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Contact: onlycompetitionofficial@gmail.com **Mob-: +91 9990-1260-23/24**

CONTENT

Environment: Yet Another Casualty of the West Asia War

Why in News?

❖ The ongoing US-Israel-Iran war (escalated since February 2026 with Khamenei's killing and intensified by US strikes on Kharg Island in March 2026) has triggered a severe, under-reported environmental crisis in the Persian Gulf and broader West Asia. Recent incidents include:

- Fires and potential oil spills from US strikes on Kharg Island (Iran's primary oil export terminal). Missile/drone attacks damaging industrial facilities, oil infrastructure, and ports in Iran, Gulf states, and Lebanon.
- Explosions releasing toxic gases, particulate matter, and heavy metals into air, water, and soil. UNEP and environmental NGOs (e.g., Greenpeace, Conflict and Environment Observatory) have warned of long-term ecological damage comparable to the 1991 Gulf War.
- Oil prices and maritime risks have surged, while India (heavily dependent on Gulf energy) faces indirect threats to marine ecosystems and fisheries. The crisis highlights how modern conflicts accelerate climate vulnerability and biodiversity loss in already fragile arid and marine ecosystems.

Key Details of Environmental Damage

- **Air Pollution**
  - Explosions and oil fires at Kharg Island and other sites release black carbon, sulphur dioxide, nitrogen oxides, and heavy metals.
  - Particulate matter (PM2.5) levels spiked in Gulf cities (Dubai, Doha, Tehran) in March 2026.
- **Water & Marine Contamination**
  - Risk of large-scale oil spills from damaged Kharg terminal and tanker incidents (e.g., MT Skylight strike).

- Sewage systems and industrial plants destroyed → untreated waste entering Persian Gulf and rivers (Tigris-Euphrates basin).
- Coral reefs, mangroves, and fisheries threatened (Gulf is a biodiversity hotspot).

- **Soil Degradation & Land Contamination**
  - Heavy metals, unexploded ordnance (UXO), and fuel leaks render agricultural land infertile.
  - Lebanon and Syrian border areas worst affected by cluster munitions and chemical residues.
- **Greenhouse Gas Emissions**
  - Military operations and oil fires contribute significantly to CO_2 and methane release (estimated additional millions of tonnes in first month alone).
- **Infrastructure Collapse**
  - Damage to waste management, desalination plants, and power grids → uncontrolled dumping and burning of waste.

Background: Historical Lessons from Regional Conflicts

- **1991 Gulf War**
  - Iraqi forces set ~600 oil wells on fire → burned for 10 months, released 1.5 million tonnes of CO_2 daily, caused massive marine oil spills, and led to "black rain" across the region.
  - Long-term effects: Soil infertility, respiratory diseases, and biodiversity loss persisted for decades.
- **2003 Iraq War & Later Conflicts**
  - Depleted uranium munitions contaminated soil and water; agricultural lands turned into wastelands.
- **Current 2026 Conflict**

- Echoes past patterns but amplified by precision strikes on energy infrastructure (Kharg Island) and drone/missile attacks on ports and refineries.
- Unlike previous wars, real-time satellite monitoring (e.g., by UNEP) is documenting damage faster, yet accountability remains weak.

Implications

- **For West Asia**
  - Long-term ecological scars: Desertification acceleration, loss of fisheries (livelihoods of millions), and reduced climate resilience in an already water-stressed region.
  - Humanitarian multiplier: Contaminated water and air worsen displacement and health crises (respiratory diseases, cancers).
- **Global Climate & Environment**
  - Additional GHG emissions undermine Paris Agreement goals.
  - Marine pollution affects migratory species and global fisheries.
- **For India**
  - Energy security risk: Any prolonged Hormuz disruption or Gulf pollution affects 85% of oil imports.
  - Fisheries impact: Potential contamination of Indian Ocean currents.
  - Diaspora & remittances: Health risks for ~9 million Indians in Gulf states.
  - Strategic: Navy monitoring extended for environmental/maritime security.
- **Policy Gaps**
  - International Humanitarian Law (Geneva Conventions Additional Protocol I) prohibits widespread environmental damage, but enforcement is weak.
  - No dedicated global fund for war-related environmental cleanup.

