



Why in News?

- Sagarmala Finance Corporation (SFC) announced plans to issue India's first Blue Bond.
- The bond aims to mobilise finance for sustainable maritime development and blue economy projects.
- It highlights India's focus on innovative climate finance instruments.

About Blue Bond

- Blue Bond is a debt instrument used to raise funds specifically for ocean-friendly and marine conservation projects.
- It works similar to green bonds but focuses on sustainable use of ocean resources.
- Investors receive fixed returns while the collected money is used for blue economy activities.

About Sagarmala Finance Corporation (SFC)

- SFC is a financial institution supporting maritime infrastructure development.
- It provides financial assistance for ports, shipping and coastal infrastructure projects.
- Issuing blue bonds will diversify funding sources for maritime development.

Objectives of India's First Blue Bond

- Promote sustainable development of marine resources.
- Mobilise long-term finance for maritime infrastructure.
- Support India's blue economy vision.
- Encourage private and institutional investment in ocean-based sectors.

INDIA'S 1ST

BLUE BONDS

What is Blue Economy?

- Blue economy means sustainable use of ocean resources for economic growth, livelihood generation and ecosystem protection.
- It includes: Fisheries and aquaculture, Shipping and ports, Coastal tourism, Marine biotechnology, Offshore renewable energy

Importance of Blue Economy for India

- India has a coastline of more than 7,500 km.
- Large population depends on coastal and marine resources.
- Maritime trade plays a major role in India's economy.
- Supports employment, exports and sustainable growth.

Projects Supported by Blue Bonds

- Sustainable fisheries management.
- Marine biodiversity conservation.
- Pollution reduction projects.
- Climate-resilient coastal infrastructure.
- Renewable ocean energy development.

Global Examples of Blue Bonds

- Seychelles issued the world's first sovereign blue bond in 2018.
- International organisations such as the World Bank support blue finance mechanisms.
- Many countries are exploring blue bonds for ocean conservation financing.

Difference Between Blue Bond and Green Bond

- Green Bonds finance broader environmental projects like renewable energy and clean transport.
- Blue Bonds specifically finance ocean and marine ecosystem-related projects.
- Both support sustainable development and climate goals.

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India's Blue Economy Initiatives

- Sagarmala Programme promotes port-led development.
- Deep Ocean Mission supports exploration of ocean resources.
- Pradhan Mantri Matsya Sampada Yojana strengthens fisheries sector.
- Maritime India Vision 2030 focuses on modern maritime infrastructure.

Importance for Climate Finance

- Helps bridge funding gaps for sustainable development.
- Encourages Environment, Social and Governance (ESG) investment.
- Supports India's climate commitments and Sustainable Development Goals (SDGs).

Relevant Sustainable Development Goals

- SDG 14: Life Below Water.



- SDG 13: Climate Action.
- SDG 8: Decent Work and Economic Growth.
- SDG 9: Industry, Innovation and Infrastructure.

Challenges in Blue Bond Implementation

- Need for strong monitoring of fund utilisation.
- Difficulty in measuring marine conservation outcomes.
- Limited investor awareness.
- Requirement of transparent standards and regulations.
- Climate risks affecting coastal projects.

Conclusion

India's first Blue Bond represents an important step towards combining

economic growth with ocean sustainability. By creating dedicated financial support for marine conservation, ports and coastal development, blue bonds can strengthen India's blue economy vision. Transparent implementation and ecological safeguards will be essential to ensure long-term sustainable maritime development.

PYQ (Prelims)

Q. With reference to Green Bonds, consider the following statements:

1. They are financial instruments used to raise money for environmentally beneficial projects.
2. The proceeds from such bonds are generally earmarked for specific sustainable activities.
3. Similar sustainable finance instruments can support ocean-based conservation projects.

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

Answer: (d) 1, 2 and 3

Why in News?

- The 11th Quad Foreign Ministers' Meeting was held in New Delhi, India in 2026.
- Quad countries announced new initiatives on maritime security, energy security, critical minerals and supply chain resilience.
- The meeting became significant due to increasing tensions in the South China Sea and Strait of Hormuz.

About Quad

- Quad (Quadrilateral Security Dialogue) is an informal strategic grouping of India, United States, Japan and Australia.
- It aims to promote a free, open, inclusive and rules-based Indo-Pacific region.
- It originated after cooperation during the 2004 Indian Ocean Tsunami.
- The idea was formally proposed in 2007 and revived in 2017.

Major Outcomes of the Meeting

- Strengthening Indo-Pacific maritime cooperation.

Quad Foreign Ministers' Meeting 2026



- Expansion of Maritime Domain Awareness initiatives.
- Cooperation on energy security and critical mineral supply chains.
- Promotion of emerging technologies and secure digital infrastructure.

