Define FOREIGN POLICY : Is an instrument available to a country to

- To protect and promote its National Interest
- To defend the country National Security
- To maximize economic benefits for its citizen's from International trade and commerce
- And to enhance the effectiveness of its Soft Power through Propagation of its Core Cultural assets.

India's national interests means :

- Ensuring territorial integrity of the Indian mainland and its island territories.
- Ensuring maintenance of peace and stability in all territories under the Indian dominion.
- Protection of Indian offshore assets.
- Maintenance of friendly relations with neighbouring countries.
- Protection of own EEZ against poaching and oil spills.
- Protect India's space based assets.
- Provide immunity for Indian business and military from cyber poaching and cyber terrorism.
- Prevent a nuclear conflict.

CONCEPT OF HARD POWER AND SOFT POWER

- **Hard power** is the use of military and economic means to influence the behavior or interests of other political bodies..
- Hard Power linked with Tangible Resources : such as population, territory, natural resources, economic and military strength .
- Ex Russia Annexation of Crimea Peninsula or Russia Invasion over Ukraine Region.

Concept of Soft Power :

Soft power is defined as the ability to attract and co-opt, instead of coercing, shaping the preferences of others through appeal and attraction.

- soft power is persuasive power deriving and grounded on intangible resources like tourism, culture, and heritage
- soft power strategies are more effective in the contemporary international system than hard power strategies.
- India received a nuclear waiver in 2008 despite not being a member of NSG because of its history of non-alignment and strong political ideals.
- India's efforts have the United Nations declared the International Day of Yoga on June 21, 2020, each year is a practical example of soft power usage

Defence , nuclear, space, nano, and biotechnology possess dual-use capabilities. Their applications in military and security contexts contribute to a nation's **hard power,** civilian applications in areas like energy, communication, health, and economy also make them crucial elements of **soft power**.

Feature	Hard Power	Soft Power
Method	Coercion, force, incentives	Attraction, persuasion
Resources	Military, economic, political	Culture, values, policies
Impact	Immediate, potentially unstable	Long-term, sustainable
Approach	Direct	Indirect
Outcome	Compliance (often unwilling)	Voluntary agreement, admiration

Technology	Hard Power Examples	Soft Power Examples
Defence	Advanced weaponry (fighter jets, missiles), cyber warfare capabilities, military presence & projection.	Peacekeeping operations, humanitarian aid delivery by military, military medical assistance.
Space	Military satellites (surveillance, communication, navigation), anti-satellite weapons (ASAT).	Scientific discoveries, satellite-based communication & weather services benefiting all, space exploration inspiring innovation.
Nuclear	Nuclear weapons as deterrents, nuclear-powered submarines.	Peaceful nuclear energy programs, international collaboration on nuclear safety & research.
Nanotechnology	Enhanced military materials (stronger armor, lighter equipment), advanced sensors, more potent explosives.	Innovations in medicine (targeted drug delivery), materials science benefiting various industries, water purification technologies.
Biotechnology	Development of bioweapons (though largely prohibited), enhanced soldier performance (potential future applications).	Advancements in medicine (vaccines, diagnostics), agriculture (disease-resistant crops), environmental bioremediation.

Smart Power :

- Recognizes that the most effective foreign policy often involves a **combination** of both hard and soft power strategies
- advocates flexible approach and strategic blending for optimal results

MAINS QUESTIONS:

1 .Define Defence Technology and Explain the role of technological advancements in ensuring National Security ?

2. How Defence Technology Contributes To Deterrence, Power Projection, And Safeguarding National Interests

Define and Key Introduction :

- refers to the application of scientific and technological advancements towards enhancing a nation's military capabilities, ensuring its security, and promoting strategic autonomy.

- Core Component of Hard Power
- It encompasses the indigenous development, acquisition, and integration of advanced materials, weapons systems and strategic approaches that are employed to protect a nation's interests, assets, and population from external threats.
- it is key to modern warfare.
- plays a vital role in shaping a nation's strategic posture and its ability to protect its core interests on the global stage

Answer Body

- Power projection is a state's capacity to deploy and sustain military forces and influence beyond its borders
- Power Projection (for safeguarding interests abroad)
- Technological advancements is key deciding factor in ensuring National Security and enhancing military capabilities .
- Safeguarding National Interests- Protecting Sovereignty and Territorial Integrity-Advanced air defense systems, border surveillance technologies, and well-equipped ground forces are essential for deterring and defending against external threats to a nation's territory and sovereignty.
- Maintaining Regional Stability: By possessing advanced military capabilities, a nation can contribute to regional stability operations, protect its allies, and prevent conflicts
- **Securing Economic Interests:** Naval power projection capabilities can protect sea lanes of communication vital for trade. Cyber security technologies safeguard critical infrastructure and financial systems from cyberattacks
- **Promoting Technological Independence:** Investing in indigenous defence research and development reduces reliance on foreign suppliers, ensuring strategic autonomy and the ability to protect national interests without external constraints
- Ensuring the Safety of Citizens and Adapting to Evolving Threats like cyber warfare, terrorism, and hybrid warfare.
- Hybrid warfare is a military strategy that combines conventional warfare tactics with unconventional methods (cyber attack, **Economic Pressure:** Using sanctions, trade wars, or financial manipulation; **support for Proxy Groups:** Utilizing non-state actors, insurgents, or criminal organizations; **Political Interference:** Meddling in elections or supporting political destabilization efforts; **Disinformation and Propaganda:** Spreading false information to manipulate public opinion and destabilize the adversary

So , defence technology is an essential aspect of national security, shaping military strategies, improving operational effectiveness, and ensuring the protection of a nation's interests in an ever-evolving global security landscape.

