

FIFTH GENERATION FIGHTER JETS

Context: Aero India 2025 is being held at the Indian Air Force station in Yelahanka, Bengaluru from February 10 to 14.

Fighter Jet Classification

- A fighter jet generation classification categorizes combat aircraft based on their **technological advancements over time**.
- Each generation represents a significant leap in capabilities like speed, manoeuvrability, radar systems, and stealth features, typically spanning from the early subsonic jets to modern stealth fighters with advanced sensors and networking abilities;

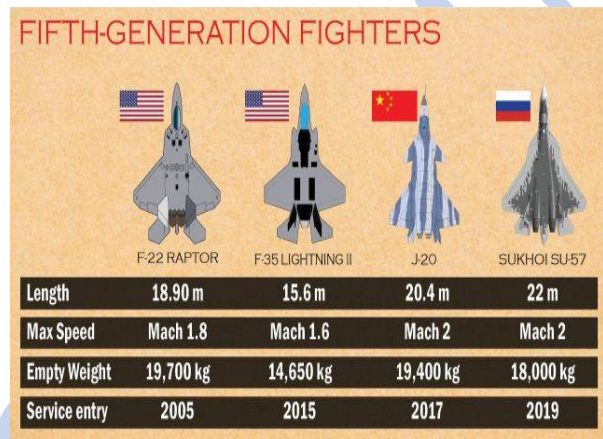
The generations are generally categorized as:

- **First:** Subsonic (*Dassault Ouraga*)
- **Second:** Transonic with basic radar (*MiG-21*)
- **Third:** Improved manoeuvrability and weapons (*SEPECAT Jaguar, MiG-23*)
- **Fourth:** Advanced avionics and multi-role capabilities (*Mirage 2000*)
- **4.5 Generation:** Fourth-generation fighter jets that have been upgraded with advanced avionics (*Sukhoi 30MKI, Dassault Rafale, Tejas MK1*)
- **Fifth:** Stealth technology and highly integrated systems
- **Sixth** generation featuring even more advanced AI and drone integration.

About 5th Generation

- A fifth-generation fighter jet is a highly advanced jet aircraft that uses stealth, advanced avionics, and computer systems to dominate the battlefield compared to all previous generations.

FIFTH-GENERATION FIGHTERS



	F-22 RAPTOR	F-35 LIGHTNING II	J-20	SUKHOI SU-57
Length	18.90 m	15.6 m	20.4 m	22 m
Max Speed	Mach 1.8	Mach 1.6	Mach 2	Mach 2
Empty Weight	19,700 kg	14,650 kg	19,400 kg	18,000 kg
Service entry	2005	2015	2017	2019

Features

- **Stealth:** 5G aircraft have multi-spectral low-observable designs to evade detection.
- **Advanced avionics:** 5G aircraft have integrated systems for real-time data fusion and situational awareness.
- **Self-protection:** 5G aircraft have radar jamming and robust defense mechanisms.
- **Network-centric operations:** 5G aircraft have enhanced communication and coordination with other assets.
- **Pilot role enhancement:** 5G aircraft allow pilots to act as mission commanders, not just operators.

Examples



- **The Russian Su-57**
 - The Su-57 is a **fifth-generation multirole fighter jet designed for air superiority and ground attack missions.**
 - With its capability to engage multiple targets simultaneously and operate in contested airspace, the Su-57 represents Russia’s most advanced fighter technology.
- **The American F22 and F-35**



- The **Lockheed Martin F-35 Lightning II** is considered the **most technologically advanced stealth fighter** in the world.
- Equipped with state-of-the-art avionics, sensor fusion, and electronic warfare capabilities, the **F-35 offers unparalleled situational**

awareness, network-centric warfare integration, and superior stealth characteristics.

- **The Chengdu J-20**



- The Chengdu J-20, or **Mighty Dragon**, is **China's** fifth-generation stealth fighter, designed for air superiority and strike missions, rivaling U.S. F-22 and F-35.
- The J-20 is a **twin-engine, all-weather stealth fighter** developed by China's Chengdu Aircraft Corporation.
- It's designed for **air superiority and precision strikes.**
- The J-20 is the world's fourth fifth-generation stealth fighter, after the American F-22, F-35, and Russian Su-57.

India’s Indigenous Technological Breakthrough: The Advanced Medium Combat Aircraft (AMCA)

- One of the most significant moments of Aero India 2025 will be the unveiling of a model of India's fifth-generation fighter jet, the AMCA
- Developed by the Aeronautical Development Agency (ADA) and Hindustan Aeronautics Limited (HAL), **AMCA is a**

major step toward India’s goal of achieving self-reliance in military aviation.