Indo-Pacific Maritime Security

- Quad expanded cooperation through

Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA).

- It improves real-time maritime monitoring and information sharing.
- Helps counter illegal fishing, trafficking and grey-zone maritime activities.

Critical Minerals Cooperation

- Quad Critical Minerals Initiative focuses on mining, processing and recycling cooperation.
- Critical minerals are essential for semiconductors, batteries, EVs and renewable energy.
- It supports supply chain diversification and reduces strategic dependency.

Energy Security

- Quad launched cooperation to strengthen energy supply resilience.
- Focus includes clean energy technology, diversification and secure energy routes.
- Maritime routes like the Strait of Hormuz remain important for global energy flows.

» Continued on P3

► From P2

Technology Cooperation

- Quad promotes cooperation in:
 - Artificial Intelligence
 - Quantum technologies
 - Cybersecurity
 - 5G and 6G communication
 - Secure digital infrastructure

Malabar Exercise

- Annual naval exercise involving Quad countries.
- Enhances maritime coordination, interoperability and security cooperation.

Importance of Quad for India

- Strengthens India's Indo-Pacific strategy.
- Supports Act East Policy.
- Enhances India's role as a net security provider in the Indian Ocean Region.
- Promotes resilient supply chains and China+1 strategy.

- Provides access to advanced technology partnerships.

Strategic Autonomy Dimension

- Quad is not a formal military alliance like NATO.
- It allows India to cooperate with partners while maintaining independent foreign policy.
- India balances Quad cooperation with its wider diplomatic interests.

Challenges Before Quad

- Absence of permanent secretariat.
- Different priorities among member countries.
- ASEAN concerns regarding major power competition.
- Economic dependence on China.
- Need for implementation beyond announcements.

Conclusion

Quad has become an important pillar of Indo-Pacific cooperation by promoting maritime security, technological collabo-

ration and resilient supply chains. For India, it strengthens strategic partnerships while preserving strategic autonomy. The future success of Quad depends on practical implementation, stronger coordination and balancing security with inclusive regional growth.

PYQ

Q. With reference to the Quad grouping, consider the following statements:

1. Quad consists of India, Japan, Australia and the United States.
2. It supports a free and open Indo-Pacific region.
3. Malabar naval exercise involves cooperation among Quad countries.

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

Answer: (d) 1, 2 and 3

Mission Senehjori

Why in News?

- The Government launched Mission Muga Silk Senehjori to strengthen Assam's traditional Muga silk sector.
- The project aims to improve livelihood opportunities for silk farmers, reelers, weavers and entrepreneurs.
- It focuses on preserving Assam's cultural heritage while promoting modern value-chain development.

About Mission Senehjori

- Mission Senehjori is a development initiative focused on Assam's Muga silk industry.
- It aims to create a sustainable and globally competitive silk ecosystem.
- The project focuses on production improvement, technology adoption, skill development and market expansion.
- It supports India's vision of Atmanir-



bhar Bharat and Vocal for Local.

Financial and Social Impact

- The project has an estimated investment of about ₹411 crore.
- It aims to benefit around 2.5 lakh people associated with the Muga silk value chain.
- Beneficiaries include farmers, women workers, artisans and rural entrepreneurs.

About Muga Silk

- Muga silk is a rare golden-coloured silk mainly produced in Assam.
- It is produced by the silkworm

Antheraea assamensis.

- It is famous for natural golden shine, durability and high economic value.
- Muga silk received Geographical Indication (GI) tag recognition.

Importance of Muga Silk for Assam

- Represents Assam's cultural identity and traditional knowledge.
- Provides livelihood support to rural communities.
- Supports women empowerment through handloom activities.
- Strengthens traditional textile-based rural economy.

Sericulture in India

- Sericulture means cultivation of silkworms for silk production.
- India is one of the largest silk-producing countries in the world.
- Major silk varieties produced in India:
 - Mulberry Silk
 - Tasar Silk
 - Eri Silk
 - Muga Silk

Muga Silk Production

Process

- Includes cultivation of host plants.
- Silkworm rearing.
- Cocoon production.
- Silk reeling.
- Weaving and textile production.

Mission Objectives

- Increase Muga silk production capacity.
- Improve quality of silk products.
- Strengthen farmer and artisan income.
- Promote branding and global marketing.
- Encourage innovation in traditional industries.

Role in Northeast Development

- Promotes economic development of Assam and Northeast India.
- Creates employment opportunities in rural areas.
- Supports local industries and traditional occupations.

- Strengthens regional identity and cultural economy.

Connection with Sustainable Development

- Encourages nature-based livelihood systems.
- Supports sustainable textile production.
- Promotes rural entrepreneurship.
- Helps preserve traditional ecological knowledge.