Certain Issues Related with Defence Technology

- Dependence on imports , Reliance on foreign technology and components, especially for high-end systems
- Lengthy and complex bureaucratic processes for defence acquisition and Procurement
- Challenges in achieving technological parity with adversaries
- cyber security threats- With the increasing reliance on computer-based systems and connectivity, the vulnerability of military networks to cyber attacks has grown
- legal and ethical concerns surrounding autonomous weapons- like Drones , robots - raises questions regarding accountability, decision-making, and potential misuse.
- Dominance of Defence Public Sector Undertakings (DPSUs), limiting private sector efficiency.
- Need for greater investment in Research and Development
- Financial Constraints- Defence budget, though increasing, is limited compared to other major powers
- Shortage of skilled labor in critical areas and Need for specialized training for handling modern and complex systems

Role of Defence Technology in International Relations

- Plays a Crucial Role in World Geopolitics
- It Influences Geopolitical Alliances and Partnerships help in Balancing Power Mechanism in the region
- comprehensive Impacts on Diplomatic ,Economic, and Security dynamics Between Countries .

- It Provide Military Superiority and deterrence (act of preventing) against potential adversaries
- Nuclear Weapons and Missile Systems plays a active role in deterrence and Strategic Stability
- Serve as a Tool For Arms Trade and Influence and to advance their Geopolitical Interest
- Can Become Platform For Source of Competition and Cooperation among Countries .
- The development and acquisition of advanced defence technology can enhance and Influence country military Capabilities which Influence its position in International Relations

Defence Technology : Also Helps in Showcasing Soft Power : Peace and Humanitarian assistance and disaster relief operations like :

- Operation Maitri: relief and rescue efforts in Nepal after 2015 earthquake
- Operation Ganga : evacuate Indians nationals from Conflict hit Ukraine
- Operation Dost : Provided emergency medical care in earthquake hit Turkey
- Operation Kaveri : evacuate Indians from conflict - torn Sudan (April 2023)
- Mission Sagar : assist countries in the Indian Ocean Littoral states during COVID- 19 pandemic .

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NATIONAL SECURITY

- security and defence of a sovereign state including its citizens, economy and institutions
- The Concept of National Security is directly linked with the National Interest of the Country .

TWO KEY ASPECTS OF NATIONAL SECURITY

- National Security concept has evolved and expanded over the years .
- Means ability of Government to protects its Citizens, Economy and Other Institutions and Include Military and Non Military Dimensions
- National Security can be categorized into two groups:

Feature	Internal Security	External Security
Origin of Threat	**Within India's borders:** Citizens, domestic groups, internal criminal elements.	**Outside India's borders:** Foreign states, foreign-based non-state actors.
Nature of Threats	Law & order issues (crime, communalism), insurgency, domestic terrorism, Left-Wing Extremism, organized crime, cybercrime (domestic), economic offenses.	External aggression, border disputes, cross-border terrorism, hostile state actions, military build-up in neighborhood, maritime threats, cyberattacks (foreign origin).
Primary Focus	Maintaining peace, stability, and rule of law *within* the nation's territory.	Protecting the nation's territorial integrity, sovereignty, and interests *from external threats.*
Key Agencies	State Police Forces, Central Armed Police Forces (CAPFs - CRPF, BSF, etc.), Intelligence Bureau (IB), National Investigation Agency (NIA).	Indian Armed Forces (Army, Navy, Air Force), Research and Analysis Wing (RAW), Border Guarding Forces (BSF, ITBP), Coast Guard.

The conventional domestic threats to national security have been categorised by the Ministry of Home Affairs in four groups:
(i) terrorism in the hinterland of the country,
(ii) cross-border terrorism in Jammu & Kashmir,
(iii) militancy in the North Eastern States; and
(iv) left-wing extremism in certain states.

HOW DEFENCE POLICY OPERATES IN INDIA :

Defence policies in India are governed by the Ministry of Defence, headed by the Defence Minister, who is a member of the Cabinet. The policies are aimed at ensuring the national security, territorial integrity, and safeguarding the interests of India.

The defence policies in India operate on the basis of a comprehensive approach, encompassing both external threats and internal security challenges

India's Defence Policy Operates On Two Fronts.

1. DIPLOMATIC AND POLITICAL FRONT :

- "centred around building bridges of peace in our neighbourhood."
- managing and resolving conflicts, and enhancing national-interests through non-military means.

2. THE MILITARY FRONT:

- are more comprehensive in scope
- They include military capabilities and guidelines for operations
- includes strategic defence dialogue for defence partnership with a number of countries, (an initiative to fight against the menace of terrorism, proliferation, trafficking, piracy and the nefarious activities of non-state actors)

1. Rafale fighter jets from France
2. S-400 surface-to-air missile systems from Russia
3. Boeing AH-64E Apache helicopters from the United States
4. C-17 Globemaster III transport aircraft from the United States
5. Sukhoi Su-30MKI fighter jets from Russia
6. INS Vikramaditya aircraft carrier from Russia
7. Kamov Ka-31 Helix airborne early warning helicopters from Russia
8. Saab 2000 airborne early warning and control systems from Sweden
9. INS Kalvari Scorpene-class submarines from France
10. Dassault Mirage 2000 fighter jets from France
11. MiG-29K fighter jets from Russia
12. Excalibur artillery projectiles from the United States
13. Israeli Heron drones from Israel
14. M777 ultra-light howitzers from the United States
15. MBT Arjun tanks from India's indigenous production
16. INS Arihant ballistic missile submarine from India's indigenous production
17. INS Chennai guided-missile destroyer from India's indigenous production
18. Mi-17V5 helicopters from Russia
19. Astra beyond visual range air-to-air missiles from India's indigenous production
20. Spike anti-tank guided missiles from Israel
21. T-90 Bhishma tanks from Russia
22. Barak 8 missile defense system from Israel

23. Akash surface-to-air missile system from India's indigenous production
24. AGNI series intercontinental ballistic missiles from India's indigenous production
25. Pinaka multi-barrel rocket launcher system from India's indigenous production

INDIAN DEFENCE

- Supreme Commander is the President of India
- Administrative Control of Armed Forces lies in Ministry of Defence
- Three Main Services Under Indian Defence System

Role of Armed Forces :

- to save the nation from external aggression and internal disturbances.
- to preserve the core values of survival and political independence against any external or internal threats by deterrence or by waging a war.

