit funds are introduced into the financial system by depositing money into gambling accounts using methods such as credit/debit cards, cryptocurrencies, prepaid cards, and cheques.

2. Layering

The source of the funds (SoF) is disguised through complex transactions involving multiple bets, transfers, and withdrawals within the gambling platform, making it difficult to trace the money's origin.

3. Integration

The laundered funds are withdrawn or used for legitimate transactions, which can include purchasing assets or transferring money to other accounts, effectively merging illicit funds with legitimate ones.

Why is Regulation of Online Gaming Under PMLA Necessary?

- **Current Regulatory Gaps:** India's **Public Gambling Act (1867)** bans public gambling but **exempts games of skill.**
  - States regulate betting and gambling **differently,** resulting in a fragmented legal environment that illicit operators exploit.
  - Illegal offshore operators exploit India's regulatory gaps, evading taxes and perpetrating large-scale fraud by siphoning user funds abroad. Cases like **Mahadev app (Rs 6,000 crore suspected proceeds) and Fiewin (Rs 400 crore fraud)** exemplify the scale of illicit operations.
    - Unscrupulous operators use **shell companies, crypto wallets, and digital channels** to launder illicit money.
  - This complex scenario highlights the **need to bring online gaming under the stringent regulatory ambit of the PMLA to curb financial crimes** and enhance oversight.
- **Strengthening Accountability:** The 2023 PMLA rules extended regulatory oversight to **virtual asset service providers,** enabling the **Financial Intelligence Unit-India (FIU)** to better monitor and penalize violations.
  - By integrating virtual assets in online RMG under this framework helps to maintain transaction records and report suspicious activities, further enhancing **accountability in the gaming ecosystem.**
- **Terror Financing:** Online RMG poses a serious threat of **terror financing** due to its **anonymous and borderless nature.** Terror operatives may exploit gameplay as a covert channel to communicate and facilitate illicit transactions within the RMG ecosystem.
  - By integrating RMG under PMLA, it can be effectively secured and monitored by national security authorities.

- **Cyber Security:** India's cybersecurity infrastructure **remains inadequate** to fully safeguard emerging digital platforms, including online gaming.
    - Online gaming platforms can be exploited to **deploy trojans or malware,** potentially compromising users' bank accounts and causing financial losses.
    - Integrating under the PMLA will enhance regulatory oversight and reduce risks of cyber fraud and bank-related losses.

What are the Challenges in Enforcing Anti-Money Laundering Regulations on Online Gaming Platforms?

- **Use of Mule Accounts and Proxy Payment Channels:** Illicit gaming platforms frequently use **"mule" bank accounts** or third-party wallets to route payments.
    - These accounts are often registered in the **name of unrelated individuals or shell entities** , obscuring the transaction's origin and purpose.
    - Online gaming platforms process thousands of **micro-transactions every minute** , making it difficult to detect suspicious patterns in real time. Automated systems must be **exceptionally robust to flag illicit activity** without disrupting legitimate gameplay.
- **Misuse of In-Game Purchases and Digital Wallets:** Players can convert **real money into in-game assets or digital currencies ,** which can be exchanged, gifted, or withdrawn as real money often without traceability.
    - **Multiple funding methods** (**Unified Payments Interface** , cards, wallets, crypto, etc.) create unstructured inflow and outflow patterns that are hard to monitor comprehensively. Integration with banking systems for AML checks remains inadequate or inconsistent.
- **Cross-Border and Jurisdictional Issues:** Gaming platforms may be registered in **foreign countries,** making coordination between regulatory authorities across borders difficult.
    - Different jurisdictions have varying AML laws, complicating enforcement and compliance monitoring.
    - Offshore sites like **1xBet frequently change domains and bank partners** , making enforcement and prosecution highly complex.
- **Difficulty in Proving Intent:** Distinguishing between **high-stakes gaming and deliberate money laundering** can be difficult.
    - Players might claim high volumes or rapid transactions are part of legitimate gameplay.
- **Evolving Fraud Techniques:** Money launderers are constantly adapting, exploiting loopholes like **refund abuse, referral bonuses, or dummy gameplay** to clean money.
    - Keeping up with new typologies of laundering requires constant regulatory and technological upgrades.
- **Ineffective Penalties and Enforcement:** The absence of a **central gaming regulator in India** creates a fragmented enforcement environment. With multiple agencies (ED, MHA, RBI, MeitY) sharing partial responsibilities, regulatory overlaps and gaps hinder timely and coordinated AML enforcement.
    - Even after failing AML checks, major **gambling firms often treat fines as routine costs, not deterrents** , leading to repeated violations.

How can India Balance Regulatory Rigor with User Convenience in Online Gaming?

- **Tiered KYC Approach:** Implement **graduated KYC based on user activity** and transaction volume—light verification (e.g., OTP on mobile number) at onboarding, with full KYC triggered after a threshold.
    - This approach aligns with established regulatory precedents in India. For instance, the **Reserve Bank of India (RBI)** allows OTP-based onboarding for prepaid payment instruments with balances up to ₹10,000, enabling simplified access for low-risk users.
- **Adopt a Tiered Regulation Model:** Differentiate between **casual games, competitive skill-based games, and real-money games.**
    - Impose proportionate regulations based on the level of risk involved akin to the UK's Gambling Commission framework.

- **Algorithmic Accountability as Law:** Gaming platforms must submit to **algorithm audits and dark pattern bans** (e.g., loot boxes, psychological nudging), as seen in **EU's Digital Services Act.**
    - India should mandate a **"Gaming Code of Ethics"** tied to platform licences under the upcoming **Digital India Act.**
- **Focus on Intelligence-Led Enforcement:** Prioritize resources on high-risk **operators and suspicious activities** rather than blanket measures to avoid alienating legitimate users and platforms.
- **Consumer Protection and Cybersecurity:** Regulations should also mandate safeguards against data theft, online abuse, and protection of minors.
- **Addressing Safe Havens for Gaming Companies:** Countries like the **United Arab Emirates** act as **safe havens** for online gaming firms, posing challenges for regulation and enforcement.
    - Strengthening diplomacy and **signing extradition treaties** with countries hosting gaming firms will ensure accountability and improve cross-border transaction monitoring.
- **Responsible Promotion and Celebrity Endorsements:** Encourage responsible marketing by **promoting only legitimate gaming apps** and ensuring celebrity endorsements adhere to the **Gaming Industry's Code of Ethics.**

What is the Code of Ethics Adopted by the Gaming Industry?