Women Empowerment Dimension

- A large number of women participate in silk weaving and allied activities.
- Improved market access increases financial independence.
- Supports inclusive rural development.

Government Support for Silk Sector

- Central Silk Board supports research and development.
- Silk Samagra Scheme promotes overall development of sericulture.
- Various schemes encourage technology adoption and skill training.

Challenges in Muga Silk Sector

- Climate change affects silkworm survival and host plants.
- Limited mechanisation.



- Competition from cheaper textile alternatives.
- Need for stronger branding and international market access.
- Requirement of improved scientific research.

Conclusion

Mission Senehgori represents an important step towards protecting Assam's traditional Muga silk heritage while creating modern economic opportunities. By combining technology, skill development and market access, the mission can strengthen rural livelihoods, empower women and promote sustainable development in Northeast India.

PYQ (Prelims)

Q. With reference to silk production in India, consider the following statements:

1. India produces different varieties of silk including Mulberry, Tasar, Eri and Muga.
2. Muga silk is mainly associated with Assam.
3. Geographical Indication tags help protect traditional products.

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

Answer: (d) 1, 2 and 3



INDIA-CHINA 35TH WMCC MEETING

Why in News?

- India and China held the 35th meeting of the Working Mechanism for Consultation and Coordination (WMCC) on India-China Border Affairs in Beijing.
- Discussions focused on border management, boundary issues, mechanism building and cross-border cooperation.
- Both sides highlighted the importance of peace and tranquillity along the Line of Actual Control (LAC) for improvement of bilateral relations.

About WMCC

- WMCC stands for Working Mechanism for Consultation and Coordination on India-China Border Affairs.
- It was established in 2012 as an institutional diplomatic mechanism.
- It aims to improve communication, coordi-

nation and management of border-related issues.

- It includes representatives from diplomatic and military establishments.