Currently the Indian Armed forces meaning (Under Ministry of Defence)

- the three services (Army, Navy, Air Force) and the
- Coast Guard are the primary organs of the state to defend or secure its territory.

INDIAN COAST GUARD (ICG)

- **is a maritime law enforcement and search and rescue agency of India with jurisdiction over its territorial waters including its contiguous zone and exclusive economic zone.**
- **formed in 1977**
- **Under Ministry of Defence**
- **The Coast Guard works in close cooperation with the Indian Navy, the Department of Fisheries, the Department of Revenue (Customs), and the Central Armed Police Forces, and the State Police Services.**

BUT UNDER MINISTRY OF HOME AFFAIRS :

- **Central Armed Police Forces (CAPF) is the collective name of central police organisations in India**
- **These forces are responsible for internal security and guarding the borders**

CAPF is further classified into three:

- **Border Guarding Forces**—Assam Rifles (AR), Border Security Force (BSF), Indo-Tibetan Border Police (ITBP), and Sashastra Seema Bal (SSB);
- **Forces for Internal Security**—Central Industrial Security Force (CISF) and Central Reserve Police Force (CRPF); and
- **Special Task Force**—National Security Guard (NSG).

Note : Assam Rifles

- **central police and paramilitary organisation responsible for border security, counter-insurgency, and law and order in Northeast India**
- **Its primary role is to guard the 1,643 kilometre long Indo-Myanmar border.**
- **It is the oldest paramilitary force in India**

- **The AR comes under the administration of the Ministry of Home Affairs (MHA), while its operational control is maintained by the Indian Army.**

VARIOUS TYPES OF INDIA INTELLIGENCE AGENCY

INSTITUTE	PARENT MINISTRY	PRIMARY FUNCTION
Research and Analysis Wing (R&AW), Delhi	Prime Minister's Office (PMO	external intelligence agency; gathers foreign intelligence, counter-terrorism, and advises policymakers.
Intelligence Bureau (IB), Delhi	Ministry of Home Affairs (MHA)	domestic intelligence agency; gathers internal intelligence, counter-terrorism
National Investigation Agency (NIA), Delhi	Ministry of Home Affairs (MHA	investigative agency in counter terrorism, National Security
Central Bureau of Investigation (CBI)	Ministry of Personnel, Public Grievances and Pensions	Investigates major crimes, corruption, and economic offenses at the national level.
Narcotics Control Bureau (NCB)	Ministry of Home Affairs (MHA)	Combats drug trafficking and the abuse of illegal substances
Financial Intelligence Unit (FIU	Ministry of Finance	financial intelligence related to money laundering and terrorist financing
Enforcement Directorate (ED	Ministry of Finance	enforcing Economic Laws and fighting Economic Crime. money laundering and violations of foreign exchange laws.
Central Board of Direct Taxes (CBDT)	Ministry of Finance	Administers direct taxes like income tax and corporate tax
Central Board of Indirect Taxes and Customs (CBIC)	Ministry of Finance	Administers indirect taxes like GST and customs duties
Directorate of Revenue Intelligence (DRI)	Ministry of Finance	India's apex anti-smuggling intelligence and enforcement agency.
Directorate General of GST Intelligence (DGGI)	Ministry of Finance	Collects intelligence and conducts investigations related to Goods and Services Tax (GST) evasion

Smuggling

- refers to is the secret movement of goods across national borders to avoid Customs Duties or import or export restrictions.
- Ex Arms and Ammunition
- Gold,
- Narcotics (Ketamine, Mephedrone and Ephedrine)
- Foreign Currency
- Electronic goods

About NTRO:

NTRO (National Technical Research Organisation)

- Technical Intelligence Agency under the National Security Advisor in the Prime Minister's Office, which operates as an autonomous organisation
- Primary objective is the acquisition of technical intelligence involving the interception and analysis of communication signals, imagery intelligence, and cyber intelligence.

NTRO, 2004, New Delhi based has the same "norms of conduct" as the Intelligence Bureau (IB) and the Research and Analysis Wing (R&AW)

National Technical Research Organization (NTRO) is an agency under;

(A) Ministry of Home Affairs

(B) Ministry of Defense

(C) Prime Minister's office

(D) Ministry of Skill Development

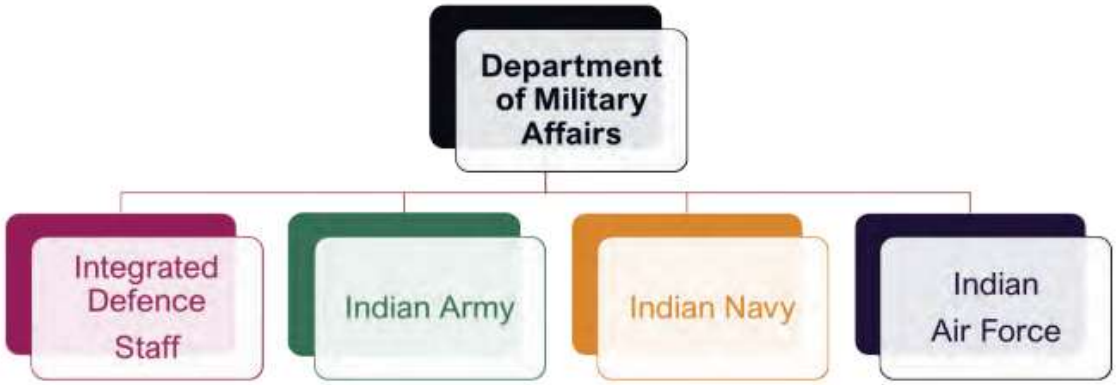
MINISTRY OF DEFENCE :

- **Formation in Year 1776, by British British East India Company at Kolkata**
- **Then After Independence, 15 Aug 1947:**
- **The President of India is the Supreme Commander of the Armed Forces of the country.**
- **The Ministry of Defence consists of Five Main Departments;**

Departments of Ministry

DEPARTMENT OF MILITARY AFFAIRS

- represents a major reform in India's defence structure
- created 1st January 2020.
- DMA is headed by the Chief of Defence Staff (CDS)
- Aim : Improving the efficiency and effectiveness of the armed forces.