Click here to Read: Decoding Online Gaming Ethics

Conclusion

A robust yet balanced regulatory framework is essential to **curb financial crimes in online gaming without stifling innovation.** Integrating PMLA with tech-driven, risk-based regulation can **ensure user safety and financial integrity.** India must act decisively to make its digital gaming ecosystem **both secure and globally competitive.**

Drishti Mains Question:

With the rapid rise of the digital gaming industry in India, what steps can be taken to ensure a balance between user convenience, innovation, and financial integrity?

[Watch Video on YouTube: ▶ **https://www.youtube.com/embed/Npg-nkWOsNQ**]

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. Which of the following is/are the aim/aims of “Digital India” Plan of the Government of India? (2018)

1. Formation of India’s own Internet companies like China did.
2. Establish a policy framework to encourage overseas multinational corporations that collect
3. Big Data to build their large data centres within our national geographical boundaries.
4. Connect many of our villages to the Internet and bring Wi-Fi to many of our schools, public places and major tourist centres.

Select the correct answer using the code given below:

(a) 1 and 2 only

(b) 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

Ans: (b)

Mains

Q. Discuss how emerging technologies and globalisation contribute to money laundering. Elaborate measures to tackle the problem of money laundering both at national and international levels. **(2021)**

IoT Revolution and Smart Future

★ ★ ★ ☆ ☆

For Prelims : **Internet of Things (IoT)** , **Wi-Fi** , **Bluetooth** , **5G** , **APIs (Application Programming Interfaces)** , **Smart Cities** , **Edge Computing** , **AI, ML** , **Deepfake** , **Public Key Infrastructure (PKI)** , **National Cybersecurity Strategy, 2020** .

For Mains : Role of Internet of Things (IoT) in daily life, its features and challenges associated with it, Measures to strengthen IoT ecosystem.

Source: FE

Why in News?

The **Internet of Things (IoT)** has become a **transformative force** , infusing intelligence into everyday things around us, thereby profoundly **impacting our daily lives** . From **smart refrigerators** that monitor **food freshness** to **security systems** that provide **real-time alerts** , IoT is making our homes **more intuitive, efficient, and secure** .

What is the Internet of Things (IoT)?

- **About:** The Internet of Things (IoT) refers to a **network of physical devices** —embedded with **sensors, software, and connectivity** —that **collect, exchange, and act** on data.
  - These smart devices range from everyday household objects (like **refrigerators and thermostats**) to **industrial machines, vehicles, and wearable technology** .
- **Key Features of IoT:**
  - **Connectivity:** It enables **device communication** over networks (**Wi-Fi** , **Bluetooth** , **5G**), working with both **wired** and **wireless connections.**
  - **Automation & Intelligence: Devices** make decisions **autonomously** , such as **self-driving cars** responding to traffic.
  - **Remote Monitoring:** Users can **remotely access** and **manage devices** , such as viewing **home security cameras** on **smartphones** .
  - **Interoperability:** Different devices work together using **standardized protocols** , **compatible software** , and **open APIs (Application Programming Interfaces)** for integration.
  - **Scalability: Systems grow** by adding **devices** like **smart cities** adding **sensors** and **factories** connecting **machines.**
  - **Data Analytics & AI Integration:** It transforms raw data into actionable insights e.g., **traffic analysis** in smart cities.
  - **Customization & Personalization:** It adapts to user preferences e.g., **smart homes** , **wearable health devices** , and **personalized retail.**
- **Major Components of IoT:**
  - **Sensors & Actuators (The Physical Layer):** These are the **eyes and hands** of IoT, interacting with the real world.
    - **Sensors detect changes** in the environment (temperature, motion, light, humidity, etc.) e.g., Temperature sensors in **smart thermostats** .
    - **Actuators perform actions** based on sensor data e.g., **Smart locks** that open via an **app** .
  - **Connectivity (Network Layer):** IoT devices rely on various communication protocols to **send and receive data** , chosen based on their power, range, and bandwidth requirements. E..g,
    - **Bluetooth** (Short-range) for smart homes and **wearable devices**
    - **Wi-Fi** (Medium-range) for **smart building** applications
    - **Cellular** (4G/5G) (Long-range) for **smart cities** , agriculture, and logistics solutions.
  - **IoT Gateways (Bridge Between Devices & Cloud):** They serve as **intermediaries between local devices and cloud servers** , performing **data preprocessing** to reduce cloud load and **enhancing security** by encrypting data before transmission.
    - E.g., **Edge computing processes** data locally to reduce latency.
  - **Cloud Computing & Data Processing (Brain of IoT): Raw sensor data** is sent to the **cloud** , where platforms like **Google Cloud IoT** handle **data storage** and **AI/ML algorithms** analyze it to enable insights like **predictive maintenance.**
    - E.g., A **smart farming** system collects soil moisture data → Cloud AI analyzes it → Sends irrigation commands to actuators.
  - **User Interface (Human Interaction with IoT):** Users control and monitor IoT systems through various interfaces, including **mobile apps** like **voice assistants** for hands-free commands, and **automated alerts** such as notifications about low fridge supplies

What are the Key Applications of the Internet of Things?