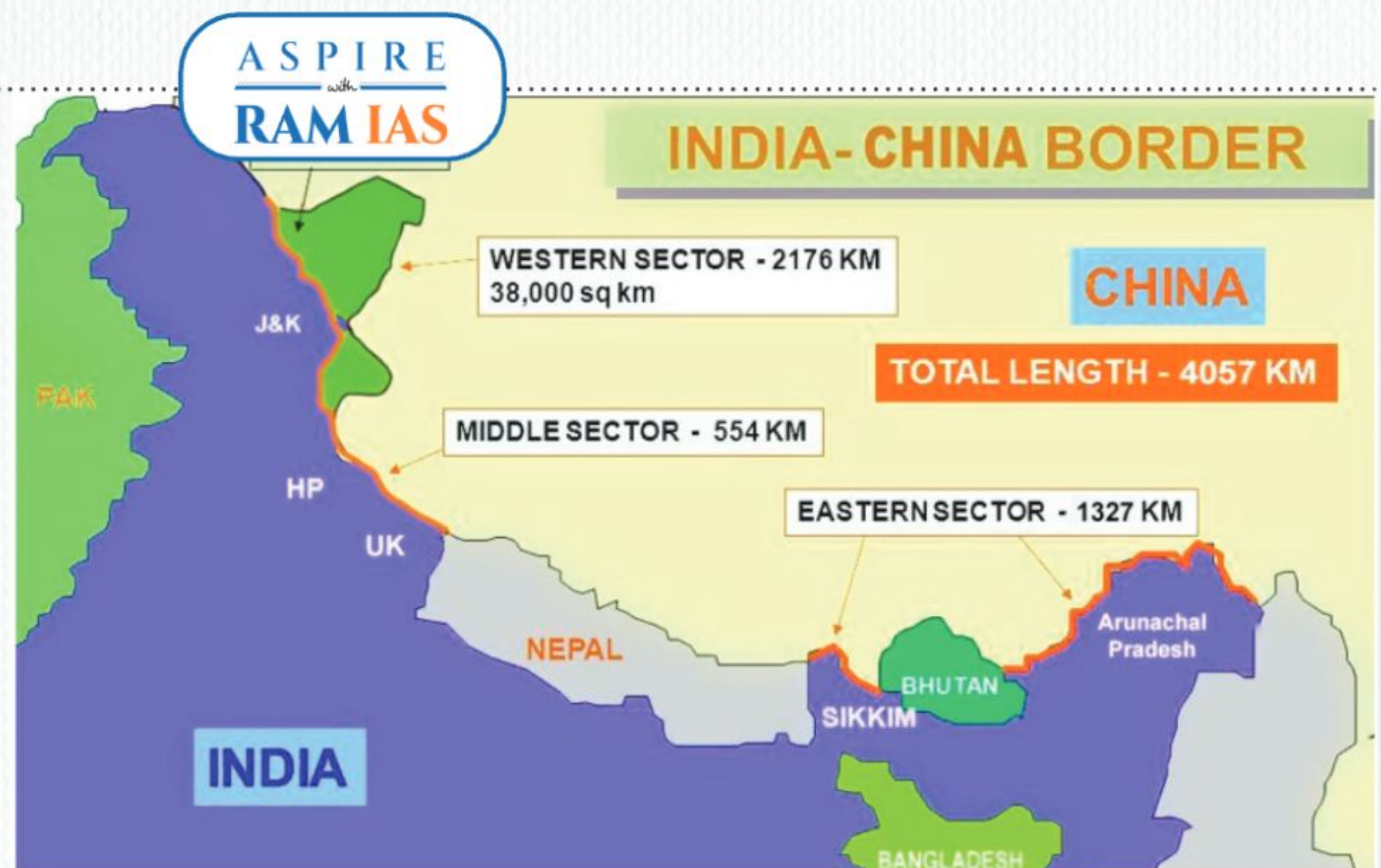
Objectives of WMCC

- Maintain peace and stability along the India-China border areas.
- Prevent escalation of border incidents.
- Improve coordination between both sides.
- Support discussions under higher-level boundary mechanisms.

Major Outcomes of 35th WMCC Meeting

- Both countries reviewed the situation along the LAC.
- They agreed to continue diplomatic and military-level communication.

INDIA-CHINA BORDER



- Focus was given to effective border management mechanisms.
- Discussions were held on strengthening confidence-building measures.
- Preparation for the 25th round of Special Representatives talks was discussed.

Line of Actual Control (LAC)

- LAC is the de facto boundary separating Indian-controlled and Chinese-controlled territories.
- It emerged after the 1962 India-China War.
- The boundary is not completely demarcated, leading to different perceptions.
- India considers the LAC around 3,488 km long, while China's perception differs.

Trans-Border Rivers Mechanism

- India raised the need for an early meeting of the Expert Level Mechanism on trans-border rivers.
- Cooperation is important because many Himalayan rivers originate in China-controlled areas.
- Data sharing helps flood management and water security.

Special Representatives (SR) Mechanism

- Established in 2003 for India-China boundary negotiations.
- Provides high-level political guidance on border settlement.
- India and China agreed to prepare for the next round of SR talks.

Importance of Stable India-China Relations

- Both countries are major Asian powers.
- Stability supports regional peace and economic development.
- Cooperation is important in global platforms such as BRICS, SCO and G20.
- Reduces risk of military escalation along sensitive borders.

Major Challenges in India-China Relations

- Unresolved boundary dispute.
- Different perceptions of LAC.
- Border incidents such as Doklam (2017) and Galwan Valley clash (2020).
- China-Pakistan strategic cooperation.
- Concerns regarding China's Belt and Road Initiative (BRI).
- Trade imbalance and strategic

India-China Border Sectors

Western Sector

- Covers Ladakh region.
- Main dispute: Aksai Chin.
- India follows Johnson Line claims while China follows different historical interpretations.

Middle Sector

- Covers Himachal Pradesh and Uttarakhand.
- Considered the least disputed sector.

Eastern Sector

- Covers Sikkim and Arunachal Pradesh.
- Based on the McMahon Line of 1914 Simla Convention.
- China disputes the McMahon Line and claims parts of Arunachal Pradesh.

Principles Agreement.

- 2013 Border Defence Cooperation Agreement.

Strategic Importance for India

- Protects territorial integrity and national security.
- Supports India's Act East Policy and Indo-Pacific strategy.
- Helps maintain balance in Asian geopolitics.
- Strengthens India's diplomatic position.

Conclusion

The 35th India-China WMCC Meeting represents an important diplomatic effort to maintain peace along the LAC and manage one of Asia's most complex border disputes. While dialogue mechanisms help prevent escalation, long-term stability requires mutual trust, respect for agreements, effective communication and peaceful resolution of differences.

PYQ (Prelims)

Q. Consider the following statements regarding India-China border:

1. The Line of Actual Control separates Indian-controlled and Chinese-controlled territories.
2. The McMahon Line is associated with the eastern sector of the India-China boundary.
3. Aksai Chin dispute is related to the western sector.

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

Answer: (d) 1, 2 and 3.

competition in Indo-Pacific.

India's Approach Towards China

- Dialogue and diplomacy for border management.
- Strengthening military preparedness along borders.
- Infrastructure development in border areas.
- Cooperation where interests converge and competition where required.

Important Border Agreements

- 1993 Agreement on Maintenance of Peace and Tranquillity along LAC.
- 1996 Confidence Building Measures Agreement.
- 2005 Political Parameters and Guiding

RUDRAM-II MISSILE

SUCCESSFULLY FLIGHT TESTED

Why in News?

