You & Technology Jan-2022

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GOOD MORNING TIMES S&T

(JANUARY-2022)

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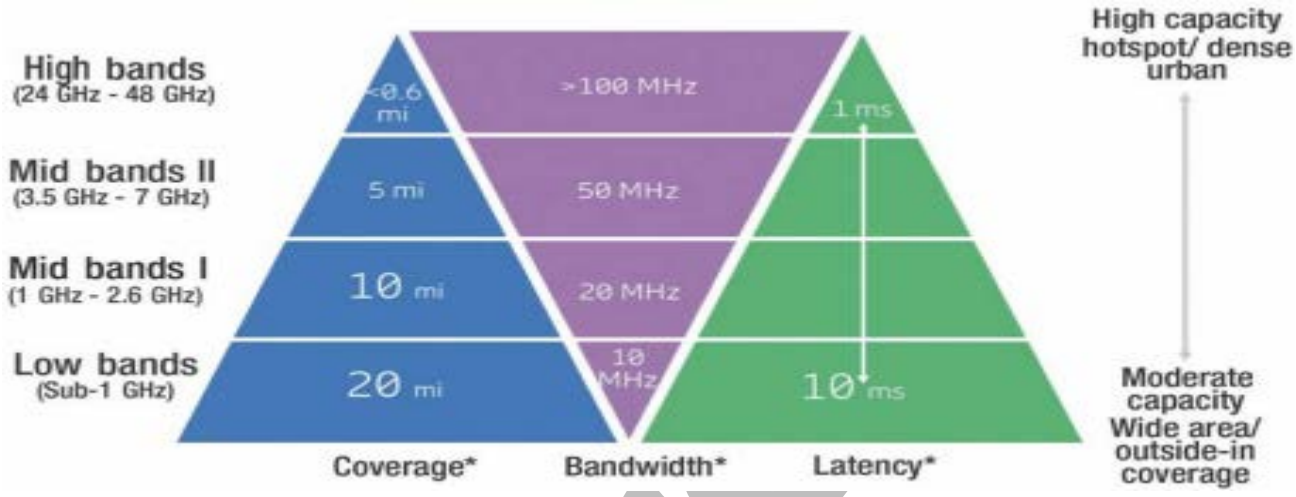
General Studies Paper-3 – S&T – Jan 2022

Millimetre Wave band in 5G

- 5G is the 5th generation mobile network. The 5G networks will operate in the mm Wave spectrum
- 5G mainly work in 3 bands, namely low, mid and high frequency spectrum .



- Millimetre Wave-Band is a particular segment of the radio frequency spectrum that ranges between 24 GHz and 100 GHz.
- This spectrum has a short wavelength, and is appropriate to deliver greater speeds and lower latencies. This in turn makes data transfer efficient and seamless
- 5G services can be deployed using lower frequency bands. They can cover greater distances and are proven to work efficiently even in urban environments, which are prone to interference.
- But, when it comes to data speeds, these bands fail to hit peak potential needed for a true 5G experience. So, mmWave is that quintessential piece in the 5G jigsaw puzzle for mobile service providers.

Securing Internet of Things

- Internet of Things is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices.
- Recently, Ministry of Communications, has released a report "Code of Practice for Securing Consumer Internet of Things(IoT)" to help in securing consumer IoT devices & ecosystem.