- **Smart Cities:** IoT sensors optimize **traffic management** by reducing congestion and accidents, while **smart streetlights** adjust brightness based on movement to save energy and enhance safety.
    - Additionally, **smart bins** alert authorities for timely waste collection, and **disaster monitoring sensors** provide early warnings for **floods and earthquakes .**
    - E.g., The city of **Jaipur** has launched the **"Jaipur Smart City" project** , featuring **smart lighting systems** and **intelligent traffic management solutions.**
- **Smart Homes: Automated lighting and appliances** , such as **smart thermostats** and **lighting systems** , adjust based on usage to **save energy** , while **IoT-enabled security devices** —including **cameras** , **door locks** , and **motion sensors** —offer **real-time alerts** and **remote monitoring** .
    - E.g., **Google's Nest Thermostat** uses **AI** , **sensors** , and **machine learning** to optimize **home heating and cooling** for **energy efficiency** , **cost savings** , and **convenience.**
- **Healthcare: Remote patient monitoring** uses IoT-enabled medical devices (glucose monitors) to send real-time data to doctors, and **emergency alert systems** notify services if a patient is in distress.
    - **Wearable devices** like **smartwatches (e.g., Apple Watch)** monitor **heart rate** , and sleep cycle.
- **Smarter Transportation: Fleet tracking** helps logistics companies monitor vehicle health, fuel use, and driver behavior, while **smart parking sensors** guide drivers to open spots, easing congestion.
    - **Connected vehicles** use IoT to predict **maintenance, prevent collisions,** and support **self-driving** features.
    - E.g., **Tesla's Autopilot** is an **advanced driver-assistance system** (**ADAS)** that uses **AI** , **cameras** , **radar** , and **sensors** to automate driving tasks like **adaptive cruise control** , **lane-keeping** , and **self-parking** , enhancing **safety** and **convenience.**
- **Industrial & Workplace Safety:** Factories use IoT for **predictive maintenance** , monitor hazards like **gas leaks** and **extreme temperatures** to ensure **worker safety** , and track assets in real time to reduce theft and loss.
    - E.g., **Siemens IoT-enabled fire safety systems** improve **fire prevention, detection, and emergency response** in **buildings and critical infrastructure.**
- **Agriculture & Food Safety: Precision farming** uses IoT sensors to monitor **soil moisture, weather, and crop health** , optimizing water and pesticide use, while **livestock monitoring** tracks animal health and location with IoT tags.
    - Additionally, **food supply chain** sensors maintain safe storage temperatures during transport to reduce spoilage.
    - E.g., **Fyllo** empowers farmers with **IoT** and **data-driven precision agriculture** to improve **crop quality** , boost **yield** , and reduce **production costs** .

What are Risks and Challenges in the Internet of Things?

- **Cybersecurity Vulnerabilities:** Many IoT devices use **weak default passwords** , making them vulnerable to **botnet attacks** , like the **Mirai botnet** that hit major websites in **2016** and resurfaced in **2025** .
    - Additionally, **insecure APIs** can expose IoT ecosystems to hackers by allowing **unauthorized access** or **data interception.**
    - E.g., **Amazon Ring** , a popular **smart doorbell** , faced criticism for **security flaws** in its API.
- **Unauthorized Access:** IoT devices collect vast **sensitive data** , raising **privacy concerns** like **eavesdropping** (secretly listening to private conversations) through hacked **smart speakers or cameras** , and **data leaks** from **unencrypted transmissions** exposing personal or corporate information.
- **Lack of Standardization and Interoperability:** IoT ecosystems face **fragmentation** due to **diverse communication protocols** (e.g., Zigbee, LoRaWAN, cellular) and **proprietary ecosystems** , leading to **compatibility issues** and limited **scalability.**
    - **Amazon Alexa** and **Google Assistant** often struggle to integrate with **ZigBee** or **Z-Wave** devices, hindering seamless operation in **multi-brand smart home ecosystems.**
- **Scalability and Infrastructure Demands:** Managing billions of IoT devices causes **data overload** —with 73 **zettabytes/year** generated—requiring **advanced cloud/edge computing** , while **energy consumption** remains a challenge for **battery-powered sensors** in remote areas.
- **AI-Powered Cyber Threats:** Attackers now use **AI to exploit IoT vulnerabilities** like **deepfake attacks** manipulating sensor data to cause **false alarms** or **system failures.**

What are Indian Government Initiatives Related to IoT?

- **Draft IoT Policy (2015)**
- **Digital Personal Data Protection (DPDP) Act, 2023**
- **5G Rollout**
- **BharatNet**
- **Future Skills Prime**

What Measures can be Adopted to Strengthen IOT Ecosystem?

- **Enhance IoT Security Measures:** Enforce **Multi-Factor Authentication (MFA)** and **Public Key Infrastructure (PKI)** for device verification, and automate **regular firmware updates** to avoid disruptions.
  - Implement **network segmentation** and **Zero Trust Architecture** to isolate IoT devices, and deploy **AI-powered behavioral analytics** for threat detection and anomaly monitoring.
- **Improve Interoperability & Standardization: Universal IoT standards** are crucial for device **compatibility and scalability** .
  - Industry consortia and standardization bodies like **Organizations like Open Connectivity Foundation (OCF)** must collaborate to create **global protocols** enabling seamless **cross-platform communication** .
- **Strengthen Compliance Frameworks:** Governments should enforce **comprehensive data protection laws** that require **IoT device manufacturers** to **secure personal data** from collection to storage and transmission.
  - Regulations such as the **General Data Protection Regulation (GDPR)** in the **EU** and **similar frameworks in other regions** should be strictly enforced.
  - India's **Digital Personal Data Protection Act, 2023** is a significant step in the **right direction** .
- **Building Robust Infrastructure: Robust infrastructure** is vital for scaling IoT solutions. **5G networks** offer the **bandwidth** and **low latency** needed for real-time applications like **autonomous vehicles** . **Edge-enabled data centers** handle massive IoT data streams, while **smart grids** optimize energy and device management in **smart cities** .

Conclusion

IoT is revolutionizing **daily life** and **industries** through **smart connectivity** , but faces challenges like **cybersecurity risks** and **interoperability issues** . Strengthening **security frameworks** , **standardizing protocols** , and leveraging government initiatives like **India's DPDP Act** and **5G rollout** are pivotal to harnessing IoT's full potential while ensuring a **secure** and **scalable ecosystem** .

Drishti Mains Question

The Internet of Things (IoT) promises transformative benefits but poses significant security and privacy challenges." Discuss these challenges and suggest measures to strengthen India's IoT ecosystem.

[Watch Video on YouTube: ▶ **https://www.youtube.com/embed/g0U1Wl0VhoI**]

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. With the present state of development, Artificial Intelligence can effectively do which of the following? (2020)

1. Bring down electricity consumption in industrial units
2. Create meaningful short stories and songs
3. Disease diagnosis
4. Text-to-Speech Conversion
5. Wireless transmission of electrical energy

Select the correct answer using the code given below:

(A) 1, 2, 3 and 5 only

(B) 1, 3 and 4 only

(C) 2, 4 and 5 only

(D) 1, 2, 3, 4 and 5

Ans: (B)

Q. With reference to “Blockchain Technology”, consider the following statements: (2020)

1. It is a public ledger that everyone can inspect, but which no single user controls.
2. The structure and design of blockchain is such that all the data in it are about cryptocurrency only.
3. Applications that depend on basic features of blockchain can be developed without anybody’s permission.

Which of the statements given above is/are correct?