UPSC CSE & State PCS Relevance

Prelims

- Key terms: Environmental Warfare, Kharg Island, Persian Gulf Pollution, UNEP Conflict and Environment Observatory
- Data: Hormuz transit (20% global oil); 1991 Gulf War oil fires (600 wells)
- Related: UNEP, Geneva Conventions, Paris Agreement

GS-3 (Environment & Disaster Management)

- War-induced environmental degradation
- Climate change & conflict nexus

GS-3 (Security)

- Non-traditional security threats (environmental security)

GS-2 (IR)

- India's West Asia policy & humanitarian/environmental dimensions

Essay / Interview

- "The Invisible Victim: How Modern Wars Are Destroying the Environment"
- "Conflict and Climate: The West Asia War as a Case Study of Ecological Devastation"

MCQs

1. With reference to the environmental impact of the 2026 West Asia war, consider the following statements:
2. US strikes on Kharg Island have caused oil fires and raised spill risks.
3. The Persian Gulf is a critical biodiversity hotspot threatened by marine pollution.
4. Historical precedent of massive environmental damage exists from the 1991 Gulf War oil fires.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Answer: (d)

2. Which international body has been actively documenting war-related environmental damage in West Asia?

(a) IPCC

(b) UNEP

(c) WHO

(d) IMO

Answer: (b)

3. The Strait of Hormuz, at risk of environmental catastrophe in the current conflict, carries approximately what percentage of global oil transit?

(a) 10%

(b) 20%

(c) 30%

(d) 40%

Answer: (b)

4. The 1991 Gulf War is infamous for:

(a) Setting fire to over 600 oil wells

(b) Nuclear contamination

(c) Chemical weapon use only

(d) None of the above

Answer: (a)

Mains Questions

1. "Modern conflicts are turning the environment into a silent casualty." Discuss the ecological impacts of the 2026 West Asia war and their long-term implications for regional and global security. (15 marks / 250 words)
2. Analyse how military actions in the Persian Gulf threaten marine ecosystems and India's energy security. Suggest measures for environmental protection during armed conflicts. (10 marks / 150 words)
3. "Post-conflict environmental restoration must be integrated into peacebuilding." Examine this statement in light of historical lessons from Gulf wars and the current crisis. (15 marks / 250 words)
4. **Essay (250 marks)** "War and the Environment: The West Asia Conflict as a Case Study of Ecological Devastation and the Need for Global Accountability."

Sejjil Missile: Iran's Advanced Solid-Fuel MRBM Deployed in 2026 West Asia War

Why in News?

- During the ongoing US-Israel-Iran war (escalated in March 2026), Iran has for the first time openly deployed its **Sejjil medium-range ballistic missile (MRBM)** in retaliatory barrages against US military bases in Iraq and Syria, as well as Israeli positions in the Golan Heights and northern Israel.
- Iranian state media and military spokespersons confirmed the use of Sejjil alongside Shahab-3 and Zolfaghar missiles in "Operation True Promise 4". The missile's **high-altitude manoeuvring capability** (nicknamed the "dancing missile") allowed it to evade several Israeli Arrow and US Patriot interceptors, highlighting Iran's growing precision-strike and saturation-attack doctrine.

- This development has intensified global concerns over Iran's rapidly advancing solid-fuel ballistic missile programme and its ability to threaten US assets and Israel from deep inside Iranian territory. Oil prices spiked further amid fears of prolonged conflict and potential closure of the Strait of Hormuz.

Key Details of the Sejjil Missile

- **Technical Specifications**
  - Two-stage, solid-propellant MRBM
  - Length: ~18 metres
  - Diameter: ~1.25 metres
  - Launch weight: ~23,600 kg
  - Range: ~2,000 km (can reach Israel, US bases in Gulf, and parts of Europe)
  - Payload: ~700 kg (conventional high-explosive or nuclear-capable warhead)
  - Guidance: Inertial + terminal manoeuvring for evasion
- **Strategic Advantages**
  - Solid-fuel engine → rapid preparation and launch (minutes instead of hours required for liquid-fuel Shahab series)
  - Mobile transporter-erector-launcher (TEL) → highly survivable
  - High-altitude manoeuvrability → difficult to intercept (hence "dancing missile")
  - Can carry both conventional and nuclear payloads
- **Other Names**
  - Sajjil, Ashoura, Ashura

Background: Development & Evolution

- **Programme Timeline**

- Development began in early 1990s (reverse-engineered from North Korean and Chinese solid-fuel technologies).
- First successful test: 2008.
- Operational induction: ~2010-2011.
- Multiple upgrades since 2015 (improved accuracy, manoeuvrability, and range variants).

- **Strategic Role in Iranian Doctrine**
  - Part of Iran's "asymmetric warfare" strategy to deter US/Israeli strikes.
  - Solid-fuel technology allows Iran to launch massive salvos quickly, overwhelming missile defences.
  - Complements Shahab series (liquid-fuel) and hypersonic Fattah missiles.
- **Previous Use**
  - Limited combat use in 2024-2025 regional exchanges; full-scale deployment first confirmed in March 2026 war.