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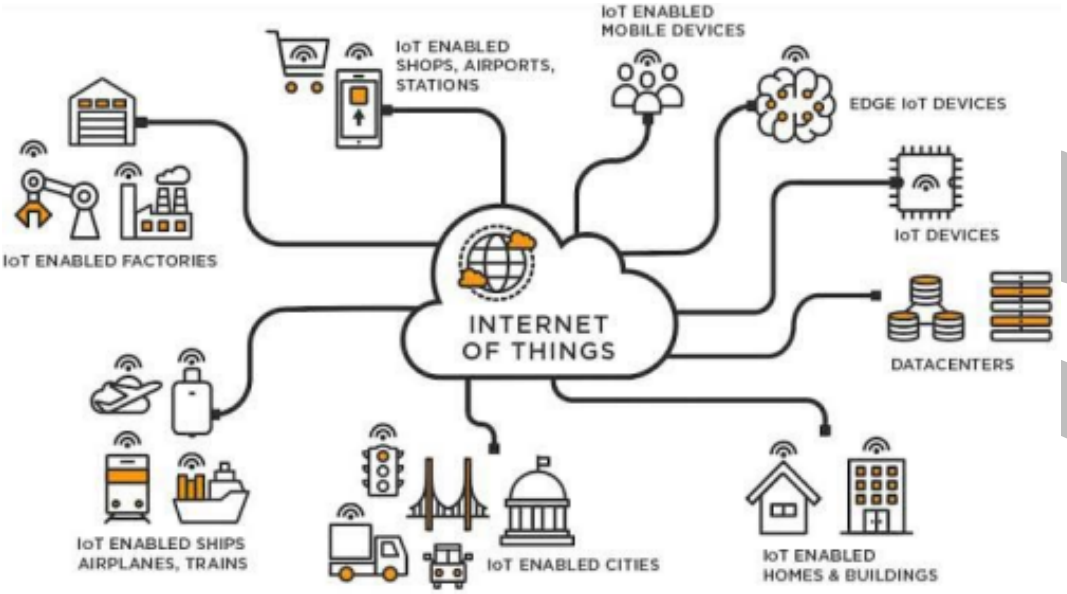
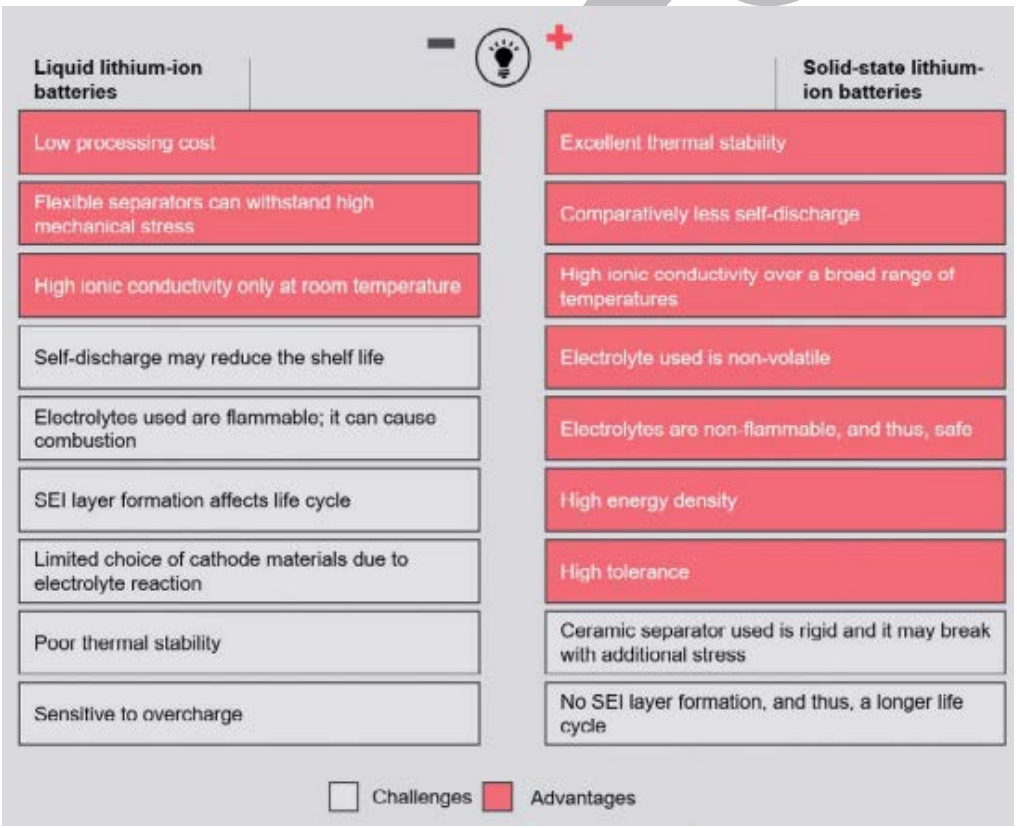


Use of IoT: It is being used to create smart infrastructure in various verticals such as Power, Automotive, Safety & Surveillance, Remote Health Management, Agriculture, Smart Homes and Smart Cities etc, using connected devices.

Guidelines for securing consumer IoT:



- No Universal Default Passwords
- IoT developers should provide a dedicated public point of contact as part of a vulnerability disclosure policy.
- Keep software updated
- Securely store sensitive security parameters
- Devices and services should operate on the 'principle of least privilege'. The Principle of Least Privilege states that a subject should be given only those

privileges needed for it to complete its task

Solid-State Batteries

Car manufacturer Volkswagen plans to have production running for solid-state batteries by 2025 via the partnership with QuantumScape.