(A) 1 only

(B) 1 and 2 only

(C) 2 only

(D) 1 and 3 only

Ans: (D)

Mains

Q. “The emergence of the Fourth Industrial Revolution (Digital Revolution) has initiated e-Governance as an integral part of government”. Discuss. (2020)

Q. Implementation of Information and Communication Technology (ICT) based Projects/Programmes usually suffers in terms of certain vital factors. Identify these factors, and suggest measures for their effective implementation. (2019)

Building-Integrated Photovoltaics

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Source: TH

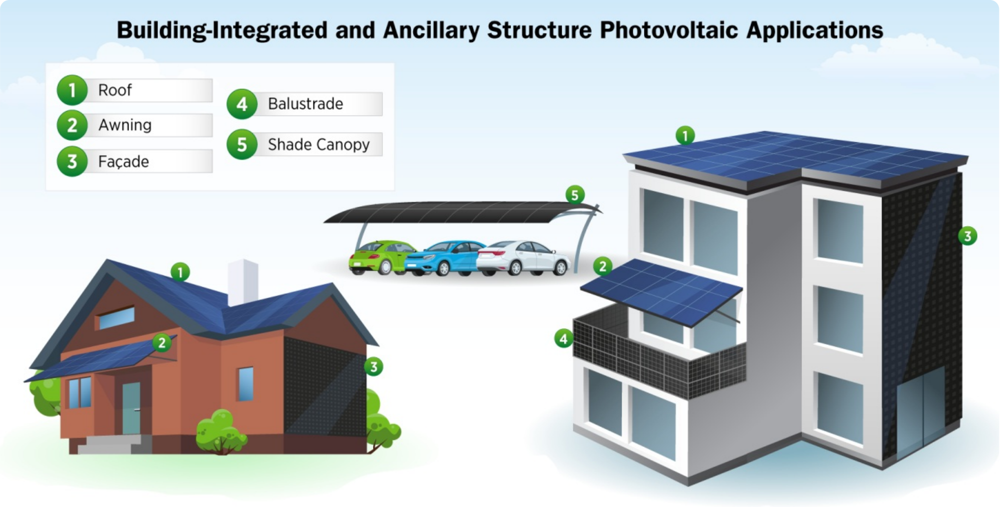
Why in News?

As India's cities grow vertically and space for conventional **rooftop solar panels** becomes limited, experts are turning to **Building-Integrated Photovoltaics (BIPV)** as a scalable, land-neutral alternative.

- According to the **World Bank,** 70% of the urban infrastructure needed for India to become a developed country by 2047 is yet to be built. Integrating BIPV from the design stage can fast-track clean energy goals.

What is Building-Integrated Photovoltaics?

- **About:** BIPV incorporates solar energy-generating components **(photovoltaic (PV) cells)** directly into a building's structure such as façades, roofs, windows, and railings, replacing conventional materials like tiles, glass, or cladding.
    - Unlike **traditional rooftop solar (RTS) systems** that sit atop buildings, BIPV becomes part of the building's design.
    - BIPV modules generate electricity while meeting the building's structural and aesthetic needs.
- **Need of BIPV in India: Rooftop solar systems** need ~300 sq. ft for 3 kilowatt (kW), but many urban homes and high-rises lack shadow-free rooftops.
    - For instance, a 16-storey building may only support ~40 kWp via RTS, whereas a **BIPV-integrated façade could generate up to 150 kWp.**
        - With the urban population projected to reach 850 million by 2051, energy demand in cities is set to soar, but RTS alone cannot bridge the gap.
    - Due to space limitations, implementation delays, and low awareness, India missed its **2022 target of 40 GW RTS under the 100 GW solar goal,** now extended to 2026. BIPV can help bridge this gap while supporting ecological sustainability.
    - India can't rely solely on **ground-mounted and rooftop systems** to meet its goal to install **300 GW of solar capacity by 2030.** Land-neutral solutions like BIPV need to be prioritised.
- **Status of BIPVs in India:** Falling **solar costs and rising demand** for sustainable architecture are driving BIPV adoption in India.
    - Notable installations include an 863-kWp system at **CtrlS Datacenters in Navi Mumbai,** a **solar dome at the Renewable Energy Museum in Kolkata,** and large **BIPV setups at Vijayawada and Sahibabad railway stations** highlighting BIPV's scalability across **public and commercial spaces.**
- **Barriers to Scaling BIPV in India:** The **high upfront investment** required for BIPV installations remains a significant hurdle, limiting widespread adoption.
    - Absence of **dedicated policies and insufficient financial incentives** discourage builders and developers from integrating BIPV early in building designs.
    - Limited expertise in BIPV and reliance on imported technology hinder local manufacturing and deployment.
    - Many stakeholders, including architects, planners, and consumers, lack awareness of BIPV benefits and applications.


Building-Integrated and Ancillary Structure Photovoltaic Applications
1 Roof
2 Awning
3 Façade
4 Balustrade
5 Shade Canopy
1
2
3
4
5

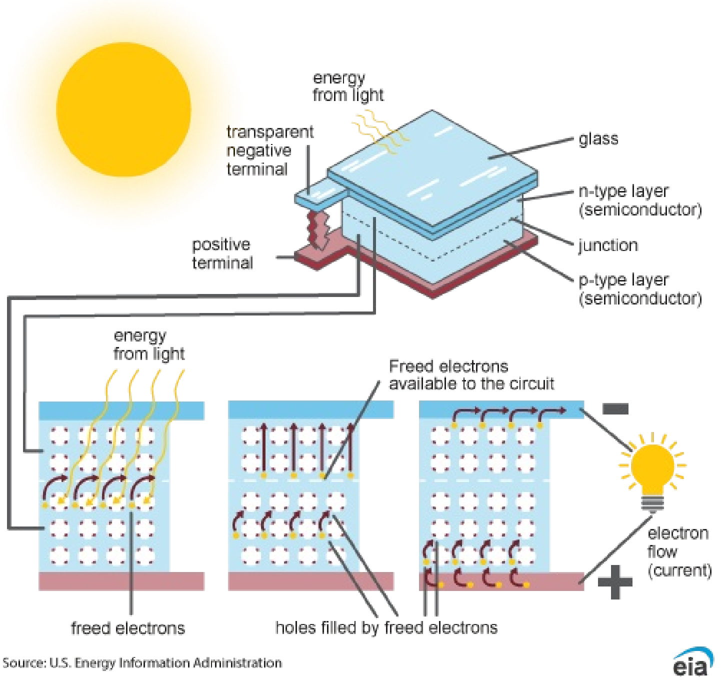
Building-Integrated Photovoltaics and Traditional Rooftop Solar

Feature	BIPV	RTS
Integration	Integrated into building design	Installed on top of the roof
Functionality	Dual-purpose (building material + power)	Solely for energy generation
Installation	Complex, part of building design	Easier, retrofit to existing buildings
Cost	Higher due to integration	Relatively lower
Maintenance	Complex and expensive	Relatively low-cost

What is Solar Photovoltaics?