Chief of Defence Staff of the Indian Armed Forces (CDS)

- High ranking uniformed officer on active duty in the Indian military and chief military adviser to the Minister of Defence
- The Chief of Defence Staff is the highest. (four star General)
- The Chief also heads the Department of Military Affairs.
- CDS serves as the **Military Advisor to the Nuclear Command Authority**
- Current CDS: General Anil Chauhan
- First Holder General Bipan Rawat
- CDS- Reports to Prime Minister and Min of Defence
- No fixed duration but till age of 65

About Nuclear Command Authority

- It is the authority responsible for command, control, and operational decisions regarding India's nuclear weaponsprogramme.
- It comprises a Political Council and an Executive Council.
- The Political Council is chaired by the Prime Minister.
- It is the sole body which can authorize the use of nuclear weapons.
- The Executive Council is chaired by the National Security Advisor.
- It provides inputfor decision-making by the NCA and executes the directives given to it by the Political Council.
- **Strategic Nuclear Command**, forms part of India's Nuclear Command Authority ,responsible for the management and administration of the country's tactical and strategic nuclear weapons stockpile.
- It was created on January 4, 2003.

KEY DAYS IN INDIA

- **Army Day** 15 January
- **IAF Day** 8 October
- **Navy Day** 4 December
- **Indian Coast Guard Day** 1 Feb
- **National Defence Day** 3 March
- **Kargil Vijay Diwas** 26 July

INDIAN ARMED FORCES: RANKS OF OFFICERS

Indian Army Ranks	Indian Navy Ranks	Indian Airforce Ranks
Field Marshal	Admiral of the Fleet	Marshal of Air Force
General	Admiral	Air Chief Marshal
Lieutenant General	Vice Admiral	Air Marshal
Major General	Rear Admiral	Air Vice Marshal
Brigadier	Commodore	Air Commodore
Colonel	Captain	Group Captain
Lieutenant Colonel	Commander	Wing Commander
Major	Lieutenant Commander	Squadron Leader

Captain	Lieutenant	Flight Lieutenant
Lieutenant	Sub Lieutenant	Flying Officer

Q. Which of the following is/are correctly matched in terms of equivalent rank in the three services of Indian Defence forces? 2024

Army	Airforce	Navy
1. Brigadier	Air Commodore	Commander
2. Major General	Air Vice Marshal	Vice Admiral
3. Major	Squadron Leader	Lieutenant Commander
4. Lieutenant Colonel	Group Captain	Captain

Select the correct answer using the code given below :

a) 1 and 4
b) 1 and 3
c) 2,3 and 4
d) 3 only

DEFENCE ACQUISITION COUNCIL

- highest decision-making body under Ministry of Defence for procurement matters.
- objective : ensure timely and efficient acquisition of defense equipment and services to meet the needs of the armed forces.
- The DAC was formed in 2001, following the Group of Ministers' recommendations on reforming the national security system, in response to the Kargil War.

  Composition
  ● Chairman: Defense Minister
  ● Members: Chief of Defense Staff (CDS), Chiefs of Army, Navy, and Air Force

  Approves a 15-year Long Term Integrated Perspective Plan (LTIPP) for defence procurement.
- Acquisition Proposals: Assesses and categorises acquisition proposals into 'Buy,' 'Buy & Make,' and 'Make' categories
- Offset Provisions: Takes decisions on offset requirements for acquisitions exceeding Rs 2000 crore.
- **Big Purchase = Obligation to Give Back:** If India makes a big purchase, the foreign company has to "give back" a certain percentage of that money to India. ex · Foreign Direct Investment (FDI): Investing in joint ventures with Indian defence companies.and Transfer of Technology (ToT):
- Technology Transfer: Oversees technology transfer in 'Buy & Make' category proposals

Navy : The Maratha Emperor, Chhatarpati Shivaji Bhosle of the 17th century is considered as "Father of the Indian Navy".

Top Navy in the World - Global Naval Powers Ranking (2025)

1 USA
2. China
3. Russia
4. Indonesia
5. South Korea
6. Japan
7 .Indian Navy

Major Command Regions :

- Western Naval Command: Mumbai
- Eastern Naval Command: Visakhapatam
- Southern Naval Command: Kochi (Training command)
- A and N Command: Port Blair

The major bases of the Indian Navy are located at Mumbai, Goa, Karwar, Kochi, Chennai, Visakhapatnam, Kolkata and Port Blair.

The biggest ships of the Indian Navy form part of its two Fleets.

A Fleet is a group of ships that operate under one authority. The Indian Navy's Western Fleet is based at Mumbai and the Eastern Fleet is based at Visakhapatnam.

Note: Marcos: Marine Commando Force: Special Forces, The MCF currently operates out of the naval bases at Mumbai, Visakhapatnam, Goa, Kochi and Port Blair

MOUNTAIN, WARRIOR, CITY, ANIMAL

Aircraft Carrier, Helicopter Control Ship, Command and Control Ship: Suitable abstract name

Cruiser, Destroyer: State capital, or large city, or name of a warrior

Frigate (multipurpose, anti-aircraft, anti-submarine): Mountain range, river, or weapon

Corvette: Personal arms

Multi-Purpose Patrol Vessel: An island

Missile/Anti-Submarine Warfare Vessel: Names with an offensive or destructive connotation

Fleet Tanker: A functional name

Amphibious Ship: Ferocious animal/amphibian reptile

Offshore Patrol Vessel: Name from Indian mythology

Mine Counter-Measure Vessel: An intermediate or minor port

Survey Ship: Suitable abstract name o a star/constellation/sign of the Zodiac

Support Ship: A functional name

Training Ship: An abstract name

Submarine: Predatory fish/abstract name associated with ocean

Name and Pattern of Ship:
Modern warships are generally divided into seven main categories, which are:

- Aircraft carriers : over 50000 tons
- Cruisers
- Destroyers more than 8000 tons
- Frigates : more than 3000 tons
- Corvettes : 500 to 2000 tons
- Submarines
- Amphibious assault ships.

