
Prelims Exam Topics

LIMITATIONS OF RAMAN SPECTROSCOPY

Context

Researchers found that carrot-derived beta-carotene can make palm oil or pig fat mimic the Raman signature of authentic cow ghee.

About the New Finding

- **Method:** Beta-carotene extracted from carrots was added to palm oil and lard, making them resemble cow ghee in colour and Raman profile.
- **Key Finding:** Characteristic Raman markers used to identify cow ghee can be artificially recreated.
- **Verification:** While Raman spectroscopy indicated similarity with cow ghee, ATR-FTIR analysis continued to reveal the original composition of lard and palm oil.
 - **ATR-FTIR Spectroscopy (Attenuated Total Reflectance–Fourier Transform Infrared Spectroscopy)** is a technique used to identify the chemical composition of a substance by measuring how it absorbs infrared (IR) radiation.
- **Significance:** Highlights the need for multiple testing methods instead of relying solely on Raman spectroscopy for food authentication and fraud detection.

About Raman Spectroscopy

- **What is it?** An analytical technique that uses the scattering of laser light to identify the molecular composition of a substance.
- **Principle:** Different molecules scatter light differently, producing a unique spectral “fingerprint”.
- **Developed By:** Named after C. V. Raman, who discovered the Raman Effect.
- **Applications:** Used in food authentication, pharmaceuticals, material science, forensic investigations and chemical analysis.
- **Advantages:** Rapid, non-destructive and requires minimal sample preparation.
- **Limitation:** Can sometimes be misled by added compounds that mimic characteristic spectral signatures, as demonstrated in this study.

WEATHER DETECTED ON A DISTANT EXOPLANET

Context

Scientists using the James Webb Space Telescope (JWST) detected weather patterns on WASP-94A b, an exoplanet located about 700 light-years from Earth.

About WASP-94A b

- **Type:** A Hot Jupiter gas giant, nearly twice the size of Jupiter but with about half its mass.
- **Orbit:** Completes one revolution around its star in just four days.
- **Tidally Locked:** One side permanently faces the star, resulting in an extremely hot dayside and a much colder nightside.
- **Weather System:** Clouds of magnesium silicate, iron and magnesium sulphide form on the cooler nightside and dissipate on the hotter dayside.
- **Detection Method:** Scientists used spectroscopy during the planet's transit to study atmospheric composition and cloud patterns.
- **Significance:** Helps understand exoplanet atmospheres, weather cycles and planetary evolution.

About James Webb Space Telescope (JWST)

- **Launch:** Launched by NASA in December 2021 in collaboration with ESA and CSA.
- **Type:** Largest and most powerful space telescope ever deployed.
- **Location:** Operates around the Sun–Earth L2 (Second Lagrange Point), about 1.5 million km from Earth.
- **Observation Range:** Primarily observes the universe in the infrared spectrum.
- **Major Objectives:** Study the early universe, formation of stars and galaxies, exoplanet atmospheres and potential signs of habitability.
- **Successor:** Considered the successor to the Hubble Space Telescope for deep-space observations.

INDIA–OMAN COMPREHENSIVE ECONOMIC PARTNERSHIP AGREEMENT (CEPA)

Context

The India–Oman CEPA entered into force on 1 June 2026, marking a major milestone in bilateral economic relations and strategic cooperation.

About India–Oman CEPA

- **Market Access:** Oman provides duty-free access to 99.38% of India's exports, covering 98.08% of its tariff lines.