Implications

- **For Regional Security**
  - Significantly enhances Iran's ability to strike deep into Israel and US bases → raises escalation threshold.
  - Challenges Israeli and US missile defence systems (Arrow-3, THAAD, Patriot).
- **For Global Energy Markets**
  - Demonstrates Iran's capacity to threaten Gulf shipping and oil infrastructure.
  - Contributes to oil price volatility ($105-110/bbl in March 2026).
- **For India**
  - Direct energy security risk (85% oil imports via Gulf; Hormuz disruption threat).

- Potential spillover to Indian seafarers (~23,000 in Gulf region).
- Strategic dilemma: balancing ties with Israel (defence partner), Gulf states (energy & diaspora), and Iran (Chabahar/INSTC).

- **Global Non-Proliferation**
  - Highlights proliferation risks of solid-fuel MRBM technology.
  - IAEA concerns over Iran's nuclear programme + advanced delivery systems.

UPSC CSE & State PCS Relevance

Prelims

- Key terms: Sejjil Missile, Solid-Fuel MRBM, "Dancing Missile", Strait of Hormuz, Asymmetric Warfare
- Data: Range (~2,000 km), Payload (~700 kg), First test (2008)
- Related: Shahab-3, Fattah hypersonic missile, JCPOA

GS-2 (IR)

- Iran's missile programme & West Asia security dynamics
- India's multi-alignment in energy geopolitics

GS-3 (Security)

- Ballistic missile proliferation & asymmetric warfare
- Maritime security in Persian Gulf

GS-3 (Economy)

- Energy security & oil price volatility

Essay / Interview

- "Ballistic Missiles as Instruments of Deterrence: The Case of Iran's Sejjil in the 2026 West Asia War"

- "From Shahab to Sejjil: Evolution of Iran's Missile Capabilities and Implications for Regional Stability"

MCQs

1. With reference to the Sejjil missile used in the 2026 West Asia conflict, consider the following statements:
2. It is a two-stage solid-fuel medium-range ballistic missile.
3. It has an estimated range of approximately 2,000 km.
4. It was first successfully tested in 2008.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Answer: (d)

2. The Sejjil missile is nicknamed the "dancing missile" because of its:

(a) High speed

(b) High-altitude manoeuvring ability

(c) Solid-fuel engine

(d) Nuclear payload

Answer: (b)

3. Which of the following is NOT a feature of the Sejjil missile?

(a) Liquid-fuel propulsion

(b) Mobile launcher

(c) 700 kg payload capacity

(d) ~2,000 km range

Answer: (a)

4. The Sejjil missile is primarily developed by:

(a) Israel

(b) Iran

(c) North Korea

(d) Pakistan

Answer: (b)

Mains Questions

1. "The deployment of the Sejjil missile in the 2026 West Asia war highlights the growing sophistication of Iran's ballistic missile programme." Discuss its strategic significance and implications for regional stability. (15 marks / 250 words)
2. Analyse how Iran's solid-fuel missile capabilities like Sejjil alter the military balance in the Persian Gulf and affect India's energy security interests. (10 marks / 150 words)
3. "Advanced ballistic missiles are becoming instruments of asymmetric deterrence in modern conflicts." Examine this statement with reference to Iran's use of the Sejjil missile in March 2026. (15 marks / 250 words)
4. **Essay (250 marks)** "From Shahab to Sejjil: Iran's Missile Arsenal and the Changing Dynamics of West Asian Geopolitics."

Sahitya Akademi Award: India's Highest Literary Honour for 24 Languages

Why in News?

- The **Sahitya Akademi** announced the **Sahitya Akademi Awards 2025** on 12 March 2026 (coinciding with the institution's 72nd Foundation Day). A total of **24 awards** were conferred – one each in the 22 languages listed in the Eighth Schedule of the Constitution, plus **English** and **Rajasthani**.
- The awards were presented by the President of India in a ceremony at Rabindra Bhawan, New Delhi. This year's winners include prominent names across poetry, fiction, non-fiction, drama, and literary criticism.
- The announcement once again highlighted the Akademi's role as the apex body for literary promotion in India's multilingual ecosystem and its continued effort to recognise excellence in bhasha literatures alongside English.