- Defence Research and Development Organisation (DRDO) and Indian Air Force (IAF) successfully flight-tested the indigenous RudraM-II missile.
- The missile was tested from a Su-30 MKI fighter aircraft platform.
- The test validated propulsion system, control mechanism, guidance system and overall missile performance.

About RudraM-II Missile

- RudraM-II is an indigenously developed air-to-surface missile system.
- It has been developed by DRDO for the Indian Air Force.
- It is part of India's RudraM series of next-generation tactical missiles.
- The missile strengthens India's precision strike and suppression of enemy air defence capabilities.

Type of Missile

- RudraM-II is a solid-propelled air-launched missile.
- It is designed to destroy enemy targets



RudraM-II

- Indigenous design and development.
- Advanced navigation system.
- Modern control and guidance technology.
- High accuracy against designated targets.
- Capability to operate in complex battle-field conditions.

Testing Details

- The missile was launched from Su-30 MKI fighter aircraft.
- Tests were conducted off the Odisha coast.
- Data from tracking systems confirmed successful achievement of mission objectives.
- The trial demonstrated reliability of critical subsystems.

Role of DRDO

- DRDO is India's premier defence research organisation.
- It develops advanced defence technologies including missiles, radars and electronic

- Successful SEAD provides safer operating conditions for friendly aircraft.

India's Missile

Development Programme

- India has developed several indigenous missile systems including:
 - Agni series ballistic missiles
 - Prithvi missile system
 - Akash surface-to-air missile
 - BrahMos supersonic cruise missile
 - Astra air-to-air missile
 - RudraM missile family

Integrated Guided Missile Development Programme (IGMDP)

- Started under the leadership of Dr. A.P.J. Abdul Kalam.
- Aimed to achieve self-reliance in missile



warfare systems.

- RudraM-II represents progress under India's self-reliant defence manufacturing goals.

Strategic Importance for India

- Enhances Indian Air Force strike capability.
- Improves ability to neutralise enemy air defence networks.
- Reduces dependence on imported missile systems.
- Strengthens India's deterrence capability.
- Supports Atmanirbhar Bharat in defence sector.

Suppression of Enemy Air Defence (SEAD)

- SEAD operations aim to weaken or destroy enemy air defence systems.
- Anti-radiation missiles are important tools in SEAD missions.

technology.

- Major missiles developed include Agni, Prithvi, Akash, Nag and Trishul.

Defence Indigenisation

- Indigenous missile development supports Make in India.
- Reduces foreign dependency in critical technologies.
- Strengthens domestic defence manufacturing ecosystem.
- Encourages private sector participation in defence production.

Challenges

- Development of advanced seekers and sensors.
- Need for continuous technological upgrades.
- Competition with rapidly evolving global missile systems.
- Requirement of large-scale production capability.

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Recent IPCC Reports



- Intergovernmental Panel on Climate Change (IPCC) is a UN body created in 1988 by UNEP and WMO to provide scientific assessment on climate change.
- Recent focus: Sixth Assessment Report (AR6) and Synthesis Report covering physical science, impacts, adaptation, vulnerability and mitigation.
- Human activities, mainly greenhouse gas emissions, are responsible for global warming trends.
- Global temperature rise has already increased climate risks including heat waves, extreme rainfall, sea level rise, biodiversity loss and food-water insecurity.
- Developing countries face higher vulnerability due to limited adaptation capacity and historical inequality in emissions.
- Report highlights need for climate resilient development combining mitigation, adaptation and sustainable growth.
- Important solutions: renewable energy expansion, energy efficiency, ecosystem protection, climate finance, carbon reduction technologies and lifestyle changes.
- India relevance: supports Mission LiFE, National Action Plan on Climate Change, renewable energy targets and demand for climate justice.

Conclusion: IPCC reports show that climate change is a development challenge requiring urgent global cooperation, scientific action and fair responsibility sharing.

GIFT City Developments

- Gujarat International Finance Tec-City (GIFT City) is located in Gandhinagar, Gujarat.
- It hosts India's first International Financial Services Centre (IFSC).
- Objective is to develop India as a global financial and technology services hub.

- International Financial Services Centres Authority (IFSCA) acts as a unified regulator for banking, insurance, securities and financial services in IFSC.
- Major areas: fintech, global banking, insurance, reinsurance, aircraft leasing, ship leasing, capital markets and fund management.
- Benefits: attracts foreign investment, improves ease of doing business, creates employment and strengthens India's role in global finance.
- Recent developments include expansion of international financial institutions, sustainable finance initiatives and global capability centres.
- Challenges: competition from global financial hubs, need for skilled workforce, strong regulation and infrastructure expansion.