- ***Easy to Move (maneuverability)***:Corvette>Frigate > Destroyer> Cruiser > Aircraft Carrier
- Capability / Missile/ Range/ Fuel capacity : Corvette < Frigate < Destroyer< Cruiser <Aircraft Carrier

Corvette

- is a small warship with light arms.
- a corvette is typically between 500 tons and 2,000 tons,
- Use for small sea
- Biggest Operator : Russia
- The corvettes are named after personal arms, such as the INS Khukri, INS Kirpan and INS Khanjar

EX :

Kamorta class : kamorta, Kadmatt, Kiltan, Kavarati, Kora, Kirch, Kulish
Khukri class : Kuthar, Kirpan Khanjar
Veer class Nishank, Vibhuti, Vipul, Vinash, Vidyut, , Nashak , Prabal ,
Abhay class : Abhay Ajay Akhsay

Frigates

- ships weighing more than 3000 tons
- smaller than Destroyers, though larger than corvettes
- Role : Protect other ships
- They are littoral combats ships
- The frigates are named after a mountain range, a river or a weapon
- INS Sahaydri, INS Shivalik, INS Satpura, INS Talwar, INS Teg, INS Brahmaputra and INS Ganga fall in this category.
- three were of Shivalik class, six were of Talwar class, three were of Godavari class, and three were of Brahmaputra class.

D**estroyer**

- is a fast, long-endurance warship
- intended to escort larger vessels in a fleet, convoy or battle group and defend them against powerful short range attackers.
- these destroyers are armed with firearms, ammunition, and guided missile systems.
- Examples 12 destroyer
- State capital or large city or name of warrior.

- INS Kolkata (D63) INS Kochi (D64)
- INS Chennai (D65) INS Delhi (D61)
- INS Mysore (D60) INS Mumbai (D62)
- INS Rajput (D51) INS Rana (D52)
- INS Vishakhapatnam INS Ranvir (D54)

A **Landing Craft Utility** (**LCU**)

- is a type of boat used by amphibious forces to transport equipment and troops to the shore.
- Indian Navy : Total 8
- ***Mk IV LCU*** class vessels : can be deployed for maritime roles that require amphibious capabilities.

Cruisers :

- strongest warship than Destroyer
- Speciality : Great Fire Power
- Due to High cost and narrow mission capability - Used in USA and Russia
- Role : Destroying Destroyer and protect merchant ship/ Aircraft carriers
- Indian Navy : No Cruisers

INDIA'S CAPABILITIES

Que : Name The Series of Related With Aircraft Carriers

a) A Series
b) S Series
c) V Series
d) K Series

Note: Vikrant , Viraat, Vikramaditya, Vikrant IAC and Vishal IAC

Aircraft Carriers (Historically):

- **INS Vikrant (R11):** India's first aircraft carrier, a Majestic-class carrier acquired from the UK. (Decommissioned).
- **INS Viraat (R22):** Originally HMS Hermes, a Centaur-class carrier acquired from the UK. (Decommissioned in 2017).

- AIRCRAFT CARRIERS

INS Vikramaditya

- **Origin:** Refurbished Russian aircraft carrier Admiral Gorshkov.
- **Commissioned:** Indian Navy, Severodvinsk, Russia.
- **Size:** Largest ship in the Indian Navy, measuring over 285m long, 60m wide, and 60m high.
- **Personnel:** Houses over 1,600 personnel, earning it the nickname "Floating City."
- **Range:** Operational range of over 13,000 km.
- **Aircraft Capacity:** Can carry over 30 aircraft, including MiG-29K/Sea Harrier, Kamov 31, Kamov 28, Sea King, ALH-Dhruv, and Chetak helicopters.
- **Landing Systems:** Features LUNA Landing system for MiGs and DAPS Landing system for Sea Harriers.

- Luna Landing System - require short runway to takeoff
- DAPS Landing System - vertically take off and Landing

- **Sea Harrier - Fighter Plane now decommissioned (Developed by British Aerospace)-Unique vertical take off and Landing Fighter Plane**

INS Vikrant (IAC-I) is the first aircraft carrier manufactured in India for the Indian Navy by the Cochin Shipyard Limited and Kochi, Kerala

INS Vishal (IAC-II) is a planned aircraft carrier for the Indian Navy which is currently in design phase and is to be built by Cochin Shipyard Limited.

.

Que : The Indian Aircraft Carrier , Vikrant which in news , was constructed by the :

a) Cochin Shipyard Limited, Kochi
b) Hooghly Dock and Port Engineers Limited, Kolkata
c) Hindustan Shipyard Limited, Visakhapatnam
d) Mazagon Dock Limited, Mumbai

Ship Building Organisations in India

At present, there are 30 shipyards, out of which 8 shipyards are in the public sector and the rest are in the private sector.