- The AMCA is designed as a twin-engine, multi-role stealth fighter with advanced avionics, super cruise capability, and internal weapons carriage for reduced radar visibility.

Source: In first, US F-35 and Russian Su-57 take to the skies at Aero India (Indian Express)

PLACES IN NEWS

Tibet Autonomous Region

- The Tibet Autonomous Region is located on the Tibetan Plateau, the **highest region on earth**.
- In northern Tibet elevations reach an average of over 4,572 metres (15,000 ft). Mount Everest is located on Tibet’s border with Nepal.
- China’s provincial-level areas of **Xinjiang, Qinghai and Sichuan** lie to the north, northeast and east, of the Tibet.
- The lake region extends from the **Pangong Tso Lake in Ladakh, Lake Rakshastal, Yamdrok Lake and Lake Manasarovar** near the source of the Indus River, to the sources of the Salween, the Mekong and the Yangtze.
- The lake region is a wind-swept **Alpine grassland**. This region is called the Chang Tang (Byang sang) or ‘Northern Plateau’ by the people of Tibet.
- Tibet Autonomous Region harbors the largest reserve of fresh water outside the North and South Polar Regions, supplying water for approximately 20 percent of the world's population.
- The river region is characterized by fertile mountain valleys and includes the **Yarlung**

Tsangpo River(the upper courses of the Brahmaputra).

- The **YarlungTsangpo Canyon, formed by a horseshoe bend in the river where it flows around NamchaBarwa, is the deepest and possibly longest canyon in the world.**
- Among the mountains there are many narrow valleys. The valleys of Lhasa, Xigazê, Gyantse and the Brahmaputra are free from permafrost, covered with good soil and groves of trees.
- The countries to the south and southwest are Myanmar, India, Bhutan, and Nepal.
- China claims Arunachal Pradesh administered by India as part of the Tibet Autonomous Region. It also claims several areas adjoining the Chumbi Valley that are recognised as Bhutan’s territory.



TERMS IN NEWS

Algorithmic Trading

About Algorithmic Trading:

- Algo trading is **computer assisted** buying and selling of stocks.
- It is also called **automated trading, black-box trading, or algo-trading.**

- It uses a computer program that follows a defined set of instructions (an algorithm) to place a trade.
 - The defined sets of instructions are based on timing, price, quantity, or any mathematical model.



Status in India:

- Algo trading came to India in 2008, but only savvy traders were using it then. Retail traders have started using advanced algos for trading mainly in the past five years.
- Around 50% of the daily trading volume in Indian stock markets is through an advanced form of algo trading where computer programmes execute trade orders based on pre-defined strategies.

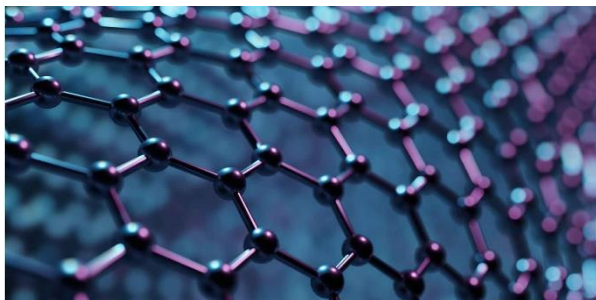
SEBI's stand on Algos:

- Unlike broker terminals which are regulated and monitored by SEBI and Stock exchanges, Algo programmes deployed by traders did not require any exchange approvals so far as there were no rules.
- But SEBI now believes that unregulated/unapproved algos pose a risk to the market and can be misused for systematic market manipulation as well to lure retail investors.

New Algo Trading Framework by SEBI

- It is aimed at spelling out the rights and responsibilities of the main stakeholders of the trading ecosystem such as investors, brokers, algo providers/vendors and Market Infrastructure Institutions (MIIs) so that the retail investors can avail algo facilities with requisite safeguards.
- Under the framework, **retail investors will get access to the approved algos only from the registered brokers.**
- The facility of algo trading would be provided by the stockbroker only after obtaining requisite permission from the stock exchange for each algo.
- All algo orders shall be **tagged with a unique identifier** provided by the exchange in order to establish audit trail and the broker shall seek approval from the exchange for any modification or change to the approved algos,"
- **Brokers** will be solely responsible for **handling investor grievances** related to algo trading and the monitoring of APIs for prohibited activities.
- Algos will be categorised **into two categories**
 - **White box algos:** Where logic is disclosed and replicable i.e. execution algos
 - **Black box algos:** Where the logic is not known to the user and is not replicable.