Conclusion: GIFT City represents India's ambition to become a global financial powerhouse by combining technology, innovation and international standard regulation.

AI Regulations & Digital India Act Draft

- Artificial Intelligence growth has created opportunities in healthcare, education, agriculture, governance and industry.

- Concerns include privacy violation, misinformation, algorithmic bias, job disruption, cyber threats and accountability gaps.
- India is moving towards responsible AI governance through innovation-friendly regulation.
- Digital India Act is proposed to replace the Information Technology Act, 2000 and address modern digital challenges.
- Expected focus areas: online safety, emerging technologies, AI accountability, cybersecurity and digital rights.
- Digital Personal Data Protection Act, 2023 strengthens privacy framework in the digital ecosystem.
- India's approach aims to balance technological innovation with trust, safety and citizen protection.
- Global comparison: European Union follows stronger risk-based AI regulation while India supports flexible innovation-led governance.

Conclusion: AI regulation is necessary to ensure that emerging technologies remain transparent, inclusive and beneficial while protecting constitutional values and citizens' rights.

Prelims Practice Question

Q. With reference to 'Global Climate Change Alliance', which of the following statements is/are correct? (UPSC Prelims 2017)

1. It is an initiative of the European Union.
2. It provides technical and financial support to targeted developing countries to integrate climate change into development policies.
3. It is coordinated by World Resources Institute and World Business Council for Sustainable Development.

Answer: Statements 1 and 2 only.

» From P6

Conclusion

The successful flight test of RudraM-II marks an important achievement in India's indigenous defence capability. By strengthening precision strike ability and reducing dependence on foreign systems, RudraM-II contributes to technological self-reliance and enhances India's strategic preparedness. Continued innovation in advanced defence systems will be essential for maintaining future security readiness.

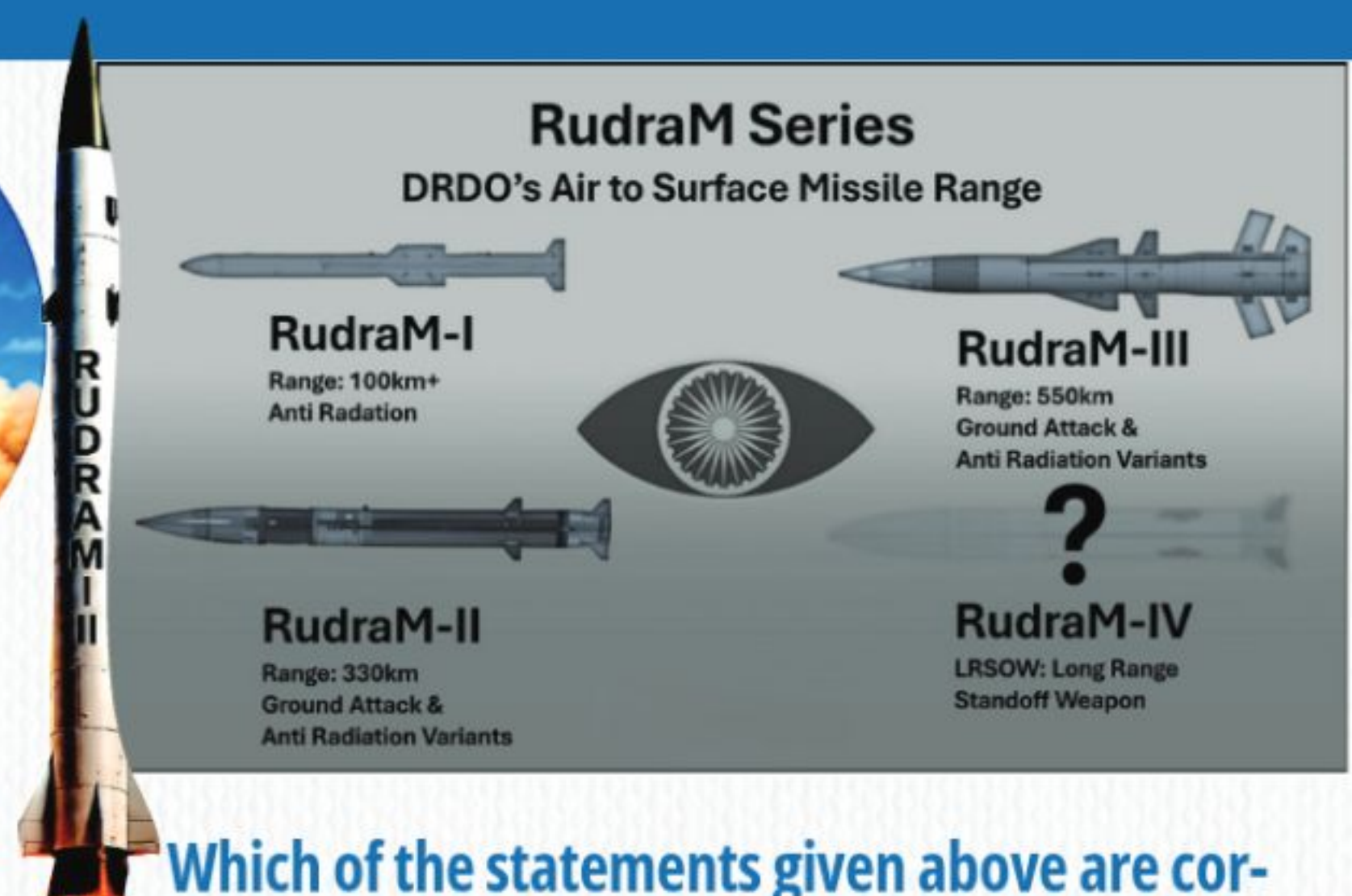
PYQ (Prelims)