- **About: Solar PV (Photovoltaic)** refers to a technology that converts sunlight directly into electricity using photovoltaic cells made from semiconductor materials.
  - When **sunlight (photons) hits a PV cell,** it excites electrons in the material, generating a flow of direct current (DC) electricity.
  - Devices called inverters are used to convert this DC electricity into alternating current (AC) for use in homes and the power grid.

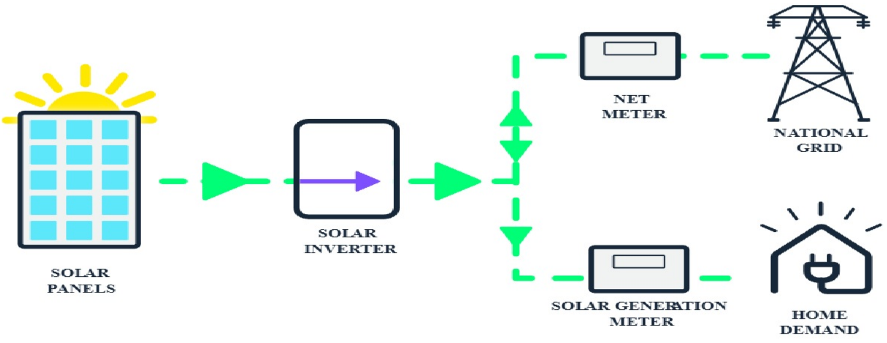
Inside a photovoltaic cell


energy from light
transparent negative terminal
glass
n-type layer (semiconductor)
junction
positive terminal
p-type layer (semiconductor)
energy from light
Freed electrons available to the circuit
electron flow (current)
freed electrons
holes filled by freed electrons
eia

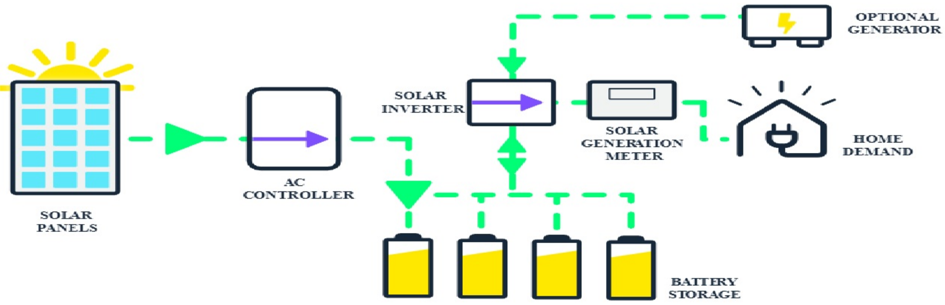
Source: U.S. Energy Information Administration

- **Key Materials Used in PV Cells:** PV cells primarily use semiconductors such as **silicon, cadmium telluride, and perovskite** to convert sunlight into electricity
  - Conductive materials like **silver and copper** enable the flow of electricity, while glass provides structural support and encapsulation.
  - Encapsulants like **EVA (Ethylene Vinyl Acetate)** and backsheets such as **TPT (Tedlar Polyester Tedlar)** protect the cells from moisture, dust, and physical damage, ensuring durability and efficiency.
- **Types of Solar PV Systems:**
  - **On-Grid Solar System:** Connects directly to the national grid without battery storage. It powers home and exports excess energy back to the grid, reducing bills and carbon footprint.
    - However, it stops working during grid outages but can be upgraded to a hybrid system by adding batteries.
  - **Off-Grid Solar System:** Fully **independent from the grid** , ideal for remote locations or energy self-sufficiency. Includes batteries and often backup generators to ensure continuous power.
  - **Hybrid Solar System:** Combines solar panels with battery storage while remaining grid-connected.
    - It stores excess energy for use during the outages, offering backup power and flexibility.

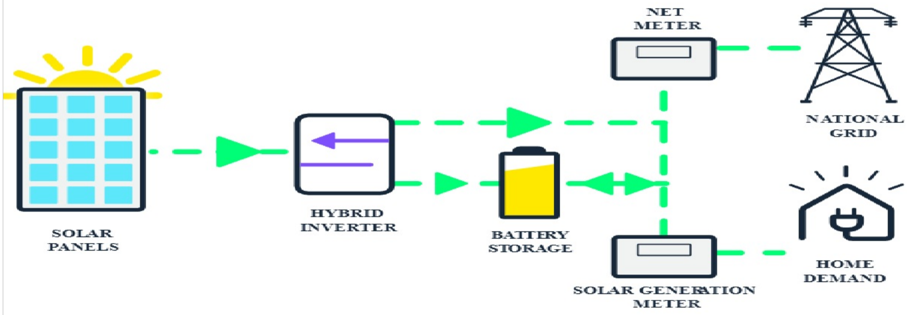
ON-GRID SOLAR SYSTEM



OFF-GRID SOLAR SYSTEM



HYBRID SOLAR SYSTEM



UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following statements about PM Surya Ghar Muft Bijli Yojana: (2025)

1. It targets installation of one crore solar rooftop panels in the residential sector.
2. The Ministry of New and Renewable Energy aims to impart training on installation, operation, maintenance and repairs of solar_rooftop systems at grassroot levels.
3. III. It aims to create more than three lakhs skilled manpower through fresh skilling, and upskilling, under scheme component of capacity building.

Which of the statements given above are correct?