UNDER THE MINISTRY OF SHIPPING:
1 Cochin Shipyard Limited, Kochi

2 Hooghly Dock and Port Engineers Limited, Kolkata

UNDER MINISTRY OF DEFENCE: •

3. Hindustan Shipyard Limited, Visakhapatnam
4. Mazagon Dock Limited, Mumbai
5. Garden Reach Ship-builders and Engineers Limited, Kolkata*. (*Rajabagan Dockyard Limited, under Central Inland Water Transport Corporation, Kolkata merged with Garden Reach Shipbuilders and Engineers Ltd. Kolkata w.e.f. 1st July 2006.)
6. Goa Shipyard Limited, Goa

UNDER THE CONTROL OF STATE GOVERNMENTS:

7. Alcock Ashdown Co. Limited, Gujarat
8. Shalimar Works Limited, Kolkata, West Bengal,

cruise missile

- is a guided missile designed to strike terrestrial targets
- cruise missiles fly low
- This allows them to deliver large warheads over long distances with precision.
- Mach: Mach is used as a unit of measurement in stating the speed of a moving object in relation to the speed of sound

Missile	Type	Range (km)	Payload (kg)	Speed	Characteristics
Nirbhay	Subsonic Cruise Missile	750-1000	500	0.7 Mach	Indigenous, low-altitude flight, nuclear capable
Brahmos	Supersonic Cruise Missile	290 (extends upto 400-500 Km)	300	2.8 Mach	India-Russia joint venture, land/sea/air launch, fire-and-forget
Brahmos NG	Supersonic Cruise Missile	290	300	3.5 Mach	Lightweight air-launched version for LCA Tejas
Brahmos II	Hypersonic Cruise Missile	about 1000 km	300	6 Mach	Hypersonic speed, under development
Moskit	Supersonic Anti-Ship Cruise Missile	120	Conventional/ Nuclear	Mach 3 (high altitude), Mach 2.2 (low altitude)	Fastest flying anti-ship missile

Cruise Missile Propulsion

Engine Type	Propulsion Method	Operating Speed	Advantages	Disadvantages
Ramjet	Air-breathing, subsonic combustion	Mach 2+	Simple design, no moving parts	Inefficient at high speeds, launch requirements
Scramjet	Air-breathing, supersonic combustion	Mach 5+	Efficient at high speeds	Complex design, high temperatures
Dual-Mode Ramjet (DMRJ)	Air-breathing, subsonic/ supersonic combustion	Mach 4-8	Efficient across a wide speed range	Complex design
Solid Fuel Ducted Ramjet (SFDR)	Solid fuel, air-breathing	Mach 3-5	Long-range interception, high speed	Solid fuel limitations

Ballistic Missile

Ex

Short Range BM -**Prahar,** Shaurya

Submarine-launched ballistic missiles- K Family , **Sagarika**

Integrated Guided Missiles Development Programme (IGDMP

conceived by Dr. A.P.J. Abdul Kalam) was started in 1983 to develop Prithvi, Trishul, Akash, Nag and a Technology Demonstrator Agni Missile

Prithvi:

A family of short-range surface to surface ballistic missiles with variants Prithvi I, II, and III.

Missile	Range (km)	Payload (kg)	Type
Prithvi I	150	1000	Short-range
Prithvi II	350	500-1000	Medium-range
Prithvi III	350	1000	Medium-range
Dhanush	350	500	Medium-range (naval)
Trishul	9-12	N/A	Surface-to-air

Dhanush: A naval variant of Prithvi with a range of 350 km.

Agni: A series of medium and long-range ballistic missiles, including Agni-I, II, III, IV, V, and VI

Missile	Range (km)	Payload (kg)	Type
Akash	4.5-25	710	Surface-to-air
NAG	0.5-4	N/A	Anti-tank guided
Agni-I	700-1200	1000	Short-medium range
Agni-II	2000+	1000	Medium-range
Agni-III	3000+	1500	Intermediate-range
Agni-IV	4000	1000	Intermediate-range
Agni-V	5000+	1500	Intercontinental-range
Agni-VI (under development)	9000-12000	3000	Intercontinental-range (MIRV capable)
Agni-P	1000-2000	1000	Medium-range

NAG: An anti-tank guided missile with fire-and-forget capabilities.

NAG missile carrier (NAMICA), a BMP II based system with amphibious capability, has been developed.

HELINA (DHRUVASTRA), an abbreviation for Helicopter Launched NAG, is an air-to-surface missile system mounted on the Advanced Light Helicopter (ALH) with an operational range of 0.5-7 km

Anti Ballistic Missile System

India's Ballistic Missile Defense (BMD) Program is a multilayered initiative to protect the nation from ballistic missile threats. The system is designed to intercept missiles in two phases:

Phase 1 focuses on intercepting missiles with a range of up to 2000 km. Key components include:

- **Prithvi Air Defense (PAD)/Pradyumna:** An exoatmospheric interceptor with a range of 300-2000 km and a maximum altitude of 80 km.
- **Advanced Air Defense (AAD)/ Ashwin:** An endo atmospheric interceptor designed to destroy targets in the lower atmosphere.
- **Prithvi Defense Vehicle:** Similar to PAD but with an enhanced flight altitude of 150 km.
- **Prithvi Defense Vehicle Mk-2 /ASAT:** An exoatmospheric interceptor capable of intercepting missiles or satellites in orbit.

Phase 2 is under development and will be capable of intercepting missiles up to 5000 km. Key components include:

- **Air Defense 1 (AD-1):** A long-range interceptor missile designed for both low exoatmospheric and endoatmospheric interception.
- **Air Defense 2 (AD-2):** A future interceptor capable of neutralizing missiles with even higher ranges.

Indigenous Systems

Long-Range Surface-to-Air Missile (LRSAM):

- **Project Kusha:** India's indigenous long-range air defence system with a range of up to 350 km. (expected to deploy in 2028-29)
- **Capabilities:** Detects and destroys stealth fighters, aircraft, drones, cruise missiles, and precision-guided munitions.
- **High Kill Probability:** Offers a single-shot kill probability of at least 80% and 90% for salvo launches.
- **Salvo:** a simultaneous discharge of two or more guns in military action or the release all at one time of a rack of bombs or rockets.

● RUDRAM Anti-Radiation Missile: Developed by DRDO, RUDRAM is an indigenous missile designed to target enemy radars and air defences.