- A solid-state battery has higher energy density than a Lithium-ion battery that uses liquid electrolyte solution.
- It doesn't have a risk of explosion or fire, so there is no need to have components for safety, thus saving more space.
- A solid-state battery can increase energy density per unit area since only a small number of batteries are needed. For that reason, a solid-state battery is perfect to make an Electric Vehicle (EV)
- The energy density of lithium-ion cells used in today's mobile phones and electric vehicles is nearly four times higher than that of older-generation nickel-cadmium batteries.
- issues such as long charging times and weak energy density persist.
- The advantages of the solid-state battery technology include higher cell energy density

Lithium-ion Batteries

- It uses an intercalated (Intercalation is the reversible inclusion or insertion of a molecule into materials with layered structures) lithium compound as one electrode material
- The battery consists of electrolyte, which allows for ionic movement
- Lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.
- Lithium-ion Battery Applications include Electronic gadgets, Tele-communication, Aerospace, Industrial applications.

Disadvantages of Li-ion Batteries:

- Long charging times.
- One major problem is that lithium metal is extremely reactive. Safety issues as instances of batteries catching fires have been there.
- Expensive to manufacture.

Other Potential Alternatives to Solid-state Batteries:

- **Graphene Batteries**: Graphene batteries may be an important alternative to lithium-ion batteries, with the latter having limitations due to the frequency with which lithium requires charging. Graphene is a newly stabilised and isolated material.
- **Fluoride Batteries**: Fluoride Batteries have the potential to last eight times longer than lithium batteries.
- **Sand Battery**: This alternative type of lithium-ion battery uses silicon to achieve three times better performance than current graphite Li-ion batteries. The battery is still lithium-ion like the one found in a smartphone, but it uses silicon instead of graphite in the anodes.

- **Ammonia-powered Batteries**: Ammonia-powered batteries may not be coming any time soon, but the chemical commonly known as a household cleaner is still an alternative to lithium in the way it can power fuel cells in vehicles and other equipment.
- **Lithium-Sulphur Batteries**: Researchers in Australia say they have developed the world's most powerful rechargeable battery using lithium-sulphur, said to perform four times better than the strongest batteries currently available.
- **Vertically Aligned Carbon Nanotube Electrode**: These are good candidates for lithium-ion battery electrodes which require high rate capability and capacity

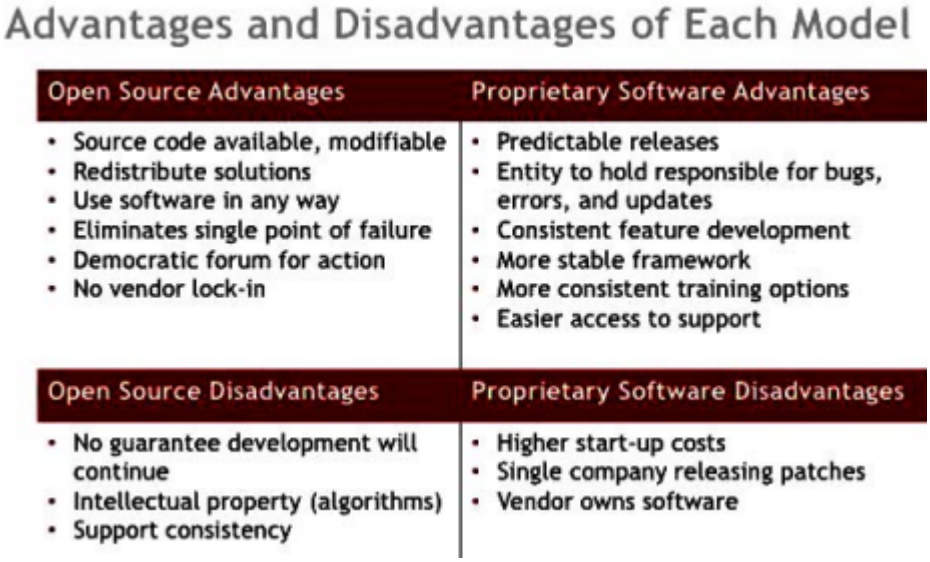
Open Source Software Platform

- Open source software (OSS) is software that is distributed with its source code, making it available for use, modification, and distribution with its original rights
- Recently, the Github, an open-source software repository service was used to create and share an offensively named app that sexually harassed a women in India.

GitHub is the world's largest open-source developer community platform where users upload their projects and code for others to view, edit, and tweak.

The platform uses the software Git, which was created in 2005 by Linus Trovalds, the developer of the open-source operating system Linux, to track changes in a set of files and for coordination in software.

- Source code is the part of software that most computer users don't ever see. It's the code computer programmers manipulate to control how a program or application behaves.
- The idea of making source code freely available originated in 1983 from an ideological movement informally founded by Richard Stallman, a programmer at MIT.



Government Policy on OSS

- The Government of India had issued a Policy on Adoption of Open Source Software in 2015.

- Free and Open Source Software for Education (FOSSEE) Project is a project promoting the use of open source software in educational institutions.
- The government has also made the android version of the Aarogya Setu app open source.