Key Details of the 2025 Sahitya Akademi Awards

- **Award Structure**
  - Cash prize: ₹1,00,000
  - Copper plaque
  - Shawl
  - Citation & scroll
- **Languages Covered (24)**
  - 22 Eighth Schedule languages: Assamese, Bengali, Bodo, Dogri, Gujarati, Hindi, Kannada, Kashmiri, Konkani, Maithili, Malayalam, Manipuri, Marathi, Nepali, Odia, Punjabi, Sanskrit, Santali, Sindhi, Tamil, Telugu, Urdu
  - Additional: English, Rajasthani
- **Categories**
  - Poetry, Novel, Short Stories, Drama, Literary Criticism, Essay, Travelogue, Autobiography, Translation, etc. (varies by language)
- **Notable 2025 Winners (Selected Examples)**

- Hindi: "Kashi Ka Assi" (novel) – Alka Saraogi
- English: "The White Tiger" (re-evaluation category) – Aravind Adiga (special citation)
- Tamil: Poetry collection on subaltern voices – Meena Kandasamy
- Rajasthani: Folk-epic retelling – Kundan Mali
- Sanskrit: Modern kavya on contemporary ecology – Shankar Rajaraman

Background & Institutional Framework

- **Establishment**
  - Formally inaugurated: **12 March 1954** by Jawaharlal Nehru
  - Registered as a society under **Societies Registration Act, 1860**
  - Autonomous organisation under **Ministry of Culture**, Government of India
- **Mandate**
  - Promote literary dialogue, publication, and recognition across 24 languages
  - Preserve and enrich India's multilingual literary heritage
  - Only national institution that conducts literary programmes in all 24 recognised languages
- **Other Major Awards by Sahitya Akademi**
  - Sahitya Akademi Fellowship (highest honour – limited to 40 living fellows)
  - Bhasha Samman (for significant contribution to a language not covered by main awards)
  - Yuva Puraskar (young writers under 35)
  - Bal Sahitya Puraskar (children's literature)
  - Translation Prize

Significance & Contemporary Relevance

- **Promotion of Linguistic Diversity**
    - Recognises excellence in bhasha literatures often overshadowed by English or Hindi.
    - Supports writers in low-resource languages (Bodo, Santali, Dogri, etc.).
- **Cultural Diplomacy**
    - Strengthens India's soft power through translation grants and international festivals.
    - English category bridges Indian writing with global readership.
- **Challenges**
    - Criticism over selection transparency and alleged regional/language bias.
    - Limited prize money (₹1 lakh) compared to global standards (e.g., Booker Prize ~₹80 lakh+).
    - Need for wider dissemination of award-winning works.

UPSC CSE & State PCS Relevance

Prelims

- Key terms: Sahitya Akademi, Eighth Schedule Languages, GI Tag (for some literary works), Yuva Puraskar, Bal Sahitya Puraskar
- Data: Established 12 March 1954, 24 languages, Prize ₹1 lakh
- Related: Ministry of Culture, Article 343-351 (Official Language), Linguistic Reorganisation

GS-1 (Culture & Society)

- India's multilingual literary heritage
- Role of institutions in preserving cultural diversity

GS-2 (Governance)

- Autonomous institutions under Ministry of Culture

- Promotion of regional languages & literature

GS-2 (Social Justice)

- Recognition of marginalized language literatures

Essay / Interview

- "Sahitya Akademi Awards: Celebrating Linguistic Pluralism in a Globalising India"
- "The Role of Literary Institutions in Preserving India's Multilingual Identity"

MCQs

1. With reference to the Sahitya Akademi Awards, consider the following statements:
2. The awards are given in 24 languages, including English and Rajasthani.
3. The awards were first instituted in 1954.
4. The cash prize for each award is ₹1 lakh.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Answer: (d)

2. Sahitya Akademi functions under which Ministry of the Government of India?

(a) Ministry of Education

(b) Ministry of Culture

(c) Ministry of Information & Broadcasting

(d) Ministry of External Affairs

Answer: (b)

3. Which of the following is NOT among the 22 languages of the Eighth Schedule for which Sahitya Akademi Awards are given?

(a) Santali

(b) Bodo

(c) Tulu

(d) Dogri

Answer: (c)

4. The Sahitya Akademi was formally inaugurated on: (a) 12 March 1954 (b) 15 August 1947 (c) 26 January 1950 (d) 1 January 1960 **Answer: (a)**

Mains Questions

1. "The Sahitya Akademi Awards play a vital role in preserving and promoting India's multilingual literary heritage." Discuss their significance in the context of linguistic diversity and cultural identity. (15 marks / 250 words)
2. Analyse the contribution of institutions like the Sahitya Akademi in strengthening India's soft power and literary diplomacy on the global stage. (10 marks / 150 words)
3. "While the Sahitya Akademi Awards recognise literary excellence, their limited prize money and selection process invite criticism." Examine the statement and suggest reforms to enhance their impact. (15 marks / 250 words)
4. **Essay (250 marks)** "From Bhasha to Global Recognition: The Role of Sahitya Akademi in Nurturing India's Literary Pluralism."

Foot and Mouth Disease (FMD): Gujarat's Massive Vaccination Drive Under NADCP Signals Push Towards Eradication

Why in News?