(a) I and II only

(b) I and III only

(c) II and III only

(d) I, II and III

Ans: (d)

Mains

Q . India has immense potential for solar energy though there are regional variations in its developments. Elaborate. **(2020)**

Trojan Horse Styled Drone Attack

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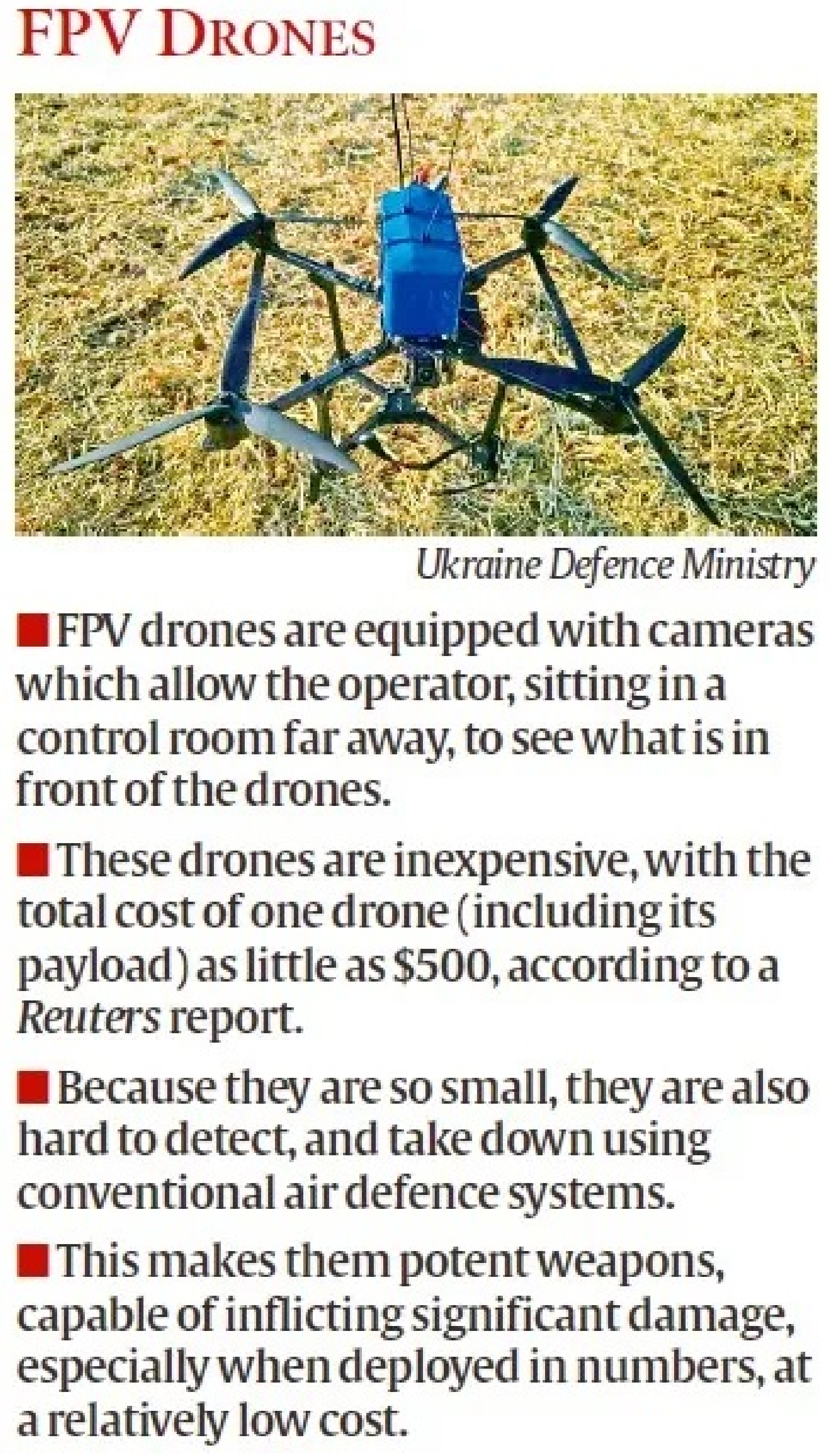
Source: IE

Ukraine launched a covert **Trojan Horse-** styled **drone strike targeting Russia air bases** using **FPV (First Person View) drones** hidden in **mobile wooden cabins** transported by trucks.

- FPV drones are **remotely operated** **unmanned aerial vehicles (UAVs)** equipped with a front-facing camera that transmits **live video feed** to the operator, giving a “pilot’s-eye view.”



FPV DRONES

Ukraine Defence Ministry

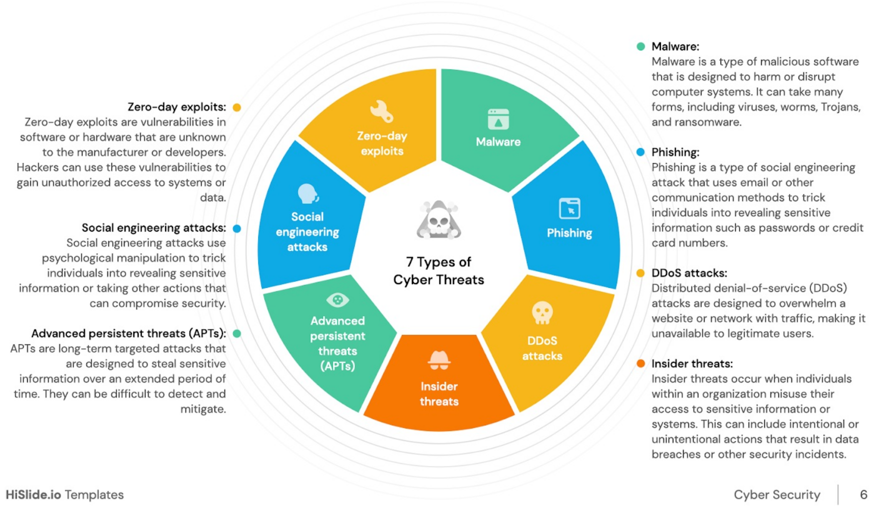
- FPV drones are equipped with cameras which allow the operator, sitting in a control room far away, to see what is in front of the drones.
- These drones are inexpensive, with the total cost of one drone (including its payload) as little as $500, according to a *Reuters* report.
- Because they are so small, they are also hard to detect, and take down using conventional air defence systems.
- This makes them potent weapons, capable of inflicting significant damage, especially when deployed in numbers, at a relatively low cost.

Trojan Horse

- The term **Trojan Horse** has significance both in **mythology (Greek) and cybersecurity.**
  - In mythology, **it represents deception— a concealed threat presented as a gift.**
  - In **cybersecurity** , a **Trojan Horse (or Trojan)** is a type of **malware** that **appears legitimate but secretly provides unauthorized access** to systems once installed.
    - It often uses **social engineering** to trick users into downloading or opening it, mirroring the ancient tale’s deceptive tactic.
- In **military and geopolitics** , a **Trojan Horse** refers to **covert tactics,** where **weapons, agents, or technology are concealed** within harmless-looking objects to **infiltrate or harm an enemy.**

Cyberattack

- **About:** A **cyberattack** is a **malicious and deliberate attempt** by an individual or organization to **breach the information system** of another individual or organization.
- **Types:**



Zero-day exploits: Zero-day exploits are vulnerabilities in software or hardware that are unknown to the manufacturer or developers. Hackers can use these vulnerabilities to gain unauthorized access to systems or data.