Drones Technology

- It is a layman terminology for Unmanned Aircraft (UA).
- A drone's autonomy level can range from remotely piloted (a human controls its movements) to advanced autonomy, which means that it relies on a system of sensors and LIDAR detectors to calculate its movement.
- Recently, the Ministry of Civil Aviation has suggested to the other Ministries to promote effective use of Drone technology.

Application of Drone Technology:

- Drone system can be used as a symmetric weapon against terrorist attacks. Deployment of drones for combat, communication in remote areas, counter-drone solutions can be done.
- Ministry of Civil Aviation has approved a project with the Telangana government for using drone technology to deliver vaccines in remote areas.
- In the agriculture sector, micronutrients can be spread with the help of drones.
- The drone technology in the SVAMITVA scheme launched by the Government of India, within less than a year, has helped about half a million village residents to get their property cards by mapping out the abadi areas.
- Drones are also significant for the law enforcement agencies, the fire and emergency services wherever human intervention is not safe and the healthcare services.

Risks Involved:

- Increased Risk of Armed Attacks
- Drones are relatively cheaper in comparison to conventional weapons and yet can achieve far more destructive results which is the primary reason for increased number of drone attacks
- threat of them being used to deliver weapons of mass destruction.

New ISRO Chairman S. Somanath

- S. Somanath, an eminent rocket scientist has been appointed as the Chairman of the Indian Space Research Organisation (ISRO) and the Space Secretary.

Major ISRO achievements of 2021:

- Amazonia-1, the optical earth observation satellite of National Institute for Space Research (INPE), would provide remote sensing data to users for monitoring deforestation in the Amazon region and analysis of diversified agriculture across the Brazilian territory
- UNITYsat have been deployed to provide Radio relay services.
- Satish Dhawan Satellite (SDSAT) is a nano satellite intended to study the radiation levels/ space weather and demonstrate long range communication technologies.

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Upcoming Missions:

- Gaganyaan Mission: India's maiden space mission, Gaganyaan, will be launched in 2023.
- Chandrayaan-3 Mission: Chandrayaan-3 is likely to be launched during the third quarter of 2022.
- EOS-4 (Risat-1A) and EOS-6 (Oceansat-3) — will be launched using Isro's workhorse PSLV, the third one, EOS-2 (Microsat), will be launched in the first developmental flight of the Small Satellite Launch Vehicle (SSLV)
- The ISRO is also planning a mission to Venus, tentatively called Shukrayaan
- India is planning to launch its own space station by 2030, joining the league of US, Russia, and China to an elite space club

India's current space activities are currently governed by two national polices which are Satellite Communication Policy (SATCOM) and Remote Sensing Data Policy (RSDP)

Small Satellite Launch Vehicle

- It is the smallest vehicle weighing only 110-tonne. It will take only 72 hours to integrate.
- It can carry satellites weighing up to 500 kg to a low earth orbit while the tried and tested Polar Satellite Launch Vehicle (PSLV) can launch satellites weighing in the range of 1000 kg.
- SSLV is a three-stage all solid vehicle and has a capability to launch up to 500 kg satellite mass into 500 km Low Earth Orbit (LEO) and 300 kg to Sun Synchronous Orbit (SSO).

- The key features of SSLV are low cost, with low turn-around time, flexibility in accommodating multiple satellites, launch on demand feasibility

Negative Ion Technology

- Negative ion technology embeds negative ions in personal products and is currently being advertised as a means to maintain health, balance energy, and improve well-being.
- This technology is used in certain silicone wristbands, quantum or scalar-energy pendants, and kinesthesiology tape.
- Negative ions are also made when sunlight, radiation, air, or water break down oxygen. The minerals that produce these negative ions often include naturally occurring radioactive substances such as uranium and thorium.
- It is believed that negative ions create positive vibes and uplift the mood whereas these ions may also act on pollutants, make them negatively charged and get them collected on surfaces
- The radiation detected in some of these products has been higher than the background level and in some cases high enough to require licensing.
- Recently, the Authority for Nuclear Safety and Radiation Protection (ANVS), Netherlands issued a statement identifying various negative ion wearable products containing more Radioactivity than legally permitted