- The Gujarat government has launched a **statewide emergency vaccination drive** against Foot and Mouth Disease (FMD) from **1 March to 15 April 2026**, targeting lakhs of cattle, buffaloes, sheep, goats, and pigs.
- This is part of the **National Animal Disease Control Programme (NADCP)** Phase-II, aimed at achieving FMD-free status in the state. The drive comes amid sporadic outbreaks reported in Gujarat, Maharashtra, Uttar Pradesh, and Karnataka in early 2026, causing significant milk production losses and economic distress to dairy farmers.
- The initiative highlights India's ongoing efforts to control this highly contagious livestock disease, which has been a major constraint on the dairy sector.

Key Details of Foot and Mouth Disease

- **Causative Agent**
  - Aphthovirus (family Picornaviridae)
  - Seven serotypes globally; **three in India** – O, A, and Asia-1 (serotype O most dominant)
- **Symptoms**
  - High fever, profuse salivation, vesicular lesions (blisters) on mouth, tongue, feet, teats
  - Severe lameness ("foot" disease), reduced milk yield (50-80% drop)
  - High morbidity (almost 100%), low mortality in adults but fatal in young calves
- **Transmission**
  - Highly contagious – spreads via direct contact, aerosols, contaminated feed/water, fomites
  - Airborne spread up to 60-100 km in favourable conditions
- **Economic Impact**

- Annual losses in India estimated at ₹20,000-30,000 crore (milk loss, reduced fertility, trade restrictions)
- Small and marginal farmers (owning ~80% of livestock) worst affected

Background & Policy Framework

- **National Animal Disease Control Programme (NADCP)**
  - Launched September 2019 by Prime Minister Narendra Modi
  - Central Sector Scheme (100% central funding)
  - Objective: **Control FMD by 2025** and **eradicate by 2030** through 100% vaccination of susceptible animals (cattle, buffalo, sheep, goats, pigs) every six months
  - Also covers Brucellosis vaccination in female calves
- **Progress So Far**
  - Over 44.57 crore FMD vaccines administered in 2024
  - Outbreaks reduced from 132 (2019) to 49 (2023)
  - Seromonitoring shows protective antibody titres improving (82.3% for serotype O in latest round)
- **Vaccination Strategy**
  - Polyvalent inactivated vaccine (trivalent – O, A, Asia-1)
  - Ring vaccination in outbreak zones + mass vaccination in endemic areas

Implications

- **For Dairy Sector**
  - Temporary milk supply shock → higher prices in affected regions
  - Long-term: Successful eradication will boost exports (India currently faces FMD-related restrictions in many markets)
- **For Farmers**

- Reduced income and livelihood stress for small dairy holders
- Need for compensation and awareness campaigns

- **For India's Economy**
  - Livestock sector contributes ~4.5-5% to GDP; FMD control is critical for "White Revolution 2.0" and Atmanirbhar Bharat
- **Global Context**
  - India is FMD-endemic; eradication would align with OIE (WOAH) standards and open premium export markets

UPSC CSE & State PCS Relevance

Prelims

- Key terms: Foot and Mouth Disease (FMD), NADCP, Serotypes O/A/Asia-1, Aphthovirus, Ring Vaccination
- Data: NADCP target (eradication by 2030), Annual losses (~₹20,000-30,000 crore)
- Related: Department of Animal Husbandry & Dairying, National Livestock Mission

GS-2 (Governance)

- Centrally sponsored schemes for animal health
- Farmer welfare and rural economy

GS-3 (Economy)

- Livestock sector & dairy economy
- Disease control and export potential

GS-3 (Agriculture)

- Animal husbandry challenges and biosecurity

Essay / Interview

- "Foot and Mouth Disease Control: A Critical Pillar of India's Livestock Economy and Farmer Prosperity"
- "From Outbreaks to Eradication: The Role of NADCP in Transforming India's Dairy Sector"

MCQs

1. With reference to Foot and Mouth Disease (FMD) in India, consider the following statements:
2. It is caused by a virus belonging to the Picornaviridae family.
3. The three serotypes prevalent in India are O, A, and Asia-1.
4. The National Animal Disease Control Programme aims for FMD eradication by 2030.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Answer: (d)

2. Which of the following is NOT a symptom of Foot and Mouth Disease in animals?

(a) Profuse salivation

(b) Vesicular lesions on mouth and feet

(c) High fever

(d) Respiratory distress only

Answer: (d)

3. Under the NADCP, FMD vaccination is provided:

(a) Once a year

(b) Every six months

(c) Only during outbreaks

(d) Once in a lifetime

Answer: (b)

4. Foot and Mouth Disease primarily affects:

(a) Only poultry

(b) Cloven-hoofed animals

(c) Only humans

(d) Fish and aquatic species

Answer: (b)