Social engineering attacks: Social engineering attacks use psychological manipulation to trick individuals into revealing sensitive information or taking other actions that can compromise security.

Advanced persistent threats (APTs): APTs are long-term targeted attacks that are designed to steal sensitive information over an extended period of time. They can be difficult to detect and mitigate.

Malware: Malware is a type of malicious software that is designed to harm or disrupt computer systems. It can take many forms, including viruses, worms, Trojans, and ransomware.

Phishing: Phishing is a type of social engineering attack that uses email or other communication methods to trick individuals into revealing sensitive information such as passwords or credit card numbers.

DDoS attacks: Distributed denial-of-service (DDoS) attacks are designed to overwhelm a website or network with traffic, making it unavailable to legitimate users.

Insider threats: Insider threats occur when individuals within an organization misuse their access to sensitive information or systems. This can include intentional or unintentional actions that result in data breaches or other security incidents.

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Cyber Security | 6

Read More: Cyber Fraud , UAVs in Modern Warfare

Miniratna Status to 3 DPSUs

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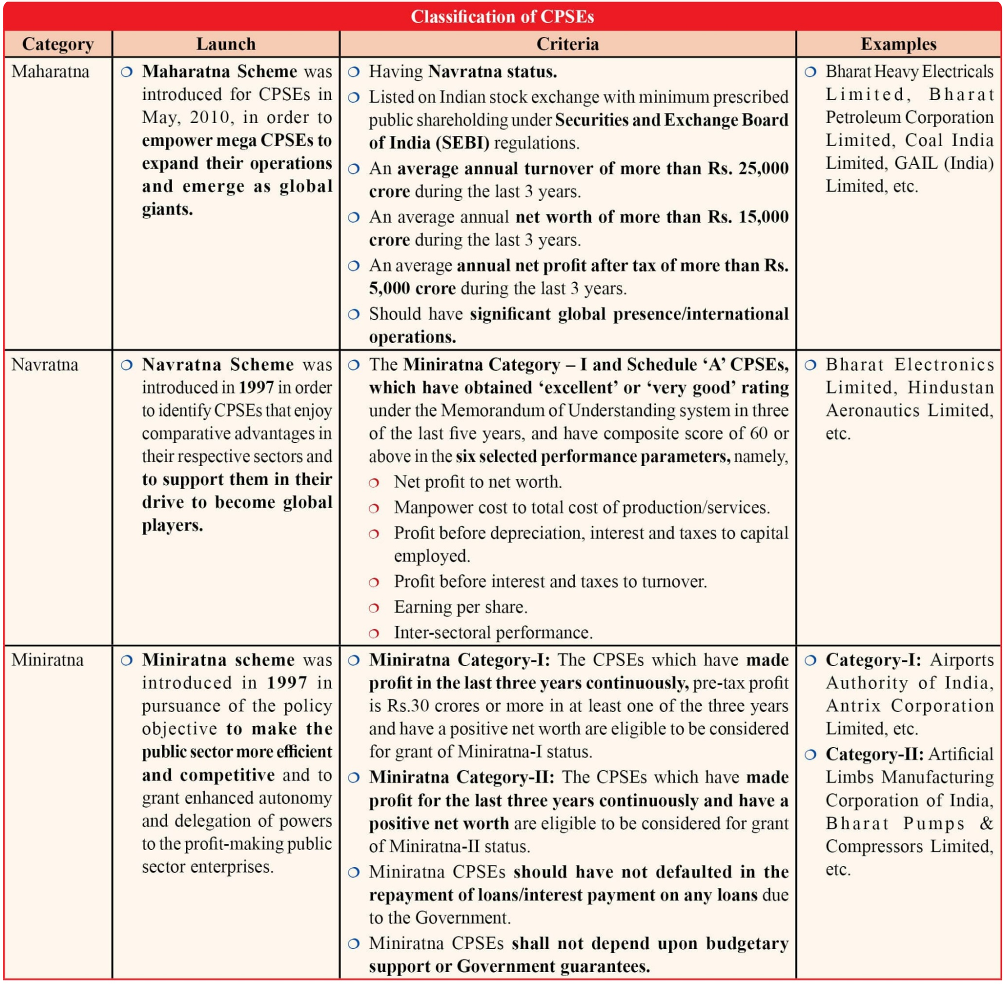
Source: PIB

The Ministry of Defence has approved the conferment of **"Miniratna (Category-I)"** status to three key **Defence Public Sector Undertakings (DPSUs) :** Munitions India Limited (MIL), Armoured Vehicles Nigam Limited (AVNL), and India Optel Limited (IOL).

- **Transformation of DPSUs:** MIL, AVNL, and IOL are three of the seven PSUs carved out of the erstwhile **Ordnance Factory Board (OFB)** in 2021 as part of the Government of India's defence sector reforms **.**
  - MIL products include ammunition (small to high calibre), mortars, rockets, grenades, and in-house explosives.
  - AVNL products include **MBT Arjun , T-90 tanks , BMP-II Sarath** (amphibious Infantry Combat Vehicle), and Defence mobility solutions (Stallion, LPTA etc.)
  - IOL specializes in Opto-electronic systems and vision equipment for tanks, artillery and naval weapons.
- **Miniratna Category-I Status:** The CPSEs which have **made profit in the last three years continuously, pre-tax profit is Rs.30 crores or more** in at least one of the three years and have a **positive net worth** are eligible to be considered for grant of Miniratna-I status.
  - Miniratna companies get **more autonomy to invest, raise capital, and make quick decisions.** This boosts efficiency, competitiveness, and global reach.