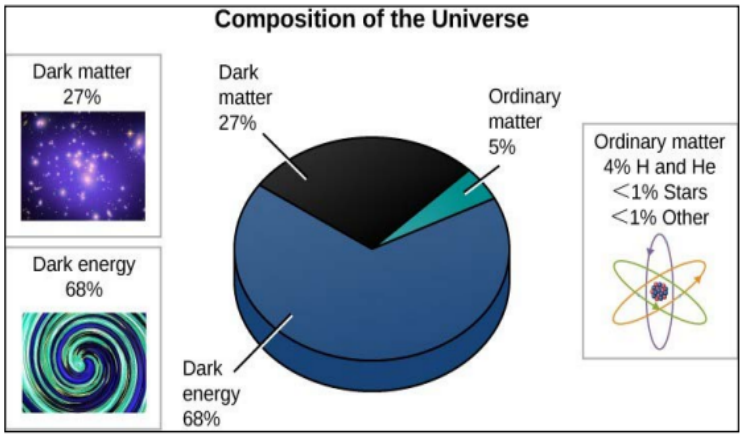
Dark Matter Shapes Galaxies

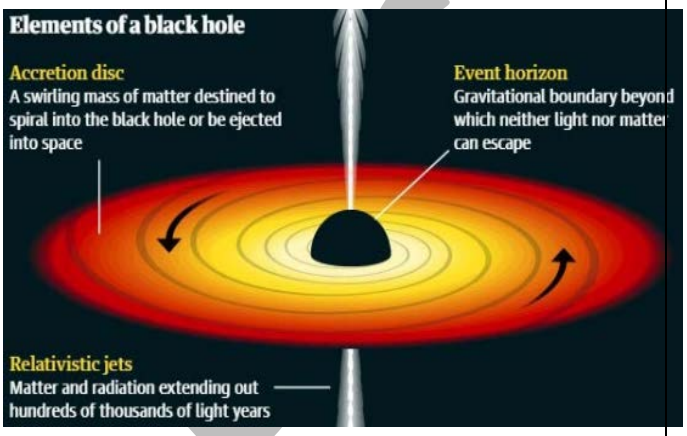
- scientists investigating how the shape of dark matter affects the motion of stars in the centre of some galaxies (stellar bars) have found that out-of-plane bending can be explained through dark matters in barred galaxies.
- Out of plane bending of the bar in barred galaxies is a rare violent bar thickening mechanism known as buckling
- A barred spiral galaxy is a spiral galaxy with a central bar-shaped structure composed of stars.

About Dark Matter:

- Dark matter, though never detected, is believed to be present in the entire universe.
- It is presumed that primordial black holes, those that were formed in the early age of the universe, are a source of dark matter. It was proposed by Professor Stephen Hawking
- It is believed that combined with dark energy, it makes up more than 95% of the universe
- Its gravitational force prevents stars in our Milky Way from flying apart
- Laws of gravity expect us to see stars closer to the center of galaxies rotating faster than the stars on the edge.
- However, in most galaxies, the stars closer to the center and the stars at the edge of the galaxies take almost the same time to make one revolution.
- This implied that something invisible and enveloping the galaxies was giving an extra push to the outer stars, speeding them up.

- The material is considered to be a 'matter' since it has gravitational attraction and it is 'dark' because it does not seem to interact with light (or any part of the electromagnetic spectrum)
- While dark matter attracts and holds galaxies together, dark energy repels and causes the expansion of our universe.





GAGANYAAN

- Indian Space Research Organisation (ISRO) plans to launch Gaganyaan before Independence Day in 2022.
- The Gaganyaan Programme envisages undertaking the demonstration of indigeneous capability to undertake human spaceflight to Low Earth Orbit (LEO)
- two unmanned missions and one manned mission will be carried out.
- ISRO is planning to launch the first uncrewed mission under Gaganyaan in 2022, following which the second unmanned mission "Vyommitra" will carry a robot and this will then be followed by the manned mission.

The major new technologies required for Gaganyaan programme are as follows:

- Human rated launch vehicle
- Crew escape systems
- Habitable orbital module
- Life support system
- Crew selection and training and associated crew management activities

The Orbital module (OM) will be launched by a human-rated GSLV MK-III vehicle and will orbit the Earth with a velocity of about 7,800 metre/second.

Gaganyaan would be smaller in size than the current manned missions of Russian Soyuz, Chinese Shenzhou and NASA's planned Orion spacecraft.