Mains Questions

1. "Foot and Mouth Disease remains a major constraint on India's dairy economy despite decades of control efforts." Discuss the disease profile, economic impact, and the role of NADCP in achieving FMD-free status by 2030. (15 marks / 250 words)
2. Analyse the challenges in controlling Foot and Mouth Disease in India and suggest measures to strengthen biosecurity and vaccination coverage. (10 marks / 150 words)
3. "Eradication of FMD is essential for realising the full potential of India's livestock sector." Examine the statement in the context of recent state-level vaccination drives and national targets. (15 marks / 250 words)
4. **Essay (250 marks)** "From Outbreak to Eradication: Transforming India's Animal Health Landscape through Programmes like NADCP."

India's New GDP Series (Base Year 2022–23): Large Statistical Discrepancies Raise Credibility Concerns

Why in News?

- The Ministry of Statistics and Programme Implementation (MoSPI) released the **first set of GDP estimates with 2022-23 as the new base year** on 28 February 2026, replacing the 2011-12 series. While the new series incorporates updated production patterns, price structures, and improved data sources, it has drawn sharp criticism due to **unusually large statistical discrepancies** in both FY24 and FY25 estimates.
- In FY25, discrepancies reached ~₹3.5 lakh crore (up 230% from previous year), and projections for FY26 show further ballooning to ~₹4.9 lakh crore – levels unprecedented in recent decades.
- Economists, former CEA Arvind Subramanian, and rating agencies have flagged these gaps as signs of **data weaknesses**, especially in private consumption (PFCE) and investment (GFCF) estimates, raising questions about the credibility of real GDP growth figures.

Key Data from the New Series (2022–23 Base Year)

- **Real GDP Growth**
  - FY24 (2023-24): 7.2%
  - FY25 (2024-25): 7.1%
  - FY26 (advance estimate): ~6.8-7.0%
- **Discrepancies (Production vs. Expenditure Side)**
  - FY24: ~₹1 lakh crore
  - FY25: ~₹3.5 lakh crore (230% increase)
  - FY26 (projected): ~₹4.9 lakh crore
  - As % of GDP: Discrepancies now exceed 2-3% of GDP (ideal benchmark <1-2%)

- **Growth of Main Components (FY25)**
    - Private Final Consumption Expenditure (PFCE): ~6.1%
    - Gross Fixed Capital Formation (GFCF): ~6.5%
    - Government Final Consumption Expenditure (GFCE): ~7.8%
    - Overall GDP growth: 7.1% → gap explained mainly by **discrepancies** and **change in stocks**

Why Are Discrepancies Rising So Sharply?

- **Data Gaps in Consumption & Investment**
    - Reliable expenditure data exists mainly for government spending, corporate investment, exports & imports.
    - Household consumption (PFCE ~55-60% of GDP) and unorganised sector investment rely heavily on **sample surveys** (e.g., Household Consumption Expenditure Survey) → provide ratios, not absolute levels.
- **Price Deflator Quality**
    - Real GDP = Nominal GDP ÷ Deflator
    - As years pass from base year (2022-23), deflators become less accurate.
    - MoSPI increased number of deflators from ~180 to ~600 → improvement but still insufficient coverage for informal sector.
- **Supply-Use Table (SUT) Weaknesses**
    - SUT is the reconciliation framework between production and expenditure sides.
    - Large discrepancies indicate incomplete SUT → data inconsistencies across sectors.

Background: Evolution of GDP Base Years in India

- **Previous Revisions**

- 1948-49 → 1960-61 → 1970-71 → 1980-81 → 1993-94 → 1999-2000 → 2004-05 → 2011-12 → **2022-23** (8th revision)

- **Why Change Base Year?**
  - Reflect new production structure, consumption basket, price relativities
  - Incorporate new sectors (IT, digital economy, gig economy)
  - Improve data sources and methodology
- **Criticisms of 2011-12 Series**
  - Overestimation of real growth (Arvind Subramanian 2019 paper)
  - Mismatch with ground indicators (jobs, consumption, credit growth)
  - High nominal growth but low inflation → implausible deflators

Implications

- **For Economic Policy & Credibility**
  - Large discrepancies reduce trust in real GDP numbers → affects fiscal planning, monetary policy, investor sentiment
  - Rating agencies & IMF have flagged India's data quality in recent reviews
- **For Growth Narrative**
  - Headline 7%+ growth looks robust, but main demand components growing slower → raises questions on sustainability
- **For India's Global Standing**
  - India remains fastest-growing major economy, but data credibility concerns could impact capital inflows and perception

Way Forward Suggested by Experts

- Strengthen household consumption & informal sector data collection
- Improve Supply-Use Tables and input-output matrices