Q. With reference to missile technology in India, consider the following statements:

1. DRDO plays a major role in indigenous missile development.
2. Anti-radiation missiles are designed to target enemy radar systems.
3. Air-launched missiles can enhance stand-off strike capability.



ness.



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

Answer: (d) 1, 2 and 3.

Two New Special Economic Zones (SEZs) IN PUDUCHERRY

Why in News?

- The Government approved establishment of two new Special Economic Zones (SEZs) in Puducherry.
- The initiative aims to boost industrial development, exports, employment generation and investment opportunities in the Union Territory.
- One major SEZ initiative includes development of an Information Technology (IT) park framework to attract technology companies and investors.

About Special Economic Zones (SEZs)

- SEZs are specially designated areas within a country having different economic regulations compared to the rest of the economy.
- They are created to promote exports, attract investment and encourage industrial growth.
- Businesses inside SEZs receive simplified procedures, infrastructure support and various incentives.

Objectives of SEZs in India

- Generate additional economic activity.
- Promote export of goods and services.
- Attract domestic and foreign investment.
- Create employment opportunities.
- Develop world-class infrastructure facilities.
- Improve India's competitiveness in global trade.

Two New SEZs in Puducherry – Significance

- The SEZ projects aim to diversify Puducherry's economic base.
- They will encourage sectors such as information technology, manufacturing and services.
- The projects are expected to generate skilled employment opportunities.
- They support regional industrialisation and balanced economic development.

Legal Framework of SEZs in India

- Special Economic Zones Act was enacted in 2005.
- SEZ Rules came into effect in 2006.



- The framework provides single-window clearance and simplified compliance procedures.
- The Ministry of Commerce and Industry administers SEZ policy in India.

Major Features of SEZs

- SEZs are treated as foreign territory for trade operations and customs purposes.
- Units mainly focus on export-oriented activities.
- Provide better infrastructure, logistics and business environment.
- Support integration with global supply chains.

Benefits of SEZ Development

- Increases Foreign Direct Investment (FDI).
- Boosts exports and foreign exchange earnings.
- Creates direct and indirect employment.
- Encourages technology transfer and

innovation.

- Supports Make in India and Atmanirbhar Bharat objectives.

Importance for Puducherry

- Strengthens industrial ecosystem of the Union Territory.
- Creates opportunities for youth employment.
- Supports development of IT and knowledge-based industries.
- Improves infrastructure and private sector participation.
- Can reduce dependence on limited traditional economic sectors.

India's SEZ Evolution

- India established Asia's first Export Processing Zone at Kandla in 1965.
- Export Processing Zones were later transformed into the SEZ model.
- The SEZ Act, 2005 provided a comprehensive legal framework.

- SEZs became important instruments of export-led growth.

Challenges Associated with SEZs

- Land acquisition and rehabilitation concerns.
- Risk of uneven regional development.
- Underutilisation of some approved SEZ areas.
- Competition from other global manufacturing hubs.
- Need for better infrastructure and policy stability.

Baba Kalyani Committee on SEZ Reforms

- The committee was formed to review

India's SEZ policy.

- It recommended shifting focus from export promotion to employment and economic growth.
- It suggested making SEZs more compatible with global trade rules.
- It emphasised better integration with domestic industries.

Conclusion

The development of new SEZs in Puducherry reflects India's continuing focus on export-led growth, investment promotion and regional industrial development. SEZs can become engines of employment creation and technological advancement if supported by strong infrastructure, policy stability and sustainable planning.

PYQ (Prelims)

Q. With reference to Special Economic Zones (SEZs) in India, consider the following statements:

1. SEZs aim to promote exports and investment.
2. The Special Economic Zones Act was enacted in 2005.
3. SEZs help generate employment opportunities.