Upcoming Space Missions	Expected date of launch	Key features
Small Satellite Launch Vehicle (SSLV)	• Scheduled for launch in the first quarter of 2022	• It has been built to carry a **500 kg payload to an altitude of 500 km**. • **It is a three-stage**, all-solid vehicle to carry multiple satellite-like nano, micro and small ones. • It would help **to meet the demand of the global launch services market for small satellites.**
Radar Imaging Satellite (RISAT)-1A (EOS-4)	• It is likely be launched in early 2022.	• It will be the **sixth in the series of RISAT satellites developed by ISRO.** • It is a remote sensing satellite has been built to map terrains and study Earth's different land areas and oceans.
Aditya-L1	• ISRO plans to launch it by the middle of 2022.	• This is the first mission **designated by ISRO to study the Sun's atmosphere.** • ISRO has selected L1, or Lagrangian point 1, between the Earth and the Sun to place the Aditya satellite. • The spacecraft will travel a long journey of 1.5 million km from the Earth for this task. • It will conduct **comprehensive research on the processes that occur in the Sun's atmosphere, which would enable us to decipher the outstanding problems in solar physics.**
Chandrayaan 3	• It is likely to be launched during the third quarter of 2022.	• The space agency is aiming to achieve a **soft landing on the south pole of the lunar surface, which is the least explored region of the Moon to date.** • Unlike its predecessor, Chandrayaan 3 will not carry an orbiter—but will include a lander and a rover to study the lunar surface
NASA-ISRO Synthetic Aperture Radar (NISAR) mission	• It is scheduled for launch in 2023.	• It is optimised for **studying hazards and global environmental change and can help manage natural resources better**. • It will provide information to scientists to better understand the effects and pace of climate change.
Shukrayaan-1	• It is expected to be launched either in 2024 or 2026.	• It is a **proposed orbiter to Venus.** • It will be the first visit to the brightest planet in solar system, Venus.

ANTI-MICROBIAL RESISTANCE (AMR)

- Antimicrobials are used to fight diseases in humans, animals and plants and include antibiotic, antiviral, antifungal and antiparasitic medicines
- Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death

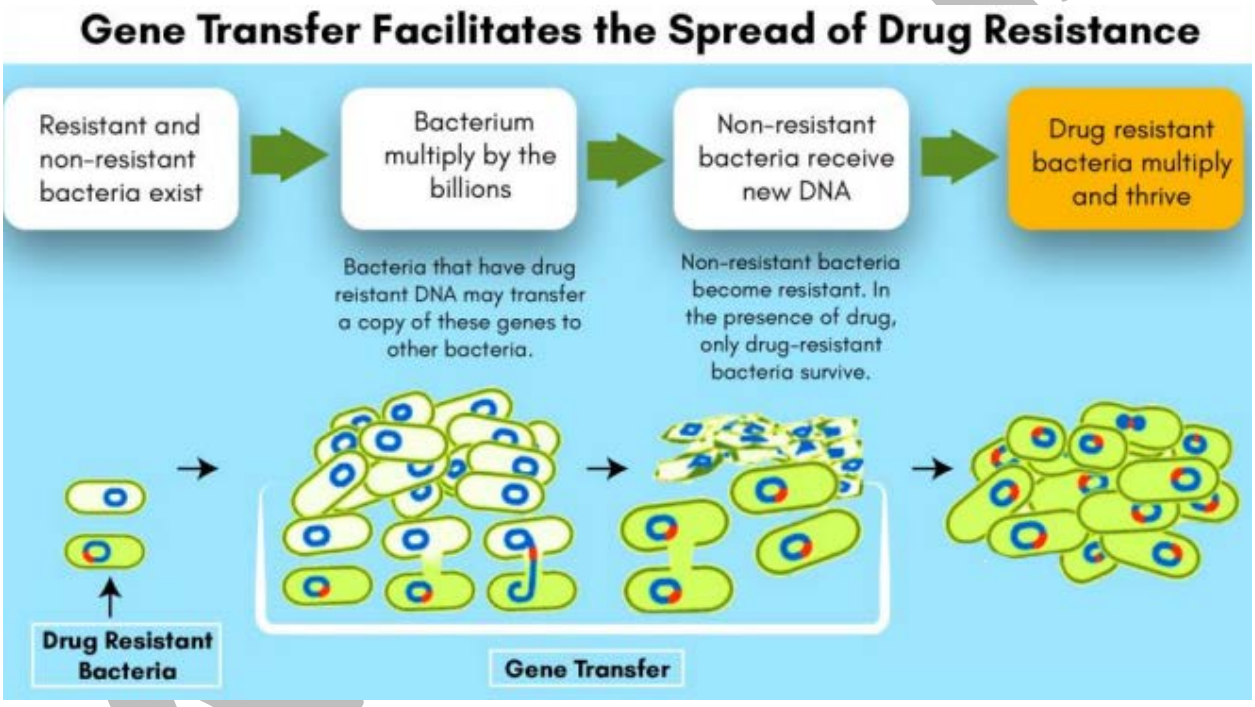
Reasons for the occurrence of AMR

- Unnecessary and injudicious use of antibiotic fixed-dose combinations
- Antibiotic Consumption in Food Animals
- Pharmaceutical Industry Pollution

- Infection Control Practices in Healthcare Settings
- Social factors including self-medication, access to antibiotics without prescription and lack of knowledge about when to use antibiotics.
- Mass bathing in rivers as part of religious mass gathering occasions.