● Sudarshan Bomb: A laser-guided bomb developed by DRDO with a range of up to 50 km

Future Developments

India's ongoing efforts to develop indigenous air defense systems, such as the Fractional Orbital Bombardment System (FOBS), demonstrate its commitment to technological self-reliance

Fractional Orbital Bombardment System (FOBS) is a warhead delivery system that uses a low Earth orbit to target its destination. It was first developed by the Soviet Union and offers unlimited range. [UPSC 2022]

FIGHTER JETS

First Generation

● MiG-21: An older model, but still in service; known for its speed and agility. Used primarily for air defense and ground attack missions

Second Generation

● MiG-29: A twin-engine air superiority fighter known for its maneuverability and effectiveness in both air-to-air and air-to-ground roles

Third Generation

● Sukhoi Su-30MKI: A multirole air superiority fighter developed in collaboration with Russia. Known for its advanced avionics, agility, and capability to carry a wide range of weapons.

● Jaguar: A ground attack aircraft designed for strike missions

Fourth Generation [UPSC 2024]

● Dassault Rafale: A French multirole fighter jet known for its versatility and advanced technology. Equipped with cutting-edge avionics and weaponry, including nuclear capabilities.

● HAL Tejas: An indigenous lightweight, multirole fighter developed by Hindustan Aeronautics Limited. Designed for air-to-air and air-to-ground combat, with advanced features and systems

Proposed (Next Generation)

- Boeing F/A-18 Super Hornet: Considered a multirole fighter with advanced systems.
- Eurofighter Typhoon: A European multirole fighter known for its cutting-edge capabilities.

SUBMARINES

India currently possesses a fleet of 15 conventional dieselelectric submarines (SSKs) and two nuclear ballistic submarine (SSBN). Many of these submarines are over 25 years old and undergoing refits

Types of Submarines

- **Diesel-Electric Submarines (SSKs):** Use electric motors charged by diesel engines for propulsion. Require frequent resurfacing for air and fuel, making them easier to detect.
  - **Shishumar Class:** Four submarines bought and built in India in collaboration with Germany.
  - **Kilo Class (Sindhughosh Class):** Eight submarines bought from Russia between 1984 and 2000.
  - **Kalvari Class (Scorpene):** Three submarines built in India in partnership with France.
- **Nuclear-Powered Attack Submarine (SSN):** Can stay underwater indefinitely, limited only by food supplies. Equipped with torpedoes, anti-ship cruise missiles, and land-attack cruise missiles.
  - **INS Chakra 2:** Leased from Russia until 2022.
- **Nuclear-Powered Ballistic Missile Submarine (SSBN):** A slow-moving platform for launching nuclear weapons.
  - **Arihant:** India's first SSBN, with three more under construction.

INS Arihant

INS Arihant is a crucial component of India's nuclear triad, providing the capability to launch nuclear weapons from submarines. This strategic advantage is particularly significant given India's "no first use" policy.

- As a nuclear-powered ballistic missile submarine (SSBN), INS Arihant was commissioned in 2016. It is currently armed with K-15 SLBMs with a range of 750 kilometers.
- **INS Arighat:** India's second nuclear powered submarine commisioned in 2024, bolstering India's strategic deterrence.
- **Nuclear Triad** means the capability of delivering nuclear weapons by aircraft, land based ballistic missiles and submarine launched missiles.

Project 75

Entails indigenous construction of **SSK submarines** of **Scorpene design** by **M/s MDSL**. The project includes the commissioning of six vessels, including **INS Kalvari**, **INS Khanderi**, **INS Karanj**, **INS Vela**, **INS Vagir**, and **INS Vagsheer**.

Project 75 (I)

It is a follow-up and improvement over **Project 75. The initiative envisages new SSK submarines** with **fuel cells** and **Air-Independent Propulsion System (AIP)** for the Indian Navy.

SSK is a hull classification symbol used by some navies to denote a **diesel-electric attack submarine** specifically designed for **anti-submarine warfare (ASW)**, also known as a **hunter-killer** submarine.

Conventional submarines need to surface every 48 hours **to charge their batteries,** because the generator that recharges them is powered by an **internal-combustion engine that requires air.** This poses a significant risk of their detection.

-**Air Independent Propulsion (AIP)** system allows submarines to remain submerged for longer durations (up to 15 days) without the need to surface. This significantly enhances their operational endurance and stealth capabilities.

Air Independent Propulsion (AIP) systems for its diesel-electric submarines significantly enhances the underwater endurance of these submarines, allowing them to stay submerged for much longer periods compared to conventional diesel-electric submarines that need to surface or snorkel to recharge their batteries. This increased stealth is a crucial operational advantage

submarines use fuel cells that will enable them to stay submerged for up to two weeks

Fuel cells convert chemical energy directly into electrical energy, typically using hydrogen.

fuel cells as clean, efficient electrochemical power generators that directly convert fuel into electricity, with hydrogen being a key fuel of interest for India's energy future.

Q. Which one of the following is the exhaust pipe emission from Fuel Cell Electric Vehicles, powered by hydrogen?

[A] Hydrogen peroxide

[B] Hydronium

[C] Oxygen

[D] Water vapour

Answer: D

Q. With reference to 'fuel cells' in which hydrogen-rich fuel and oxygen are used to generate electricity, consider the following statements: 2015

1. **If pure hydrogen is used as a fuel, the fuel cell emits heat and water as by-products.**
2. **Fuel cells can be used for powering buildings and not for small devices like laptop computers.**
3. **Fuel cells produce electricity in the form of Alternating Current (AC).**

Which of the statements given above is/are correct?