Graphene



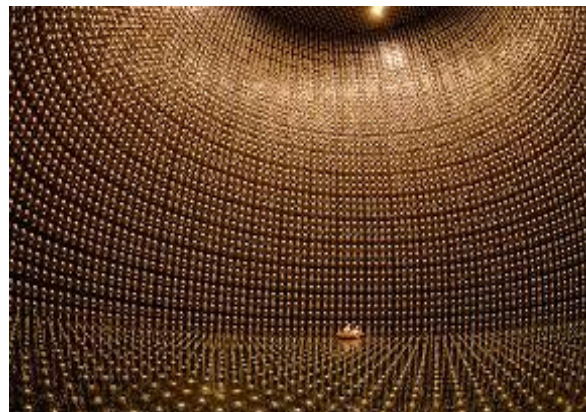
About Graphene

- It is an **allotrope of carbon**, along with diamond and graphite.
- It is a **two-dimensional material** consisting of a **single layer of carbon atoms arranged in a honeycomb structure**.
- The **stacked form** of graphene is **graphite**.
- Graphene was first isolated in 2004. Since then, graphene has found hundreds of innovative **applications, from sensors and electronics to energy storage and healthcare**.

Graphene Properties

- **Thickness:** Graphene is the **world's thinnest material** – it is only one atom thick, one million times thinner than a human hair.
- **Strength:** It is **200 times stronger than steel** but **six times lighter**.
- **Flexibility:** It is **extremely flexible and stretchable**.
- **Conductivity:** It is an **excellent electrical and thermal conductor**.
- **Transparency:** It is **almost perfectly transparent** since it only absorbs 2% of light.
- It is **impermeable to gases**, even those as light as hydrogen or helium.

Neutrinos



- Neutrinos are subatomic **particles** that have negligible **electric charge**, have a small mass, and are **left-handed (the direction of its spin is opposite to the direction of its motion)**.
- They are the **second-most abundant particles in the universe after photons** and the most abundant among particles that make up matter.
- Neutrinos **interact with matter very rarely**, making them difficult to study.
- Neutrinos can change from one type (**electron-neutrino, muon-neutrino, tau-neutrino**) to another as they travel and interact with other particles, a phenomenon called **neutrino oscillation**.
- Neutrinos can **carry information across large distances** due to their low interaction rate with matter.
- They could **potentially be used to transmit information, replacing electromagnetic waves in communication channels**.
- Physicists have built large and sensitive detectors to study neutrinos and maximise the number of interactions between neutrinos and the detector's matter.
- **India's Neutrino Observatory project** is proposed to be set up at **Potti Puram**

village in Theni (Tamil Nadu) in a 1,200-metre-deep cave.

PRACTICE QUESTIONS

Q1: Which among the following is not a 5th Generation Fighter Jet Aircraft

- A. Sukhoi Su-57
- B. Chengdu J-20
- C. F-35 Lightning II
- D. MiG-35

Q2: Consider the following statements regarding Tibet Autonomous Region

1. It is one of the highest regions on earth.
2. It is the largest reserve of fresh water outside the North and South Polar Regions.
3. This region is called the Chang Tang or 'Northern Plateau' by the people of Tibet.

How many of the above statements are incorrect?

- A. Only One
- B. Only Two
- C. All the Above
- D. None of the Above

Q3: Consider the following statements regarding Graphene?

1. It is an allotrope of carbon, along with diamond and graphite.
2. It is a two-dimensional material consisting of a single layer of carbon atoms arranged in a honeycomb structure.
3. The stacked form of graphene is graphite.

How many of the above statements are correct?

- A. Only One
- B. Only Two
- C. All the Above
- D. None of the Above

Q4: Consider the following statements regarding Neutrinos

1. Neutrinos are subatomic particles that have negligible electric charge, have a small mass, and are left-handed (the direction of its spin is opposite to the direction of its motion).
2. They are the second-most abundant particles in the universe after photons and the most abundant among particles that make up matter.
3. Neutrinos interact with matter very rarely, making them difficult to study.

How many of the above statements are incorrect?

- A. Only One
- B. Only Two
- C. All the Above
- D. None of the Above

Q5: Consider the following statements regarding Algorithmic Trading

1. Algo trading is computer assisted buying and selling of stocks.
2. It is also called automated trading, black-box trading, or algo-trading.
3. Only around 1% of the daily trading volume in Indian stock markets is

through an advanced form of algo trading

How many of the above statements are incorrect?

- A. Only One
- B. Only Two
- C. All the Above
- D. None of the Above

Answers

1. D
2. D
3. C
4. D
5. A