Classification of CPSEs

Category	Launch	Criteria	Examples
Maharatna	○ **Maharatna Scheme** was introduced for CPSEs in May, 2010, in order to **empower mega CPSEs to expand their operations and emerge as global giants.**	○ Having **Navratna status.** ○ Listed on Indian stock exchange with minimum prescribed public shareholding under **Securities and Exchange Board of India (SEBI)** regulations. ○ An **average annual turnover of more than Rs. 25,000 crore** during the last 3 years. ○ An average annual **net worth of more than Rs. 15,000 crore** during the last 3 years. ○ An average **annual net profit after tax of more than Rs. 5,000 crore** during the last 3 years. ○ Should have **significant global presence/international operations.**	○ Bharat Heavy Electricals Limited, Bharat Petroleum Corporation Limited, Coal India Limited, GAIL (India) Limited, etc.
Navratna	○ **Navratna Scheme** was introduced in **1997** in order to identify CPSEs that enjoy comparative advantages in their respective sectors and **to support them in their drive to become global players.**	○ The **Miniratna Category – I and Schedule 'A' CPSEs, which have obtained 'excellent' or 'very good' rating** under the Memorandum of Understanding system in three of the last five years, and have composite score of 60 or above in the **six selected performance parameters,** namely, ○ Net profit to net worth. ○ Manpower cost to total cost of production/services. ○ Profit before depreciation, interest and taxes to capital employed. ○ Profit before interest and taxes to turnover. ○ Earning per share. ○ Inter-sectoral performance.	○ Bharat Electronics Limited, Hindustan Aeronautics Limited, etc.
Miniratna	○ **Miniratna scheme** was introduced in **1997** in pursuance of the policy objective **to make the public sector more efficient and competitive** and to grant enhanced autonomy and delegation of powers to the profit-making public sector enterprises.	○ **Miniratna Category-I:** The CPSEs which have **made profit in the last three years continuously,** pre-tax profit is Rs.30 crores or more in at least one of the three years and have a positive net worth are eligible to be considered for grant of Miniratna-I status. ○ **Miniratna Category-II:** The CPSEs which have **made profit for the last three years continuously and have a positive net worth** are eligible to be considered for grant of Miniratna-II status. ○ Miniratna CPSEs **should have not defaulted in the repayment of loans/interest payment on any loans** due to the Government. ○ Miniratna CPSEs **shall not depend upon budgetary support or Government guarantees.**	○ **Category-I:** Airports Authority of India, Antrix Corporation Limited, etc. ○ **Category-II:** Artificial Limbs Manufacturing Corporation of India, Bharat Pumps & Compressors Limited, etc.

Read more: Seven New Defence Public Sector Units (DPSUs)

India’s First Indigenous Polar Research Vessel

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Source: IE

Garden Reach Shipbuilders and Engineers Limited (GRSE) , a Government of India undertaking, has signed an MoU with Norway’s Kongsberg firm to develop India’s **first indigenously built Polar Research Vessel (PRV).**

- A PRV is a ship that supports research in the polar regions (around the North and South Poles) and ocean areas, tailored to the needs of the **National Centre for Polar and Ocean Research.**
- PRV will support India’s **polar and ocean research missions** , strengthening its existing three research stations: **Bharati** and **Maitri** in **Antarctica** , and **Himadri** in the **Arctic** .
    - The vessel will be equipped with **advanced scientific instruments** to explore marine ecosystems and **deep-sea biodiversity** in polar and southern ocean realms.
- The project will reinforce India’s commitment to **MAHASAGAR (Mutual and Holistic Advancement for Security Across the Regions)** .
    - Under **Sagarmala 2.0** , India aims to become a **global maritime leader** by bridging infrastructure gaps and **enhancing shipbuilding, repair, and recycling.**
- The collaboration with Norway also aligns with India’s **‘Make in India’** and **Atmanirbhar Bharat** goals by boosting **indigenous shipbuilding capability** .

Read more: **India's Maiden Winter Arctic Research**

Mysterious Star Emitting Both Radio Waves and X-Rays

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Source: IE

Astronomers have discovered a **unique celestial object** that emits **simultaneous radio waves and X-rays** every 44 minutes, marking it as a **rare member** of a newly identified class known as **long-period radio transients** .

- It is located in the **Milky Way galaxy** about 15,000 light-years from Earth in the direction of the **constellation Scutum.**
- **Long-period radio transients** emit **bright radio bursts** every few minutes to hours—much longer than typical **pulsars** , which blink **on and off** in **milliseconds to seconds** due to their **rapid rotation** .
    - **Pulsars** are rapidly rotating **neutron stars** , formed from the **collapsed core of a massive star** after it dies.
- **Nature of the object is still unknown** , with possible identities including:
    - A **magnetar** (a spinning neutron star with an **extreme magnetic field**)
    - A **white dwarf** in a **binary system** with a companion star.
        - **Stars** up to **eight times the mass of our Sun** end as **white dwarfs** . After using up their **hydrogen fuel** , they expand into **red giants** , **shed outer layers** , and collapse into a **dense, Earth-sized core** called a **white dwarf.**
- Researchers used data from **NASA's Chandra X-ray Observatory** , and **other telescopes** for their study.
- Radio waves have **long wavelengths and low frequencies,** primarily used for **communication** such as **radio and television** . **X-rays** possess **short wavelengths and high frequencies,** allowing them to penetrate materials and are widely used in **medical imaging** .

Read More: Magnetars and Related AstroSat's Discovery

National Florence Nightingale Awards 2025

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Source: PIB

The **President of India** presented the **National Florence Nightingale Awards 2025** to 15 **nursing professionals,** recognizing their exemplary contributions to healthcare and public service.

National Florence Nightingale Awards

- **About:** It was instituted in **1973** by the **Ministry of Health and Family Welfare** to honour outstanding **nursing personnel** serving in **Central and State Governments, Union Territories** , and **Voluntary Organizations** .
  - These awards recognize meritorious contributions in **clinical care, public health, education** , and **nursing administration.**
- **Categories** : It is presented across 3 categories: **Registered Nurses and Midwives (RN & RM)** , **Registered Auxiliary Nurses and Midwives (RANM)** , and **Registered Lady Visitors** .
- **Eligibility:** Eligible nominees include nurses working in **hospitals, community settings, educational institutions, or administrative roles** .
- **Award:** Each award comprises a **Certificate of Merit** , a **cash prize of Rs. 1,00,000** , and a **medal** .

Florence Nightingale

- **Florence Nightingale** (1820–1910) was an **English social reformer, statistician,** and **founder of modern nursing** .
- She rose to prominence during the **Crimean War** (fought between **Russia and the Ottoman Empire**) for **organizing care for wounded soldiers** and significantly **reducing mortality through improved hygiene** .
- She founded the **Nightingale School of Nursing** at St. Thomas’ Hospital, London, laying the foundation for **modern nursing education.**

Read More: State of the World’s Nursing 2025 Report