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

Answer: (a) 1 only

- **Fuel cells can power almost any portable device or machine that uses batteries. Laptop computers, cellular phones, and hearing aids could be powered by portable fuel cells. Hence statement 2 is incorrect.**
- Hydrogen-powered fuel cells are more energy-efficient than traditional combustion technologies.
- Fuel cells produce electricity in the form of **direct current (DC). Hence statement 3 is incorrect.**

1. INSV Tarini (2017)

- The Indian Naval Sailing Vessel (INSV) Tarini **is an indigenously built, 56-foot sailing vessel**
- **Part of** Navika Sagar Parikrama expedition
- **Symbolic naming:** The vessel is named after the **Tara-Tarini hill shrine** in **Odisha**, which was historically revered by sailors for **safe voyages**. In Sanskrit, **'Tarini'** means both **boat** and **saviour**
- Successfully circumnavigated the globe with an allwoman crew

About Navika Sagar Parikrama II

- The expedition was **flagged off from Goa on October 2, 2024**, by **Chief of the Naval Staff, Admiral Dinesh K. Tripathi**.
- **Total distance:** The mission aims to cover **23,400 nautical miles (approximately 43,300 km)** in **eight months**, sailing across **three oceans** and **three major capes**.
- **Route covered:**
  - **Fremantle, Australia**
  - **Lyttelton, New Zealand**
  - **Port Stanley, Falkland Islands (UK)**
  - **Cape Town, South Africa** (final stop before returning to India)
- The mission is scheduled to conclude in **May 2025**, when INSV Tarini returns to **Goa**.

NON-INDIGENOUS VESSELS

1 **INS Vikramaditya:** A modified Kiev-class aircraft carrier acquired from Russia. It is currently the flagship of the Indian Navy.

Aircraft Carriers (Historically):

- **INS Vikrant (R11):** India's first aircraft carrier, a Majestic-class carrier acquired from the UK. (Decommissioned).
- **INS Viraat (R22):** Originally HMS Hermes, a Centaur-class carrier acquired from the UK. (Decommissioned in 2017).

3 **Destroyers: Rajput-class:** These are Indian-specific variants of the Soviet Kashin-class destroyers.

4 Frigates: Talwar-class: These are advanced stealth frigates designed and built by Russia..

- **Teg-class:** An upgraded version of the Talwar-class frigates, also built in Russia

5 Submarines:

- **Kilo-class (Sindhughosh-class):** Diesel-electric submarines acquired from Russia.
- **Akula-class (INS Chakra):** A nuclear-powered attack submarine (SSN) leased from Russia (INS Chakra was returned in 2021, but India is expected to lease another Akula-class submarine).
- **Kalvari-class:** These are Scorpène-class diesel-electric submarines designed by the French

INDIGENOUS VESSELS

INS Astradharini (2015) -

- A torpedo launch and recovery vessel, Has a length of 50 meters and can operate in high seas with a maximum speed of 15 knots and Replaced INS Astravahini.

Project 28

- refers to the **Kamorta-class corvettes** of the Indian Navy
- They are the first anti-submarine warfare stealth corvettes to be built in India.
- Four ships were built under this project
- **Names of the Ships:** INS Kamorta, INS Kadmatt, INS Kiltan, and INS Kavaratti. These names are derived from islands in the Lakshadweep archipelago.
- Project 28 was a crucial step towards India's self-reliance in warship building and enhancing its naval capabilities
- They are **indigenously designed** by the Indian Navy's Directorate of Naval Design and **built in India** by Garden Reach Shipbuilders & Engineers (GRSE) in Kolkata.
- Kamorta is part of the Central Nicobar group of islands, belongs to the Nancowry subdivision

Project 17 A (Ongoing) - Guided missile frigates, 75% indigenous- Includes four ships: Nilgiri, Udaygiri, Taragiri, and Mahendragiri.

Project 15 B (Ongoing) - Advanced variants of the Kolkata class guided missile destroyers, 75% indigenous. Includes four ships: INS Visakhapatnam, INS Mormugao, INS Imphal, and INS Surat.

UNMANNED AERIAL VEHICLES (UAV)/DRONE AND ROBOTS

UAV/Drone is a military aircraft/land-water based vehicle that is guided autonomously, by remote control, or both and that carries sensors, target designators, offensive ordnance, or electronic transmitters designed to interfere with or destroy enemy targets.

Name	Indigenous/Imported From	Utility
NETRA	Indigenous (DRDO)	Airborne Early Warning and Control System (AEW&C/AWAC) for surveillance, target tracking, and command and control
Lakshya 2	Indigenous (DRDO)	Advanced pilotless target aircraft (PTA) for training air defense systems, simulating enemy aircraft, and evaluating weapon systems
Nishant	Indigenous (DRDO)	Battlefield surveillance, reconnaissance, target tracking, localization, intelligence gathering, and electronic warfare support
Panchi	Indigenous (DRDO)	Tactical UAV with conventional take-off/landing for reconnaissance, surveillance, target acquisition, and communication relay
Daksh	Indigenous (DRDO)	IED identification and handling, nuclear/chemical contamination monitoring, explosive ordnance disposal (EOD), and search and rescue operations
Daksh Mini	Indigenous (DRDO)	Confined space ROV for inspecting hazardous areas, extracting suspicious objects, and supporting search and rescue operations
UXOR	Indigenous (DRDO)	Unexploded ordnance (UXO) handling and detection, neutralizing bombs and missiles up to 1000 kg
UAV-NETRA	Indigenous (DRDO)	Mini UAV for surveillance, reconnaissance, intelligence gathering, and border monitoring
Rustom 2	Indigenous (DRDO)	Long-endurance MALE UAV for intelligence, surveillance, reconnaissance (ISR), electronic warfare, communication relay, and precision strike
Heron	Imported (Israel)	Medium-altitude long-endurance (MALE) UAV for ISR, border surveillance, target acquisition, and communication relay
FireFly	Imported (Israel)	Loitering munition for precision strikes against ground targets
Harpy/Harop	Imported (Israel)	Loitering munitions for electronic warfare and precision strikes
Predator	Imported (United States)	Medium-altitude long-endurance (MALE) UAV for ISR, strike missions, and combat search and rescue
Sea Guardian	Imported (United States)	Maritime surveillance UAV for maritime domain awareness and anti-submarine warfare