Impacts of AMR:

- New resistance mechanisms make it difficult to treat infectious diseases resulting in prolonged illness, disability and an increase in death rate.
- Owing to lengthier stays in hospitals, additional tests and use of more expensive drugs.
- Adverse impact on animal health As it undermines the effectiveness of veterinary medicines.
- Beyond more direct implications for food production and food safety, it is estimated that in ten years' time, 24 million more people may be forced into extreme poverty because of AMR.



SOLAR FARE CAUSES RADIO BLACKOUT OVER INDIAN OCEAN

- Recently, sun emitted a large solar flare that was observed by NASA's Solar Dynamics Observatory (SDO).
- Solar flares are a sudden explosion of energy caused by reorganizing of magnetic field lines near sunspots.

- Solar magnetic cycle that works in deep interior of Sun creates regions that rise to surface and appear like dark spots. These are sunspots.
- They appear dark because they are cooler than other parts of Sun's surface.
- In a solar flare, energy stored in sun's magnetic structures is converted into light and heat energy. This causes emission of high energy x-ray radiation and highly accelerated charged particles to leave the sun's surface.
- solar flares also cause hot plasma to be ejected from Sun, causing a solar storm, and this is called Coronal Mass Ejection (CME).

AMR in India

- As the largest producer and consumer of antibiotics in the world, **India has been labelled the "epicentre" of AMR**, with both substandard healthcare practices and poor water quality and sanitation contributing to the problem
- The **Ministry of Health & Family Welfare (MoHFW) identified AMR as one of the top 10 priorities** for the ministry's collaborative work with WHO.
- In 2012, India's medical societies adopted the **Chennai Declaration**, a set of national recommendations to promote antibiotic stewardship.
- **India's Red Line campaign** demands that prescription-only antibiotics be marked with a red line, to discourage the over-the-counter sale of antibiotics.
- **National Action Plan on AMR (NAP-AMR) (2017-21) was adopted**, with the Ministry of Health and Family Welfare (MoHFW) as the nodal ministry and the National Centre for Disease Control (NCDC) as the key surveillance body.
- A **separate Schedule H-1** has been incorporated in Drug and Cosmetic rules to regulate the sale of antimicrobials in the country.
- Government has **capped the maximum levels of drugs that can be used for growth promotion in meat** and meat products.

OMISURE

- It is made in India kit to detect the omicron.
- It is developed by The Tata Medical and Diagnostics that can detect the Omicron during the RT-PCR tests.

5G TECHNOLOGY POSES A SERIOUS THREAT TO THE AIRLINE SAFETY

- Amid growing concerns over the aviation crisis in the USA over deployment of 5G services, Air India and other carriers have curtailed flights to US.
- US auctioned mid-range 5G bandwidth to mobile phone companies in the 3.7-3.98 GHz range on the spectrum which is close to the airwaves the altimeters use, giving rise to concerns about potential interference of 5G with sensitive aircraft electronics

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MAGNETIC FIELD ON AN EXOPLANET

- An exoplanet is any planet beyond our solar system
- Most orbit other stars, but free-floating exoplanets, called rogue planets, orbit galactic center and are untethered to any star
- Earth's magnetic field acts as a shield against energetic particles from the sun known as the solar wind.
- Magnetic fields could play similar roles on other planets
- Researchers have identified the first signature of a magnetic field surrounding an Exoplanet HAT-P-11b

CHINA'S CHANG'E 5 LUNAR PROBE FINDS FIRST ON-SITE EVIDENCE OF WATER ON MOON'S SURFACE

- Presence of water had been confirmed by remote observation but the lander has now detected signs of water in rocks and soil
- It also revealed that the moon had turned drier, owing probably to the degassing of its mantle reservoir.
- India's Chandrayaan-1 (2008) data showed evidence for water in the exosphere of Moon, on the surface of Moon and also sub-surface.
- Other lunar missions: Artemis (NASA), Volatiles Investigating Polar Exploration Rover (NASA), Korea Pathfinder Lunar Orbiter (South Korea), Chandrayaan3 (India).

DARK GENOME

- Scientists investigating the DNA outside our genes (the 'dark genome) have

Global Efforts towards controlling AMR

- **One Health Global Leaders Group on Antimicrobial Resistance (AMR):** Launched by **Food and Agriculture Organization, World Organisation for Animal Health and World Health Organization**.
  - It works for polices and legislation **to govern the importation, manufacture, distribution and use of quality antimicrobial drugs across all sectors at global and regional levels.**
- **Global Antimicrobial Resistance Surveillance System (GLASS) by WHO**.
- **AWaRE tool by WHO**: It is aimed at guiding policy-makers and health workers to use antibiotics safely and more effectively. It classifies antibiotics into three groups:
  - **Access**- antibiotics used to treat the most common and serious infections
  - **Watch**- antibiotics available at all times in the healthcare system
  - **Reserve**- antibiotics to be used sparingly or preserved and used only as a last resort
- **Global Action Plan on antimicrobial resistance** aims to ensure prevention and treatment of infectious diseases with safe and effective medicines.

discovered recently evolved regions that code for proteins associated with schizophrenia and bipolar disorder.