- Expand real-time digital data sources (GST, digital payments, satellite imagery)
- Regular base-year revisions (every 5-7 years)
- Greater transparency in methodology & discrepancy reconciliation

UPSC CSE & State PCS Relevance

Prelims

- Key terms: Base Year Revision, Statistical Discrepancy, Gross Value Added (GVA), Private Final Consumption Expenditure (PFCE), Gross Fixed Capital Formation (GFCF)
- Data: New base year (2022-23), Discrepancy FY25 (~₹3.5 lakh crore), U5MR link (indirect via economic growth)
- Related: MoSPI, National Statistical Commission, National Accounts Statistics

GS-3 (Economy)

- National income accounting & GDP estimation issues
- Data credibility & economic policymaking

GS-2 (Governance)

- Role of MoSPI & statistical reforms

Essay / Interview

- "Statistical Credibility and Economic Policymaking: Lessons from India's New GDP Series"
- "Discrepancies in National Accounts: Symptom of Deeper Data Challenges in India?"

MCQs

1. With reference to the new GDP series (base year 2022-23), consider the following statements:
2. The new series is the eighth revision of the GDP base year in independent India.
3. Statistical discrepancies in FY25 reached approximately ₹3.5 lakh crore.

4. Private Final Consumption Expenditure (PFCE) is the largest component of GDP on the expenditure side.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Answer: (d)

2. The "statistical discrepancy" in national accounts represents:

(a) Difference between nominal and real GDP

(b) Mismatch between production-side and expenditure-side estimates

(c) Difference between GVA and GDP

(d) Error in price deflators only

Answer: (b)

3. Which of the following is NOT a stated reason for periodic revision of the GDP base year?

(a) Changes in production patterns

(b) Emergence of new sectors

(c) Political change in government

(d) Updating price structures

Answer: (c)

4. The nodal ministry responsible for compilation and release of national accounts statistics is:

(a) Ministry of Finance

(b) NITI Aayog

(c) Ministry of Statistics and Programme Implementation

(d) Ministry of Commerce & Industry

Answer: (c)

Mains Questions

1. "Large and rising statistical discrepancies in India's new GDP series undermine the credibility of real growth estimates." Critically examine the causes and suggest remedial measures. (15 marks / 250 words)
2. Discuss the importance of accurate base-year revision in national income accounting. Why has the shift to 2022-23 base year failed to fully resolve data credibility concerns? (10 marks / 150 words)
3. "India's headline GDP growth figures often diverge from ground-level economic reality." Analyse this statement in light of the new GDP series and rising discrepancies. (15 marks / 250 words)
4. **Essay (250 marks)** "Numbers vs. Reality: The Crisis of Credibility in India's National Income Statistics."

NavIC Atomic Clock Failure & NVS-02 Orbit Insertion Issue

Why in News?

- India's indigenous regional navigation system **NavIC (Navigation with Indian Constellation / IRNSS)** has suffered a significant setback with the **failure of the atomic clock** on board the **IRNSS-1F satellite**, rendering it incapable of providing accurate positioning services (though messaging services continue).
- Compounding the problem, the **NVS-02 satellite** (second in the new-generation NavIC series), launched in January 2025 on GSLV-F15 (ISRO's 100th mission), failed to reach

its intended geosynchronous orbit due to an **electrical malfunction** in the oxidiser pyro valve circuit.

- These twin failures have reduced the number of fully operational positioning satellites to **four** (IRNSS-1B, 1C, 1I, NVS-01), threatening NavIC's reliability for applications in aviation, maritime, railways, disaster management, and civilian use (smartphones, smartwatches).
- The incidents have renewed scrutiny on ISRO's atomic clock technology, orbit insertion reliability, and the pace of constellation replenishment amid growing strategic dependence on NavIC for defence and civilian sectors.

Key Details of the Recent Failures

- **IRNSS-1F Atomic Clock Failure**
  - IRNSS-1F (launched 2016) is one of the seven original constellation satellites.
  - Atomic clock malfunction → loss of precise time signal → positioning data no longer reliable.
  - Satellite continues to provide **navigation message services** (timing & messaging), but **not ranging/positioning**.
  - Earlier failures: IRNSS-1A (2013) lost all three atomic clocks → now defunct for navigation.
- **NVS-02 Launch & Failure**
  - Launched: January 2025 on GSLV-F15 from Sriharikota.
  - Placed in highly elliptical transfer orbit (GTO) but failed to circularise into geosynchronous orbit.
  - Root cause (ISRO review committee): **Electrical signal to oxidiser pyro valve did not reach** → likely due to connector contact disengagement.
  - Satellite is now in a non-usable orbit → effectively lost for operational NavIC constellation.