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

Answer: (d) 1, 2 and 3

New Cascade Frog Species Discovered in Nagaland

Why in News?

- Scientists discovered a new cascade-dwelling frog species named *Amolops kamal* in Nagaland.
- The discovery was made from hill-stream ecosystems of Kiphire district in Nagaland.
- The finding highlights the rich but still underexplored biodiversity of Northeast India.

About *Amolops kamal* (Nagaland Cascade Frog)

- *Amolops kamal* is a newly identified amphibian species belonging to the genus *Amolops*.
- It belongs to the family Ranidae, commonly known as true frogs.
- The species has been named in honour of zoologist Dr. Kamal Choudhury for his contribution to biodiversity studies.
- It is commonly called the Nagaland cascade frog.

About Cascade Frogs

- Cascade frogs are frogs adapted to live near fast-flowing mountain streams and waterfalls.



- They usually inhabit clean, oxygen-rich freshwater ecosystems.
- They possess specialised adaptations to survive strong water currents.

Habitat and Distribution

- The species was discovered from Singrep village region of Kiphire district, Nagaland.
- The area lies close to the India-Myanmar border.
- The habitat forms part of the Indo-Burma biodiversity hotspot.

- It lives in rugged hill streams and forested mountain ecosystems.

Physical Adaptations

- Strong limbs help movement in fast-flowing streams.
- Large toe discs help the frog grip wet and slippery rocks.
- Extensive webbing assists movement in aquatic habitats.
- These features allow survival in turbulent waterfall ecosystems.

Cryptic Species Concept

- Amolops kamal is an example of a cryptic species.
- Cryptic species appear physically similar to related species but are genetically different.
- Modern DNA-based studies help identify such hidden biodiversity.
- Integrative taxonomy combining morphology and genetic analysis confirmed the new species.

Amolops Genus

- The genus Amolops includes Asian cascade or sucker frogs.
- These frogs are mainly distributed across Asia.
- Many species of this genus are found in Northeast India due to favourable ecological conditions.
- The discovery shows the presence of hidden amphibian diversity in the region.

Role of Zoological Survey of India (ZSI)

- ZSI conducts animal taxonomy, biodiversity research and species documentation.
- It plays an important role in identifying India's faunal diversity.
- Scientific surveys help improve conservation planning.

Importance of Northeast India Biodiversity

- Northeast India is part of globally important biodiversity regions.
- The region contains high levels of endemism.
- Unique geography, rainfall and forest ecosystems support rich amphibian diversity.
- Many species remain scientifically undocumented.

Indo-Burma Biodiversity Hotspot

- It is one of the world's major biodiversity hotspots.
- It includes parts of Northeast India and Southeast Asia.
- The region supports several endemic plants, amphibians, reptiles, birds and mammals.
- Habitat destruction remains a major conservation challenge.

Importance of Amphibians in Ecosystem

- Amphibians act as biological indicators

of environmental health.

- They are sensitive to pollution and climate change.
- They control insect populations.
- They form an important part of aquatic and terrestrial food chains.



Threats to Amphibians

- Habitat loss and forest degradation.
- Climate change affecting rainfall and temperature patterns.
- Water pollution and stream ecosystem disturbance.
- Disease outbreaks such as chytridiomycosis.
- Infrastructure expansion in sensitive ecosystems.

Conservation Importance

- Protecting hill-stream ecosystems is essential for survival of specialised amphibians.
- New discoveries help identify priority conservation areas.
- Scientific research strengthens biodiversity protection policies.
- Community participation is important in Northeast conservation efforts.

Way Forward

- Increase biodiversity exploration in under-studied regions.
- Strengthen protection of freshwater ecosystems.
- Promote genetic research and taxonomy studies.
- Integrate local communities in conservation programmes.
- Reduce habitat destruction through

sustainable development planning.

Importance for UPSC Examination

- Relevant for GS Paper III – Environment and Biodiversity.
- Important for species in news, biodiversity hotspots and conservation topics.
- Useful for Prelims questions on newly discovered species and Mains answers on biodiversity protection.

Conclusion

The discovery of Amolops kamal in Nagaland highlights the extraordinary biodiversity richness of Northeast India and the importance of scientific exploration. Such discoveries reveal hidden species diversity and emphasise the need to conserve fragile freshwater and forest ecosystems. Protecting biodiversity hotspots through research, sustainable development and community participation is essential for ecological security.

PYQ (Prelims)

Question: Consider the following statements regarding biodiversity hotspots:

1. Biodiversity hotspots contain high levels of endemic species.
2. Habitat loss is an important criterion in identifying biodiversity hotspots.
3. Indo-Burma region is recognised as a biodiversity hotspot.

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

Answer: (d) 1, 2 and 3