- Dark genome refers to 'DNA outside of the regions conventionally defined as genes'.
- They are genes/proteins for which there is minimal knowledge on biological function and, allied to this, limited tools for their analysis (such as antibodies).
- Thus, it adversely affects the precision medicine initiative

GREEN HYDROGEN MICROGRID PROJECTS

- National Thermal Power Corporation Limited (NTPC) has awarded a standalone fuel-cell based Green Hydrogen Microgrid Project at Simhadri in Andhra Pradesh.
- It is India's first Green Hydrogen based Energy Storage Project.
- The hydrogen would be produced using the advanced 240 kW Solid Oxide Electrolyser by taking input power from the nearby Floating Solar project.
- It is a unique project for India and would open doors for decarbonising the far-off regions of the country like Ladakh, J&K etc

National Hydrogen Energy Mission NHEM - AspireIAS

HYPERSONIC WEAPONS

- China tested a nuclear-capable hypersonic missile in August that circled the globe before speeding towards its target, demonstrating an advanced space capability
- Russia announced that it had successfully test launched a Tsirkon hypersonic cruise missile from a Severodvinsk submarine deployed in the Barents Sea
- India is also developing an indigenous, dual-capable hypersonic cruise missile as part of its Hypersonic Technology Demonstrator Vehicle (HSTDV) program
- Hypersonic Weapons are maneuverable weapons that can fly at speeds in excess of Mach 5.
- The speed of sound is Mach 1, and speeds upto Mach 5 are supersonic and speeds above Mach 5 are hypersonic
- Hypersonic weapons travel within the atmosphere and can maneuver midway which combined with their high speeds makes their detection and interception extremely difficult

EARTH'S BLACK BOX

- Being dubbed as the flight recorder version of the planet, the Earth's Black Box will be built in 2022 on the remote West coast of Tasmania, Australia.
- Just like a black box on board an aircraft, the "indestructible" storage device will record humanity's handling of the climate change crisis.
- Tasmania was chosen for its relative geopolitical and environmental safety, and the monolith will be designed to be resilient against threats including cyclones, earthquakes

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NASA'S IMAGING X-RAY POLARIMETRY EXPLORER

- NASA's newest X-ray observatory was launched to study exploded stars, black holes and other violent high-energy events unfolding in the universe.
- IXPE observatory is a joint effort of NASA and the Italian Space Agency
- The mission will study "the most extreme and mysterious objects in the universe – supernova remnants, supermassive black holes, and dozens of other high-energy objects
- The mission's primary length is two years and the observatory will be at 600 kilometers altitude, orbiting around Earth's equator

Instruments Onboard

- IXPE carries three state-of-the-art space telescopes. Each of the three identical telescopes hosts one light-weight X-ray mirror
- This new mission will complement other X-ray telescopes such as the Chandra X-ray Observatory and the European Space Agency's X-ray observatory, XMM-Newton

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1. Geography OPTIONAL and RRVAP (Rapid round value addition programme with TEST SERIES)

- For the last 5 years favourite programme among students.
- Where you are lacking we are working upon like, Paper-2 in contemporary and geographical manner, Mapping and its application, special emphasis on Thoughts-Regional planning and biogeography.
- Full coverage of geography with writing skill development
- 2013 when the average score was 140 in Geo our students scored 200+ (Isha Dhuna, Nitin Agarwal and Aditya uppal)
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- Same trend in 2015-18
- Starts after 7 days of PT examination

2. Our best and SUCCESS GRADE course Newspaper analysis and writing skill programme.

** Our TM and most successful programme start 7 days of PT exam with the coverage of last **3 years issues** highly helpful in P-2&3 (Seats are limited). *FOR FRESHERS AS WELL AS THOSE WHO WANT TO SCORE 450+ IN MAINS 2019*

3. Writing skill development, enhancement and management programme.

- Best developed programme to enhance the writing skills at individual level
- Yield a fantastic result: RANK-22 (Saloni Rai) and Rank 1 Nandani others….

33 sessions with same day discussion, feedback and evaluation of the copies.

4. Special batch for ETHICS and 150 CASE STUDIES. (15 days with the guidance to score 110+ by DIRECTOR sir)

5. Geography for GS MAINS

6. Sociology, political science and Public administration full course and crash course with writing skills.

7. Ncert Foundation btach.

8. Target-50 GS-FOUNDATION batch for 2022….

All the Best to all my Economics students…
Hope this material will help you.
God bless...JAI Hind

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All the Best
Jai Hind ☺