- **Significance:** India becomes only the second country after the United States to secure a comprehensive bilateral trade pact with Oman.
- **Key Export Sectors:** Agriculture, marine products, textiles, gems & jewellery, pharmaceuticals, engineering goods, automobiles and footwear gain full or enhanced market access.
- **Services Liberalisation:** Oman has offered commitments across 127 services sub-sectors, including IT, healthcare, education, engineering, tourism and financial services.
- **Pharmaceutical Advantage:** Products approved by USFDA, EMA, UK MHRA and TGA can obtain marketing authorisation in Oman within 90 days.
- **Trade Facilitation:** Oman will recognise certificates issued by India's Export Inspection Council (EIC), reducing compliance costs and non-tariff barriers.
- **Strategic Connectivity:** Utilises **Oman's ports at Sohar, Duqm and Salalah** as gateways to GCC and East African markets.
- **Protected Sectors:** India excluded sensitive sectors such as dairy, cereals, fruits, vegetables, edible oils, oilseeds, rubber, leather and spices from tariff commitments.

BEAUFORT CASTLE (QALAAAT AL-SHAQIF)

Context

Beaufort Castle in southern Lebanon recently came into focus after Israeli forces captured the strategic hilltop fortress during military operations against Hezbollah.

About Beaufort Castle

- **Location:** Situated in southern Lebanon near Nabatieh, overlooking the Litani River and close to the Israel–Lebanon border.
- **Altitude:** Built on a rocky hill about 700 m above sea level, providing a commanding view of southern Lebanon.
- **Other Names:** Known as **Qalaat al-Shaqif** or **Shaqif Arnoun** in Arabic.
- **History:** Constructed by Crusaders in the 12th century; the name



"Beaufort" means "Beautiful Fortress" in Old French.

- **Strategic Significance**

- **Natural Observation Post:** Overlooks large parts of southern Lebanon, northern Israel, the western Bekaa Valley and approaches to the Golan Heights.
- **Military Importance:** Its elevated position allows monitoring of troop movements and communication routes across the region.
- **Litani River Region:** Located near the strategically important Litani River, a key geographical feature in southern Lebanon.

SACRED RELICS OF BUDDHA'S CHIEF DISCIPLES ENSHRINED IN MONGOLIA

Context

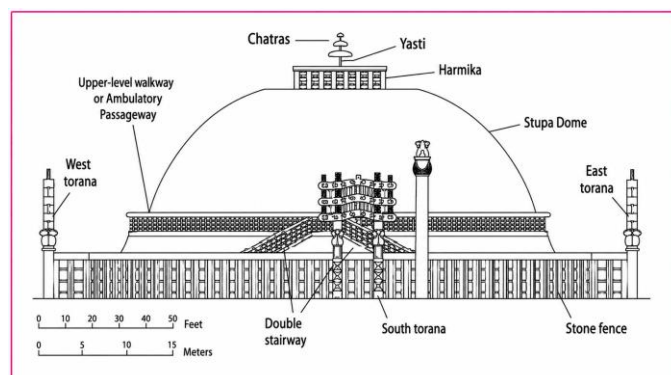
On the occasion of Buddha Purnima (Vesak Day) 2026, the sacred relics of Arhat Sariputra and Arhat Mahamoggallana, the two chief disciples of Lord Buddha, were ceremonially enshrined at the Gandantegchenling Monastery in Mongolia.

About the Relics

- Sacred Buddhist relics preserved at the Sanchi Stupa have been sent to Mongolia for public exposition viewing in Ulaanbaatar (capital of Mongolia). Relics are of the following two disciples:
 - **Arhat Sariputra:** One of the closest and most respected disciples of Lord Buddha who is celebrated for his wisdom, knowledge, and clear understanding of Buddhist teachings.
 - **Arhat Mahamoggallana:** Known for his deep meditation practices and exceptional spiritual attainments while preserving Buddha's teachings.

About Sanchi Stupa

- Located in the Raisen district of Madhya Pradesh, on a plateau near the Betwa River.
- Built by Emperor Ashoka in the 3rd century BCE.
- Houses relics associated with Lord Buddha and some of his most revered disciples.
- Recognized as a UNESCO World Heritage Site since 1989.