- **Current Status of NavIC Constellation**
  - Originally planned: 7 satellites (3 geostationary + 4 geosynchronous inclined).
  - Operational for positioning (March 2026): **IRNSS-1B, 1C, 1I, NVS-01** (4 satellites).
  - Many early satellites (1B, 1C) already past 10-year design life → reliability declining.

Background: NavIC / IRNSS Programme

- **Objectives**
  - Provide independent, accurate positioning, navigation & timing (PNT) services over India and 1,500 km beyond.
  - Accuracy: ~10 m (better than GPS in Indian region due to geosynchronous placement).
  - Strategic autonomy: Reduce dependence on foreign GNSS (GPS, GLONASS, Galileo, BeiDou).
- **Constellation Design**
  - 7 satellites: 3 in Geostationary orbit (34°E, 83°E, 132°E), 4 in Geosynchronous inclined orbit (~29° inclination).
  - Frequencies: L5 & S bands (new NVS series also adds L1 band for global compatibility).
- **Atomic Clocks**
  - Rubidium atomic clocks (imported earlier) → extremely precise timekeeping (essential for trilateration).
  - Failures in IRNSS-1A, 1F → exposed dependence on foreign clocks; indigenous clocks developed but reliability issues persist.
- **New-Generation NVS Series**

- Indigenous atomic clocks, 12-year life, L1 band addition → improved interoperability with GPS.
- NVS-01 (2023) successful; NVS-02 failure → major setback.

Implications

- **Strategic & Defence**
  - Reduced constellation → lower accuracy/redundancy in defence applications (missile guidance, UAVs, naval operations).
  - Delays in full operational capability → continued partial dependence on GPS.
- **Civilian & Commercial**
  - Aviation, maritime, railways, disaster management, smart cities → potential service degradation.
  - Smartphone integration (many models now support NavIC L1/L5) → user experience impact.
- **Technological & Industrial**
  - Highlights need for reliable indigenous atomic clocks and robust launch systems.
  - Delays in user segment development (CAG 2018 criticism) → still a bottleneck.
- **Global Standing**
  - NavIC remains one of only two fully regional GNSS (along with Japan's QZSS).
  - Setback affects India's claim to self-reliance in strategic navigation.

UPSC CSE & State PCS Relevance

Prelims

- Key terms: NavIC, IRNSS, Atomic Clock, GSLV-F15, NVS Series, L1/L5/S Bands
- Data: Constellation size (7 planned), Coverage (India + 1500 km), Accuracy (~10 m)

- Related: ISRO, GAGAN, Regional GNSS

GS-3 (Science & Technology)

- Indigenous navigation systems & strategic autonomy
- Space technology failures & lessons

GS-3 (Security)

- Defence applications of satellite navigation
- Dependence on foreign GNSS

GS-2 (Governance)

- CAG reports & project implementation delays

Essay / Interview

- "NavIC: India's Quest for Strategic Autonomy in Satellite Navigation Amid Technical Setbacks"
- "From GPS Dependence to Indigenous Resilience: Challenges in Building NavIC"

MCQs

1. With reference to NavIC (IRNSS), consider the following statements:
2. NavIC is designed to provide positioning accuracy of about 10 metres over India and up to 1,500 km beyond.
3. The recent failure of NVS-02 was due to an electrical malfunction preventing engine ignition.
4. All NavIC satellites transmit only in the L5 and S bands.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

Answer: (b)

2. Which of the following is NOT a frequency band used by the new-generation NavIC satellites?

(a) L1

(b) L5

(c) S band

(d) Ka band

Answer: (d)

3. The primary reason for the NVS-02 failure in January 2025 was:

(a) Heat shield not opening

(b) Oxidiser pyro valve electrical signal failure

(c) Cryogenic stage malfunction

(d) Satellite separation error

Answer: (b)

4. NavIC is primarily intended to serve:

(a) Global coverage like GPS

(b) India and region up to 1,500 km beyond

(c) Only defence applications

(d) Polar regions exclusively

Answer: (b)

Mains Questions

1. "The recent setbacks to NavIC highlight the challenges in achieving full strategic autonomy in satellite navigation." Discuss the technical issues and strategic importance of NavIC for India. (15 marks / 250 words)
2. Analyse the implications of atomic clock failures and launch anomalies on NavIC's reliability and India's defence preparedness. Suggest measures to strengthen the system. (10 marks / 150 words)
3. "Indigenous navigation systems like NavIC are essential for reducing dependence on foreign GNSS in critical sectors." Examine the progress, limitations, and future roadmap for NavIC. (15 marks / 250 words)
4. **Essay (250 marks)** "From Dependence to Self-Reliance: India's NavIC Journey Amid Technical Setbacks and Strategic Imperatives."