- Surrounded by a large stone railing with four beautifully carved gateways, famous for their detailed sculptures depicting Buddhist themes.
- The main stupa consists of a hemispherical dome (Anda), symbolizing the universe and the spiritual journey.
- Above the dome stands the Harmika, a square structure representing the sacred mountain at the center of the world.
- Rising from the Harmika is the Yashti (central pillar), symbolizing the link between heaven and earth.
- The pillar is topped by Chatras (umbrellas), which represent different heavenly realms and spiritual protection.

THE AYUSHMAN BHARAT DIGITAL MISSION (ABDM)

Context

The Ayushman Bharat Digital Mission (ABDM) has crossed a landmark milestone by generating over 90 crore Ayushman Bharat Health Accounts (ABHAs) across the country.

Key Features and Building Blocks

The ABDM architecture is powered by six foundational, open-standard components designed to drive frictionless data exchange across the nation:

- **Ayushman Bharat Health Account (ABHA):** A unique, 14-digit digital health identifier assigned to citizens. It acts as the master key to securely compile, link, and share digital medical histories across different healthcare apps and facilities.
- **Healthcare Professionals Registry (HPR):** A centralized, verified national repository of all licensed healthcare professionals, including doctors, nurses, and paramedical staff practicing across modern and traditional systems of medicine.
- **Health Facility Registry (HFR):** A comprehensive master registry of all public and private medical establishments, including hospitals, clinics, diagnostic centers, and pharmacies across the country.
- **Health Information Exchange & Consent Manager (HIE-CM):** A secure data-routing architecture that ensures medical files are only transferred between doctors and patients using explicit, electronic, and revocable **consent-based protocols**.

- **Unified Health Interface (HI):** An open network protocol that allows patients to seamlessly schedule teleconsultations, book diagnostic slots, or look up medical services across any compliant application or portal.
- **National Health Claims Exchange (NHCE):** A digital platform designed to standardize, quicken, and automate the settlement of health insurance claims between hospitals and insurance providers.

ZERO COUPON ZERO PRINCIPAL INSTRUMENT

Context

Recently, the Ministry of Corporate Affairs (MCA) has allowed companies to deploy a portion of their Corporate Social Responsibility (CSR) spending through Zero Coupon Zero Principal (ZCZP) instruments.

About Zero Coupon Zero Principal Instrument

- It is a financial instrument issued by a not-for-profit organization which carries neither interest payments nor repayment of principal.
- These financial instruments allow non-profit organizations (NPOs) to raise funds that are listed on the social stock exchange.
- This instrument effectively makes it a philanthropic funding mechanism routed through a market framework.
- ZCZP instruments from NPOs are designated for specific projects or activities and must be completed within the timeframe outlined in the fundraising documents.
- This instrument shall be issued in dematerialized form only.
- It shall not be transferable from the original subscriber/ holder till the expiry of the tenure of the said instrument.

KILL SWITCH

Context

Recently, the Reserve Bank of India mentioned in its annual report that it is exploring the **possibility of introducing a 'Kill switch' mechanism.**

About Kill Switch

- It is a mechanism that allows a system, device, account, or service to be shut down, disabled or blocked immediately in an emergency or under specific conditions.
- It allows users at the receiving end of a potential digital scam to immediately stop all financial transactions from their accounts.
- It is expected to function as an emergency control that can immediately freeze or block banking transactions.
- It aims to help users instantly stop banking transactions during suspected digital frauds and improve security across payment systems.

How does it work?

- If someone suspects a request for transfer of funds is fraud or not genuine, they can activate the kill switch through the bank app on the mobile phone to stop money transfers instantly.
- Once triggered, the feature could temporarily stop all outgoing financial transactions from the account.
- Significance: It could give customers control over their digital payment usage and contribute towards controlling fraud in digital payment transactions.

POLYMER BANKNOTES

Context

RBI is reconsidering the introduction of polymer banknotes to reduce rising currency printing costs and improve the durability of notes in circulation.

Features

- Polymer banknotes are **currency notes printed on a thin, flexible plastic substrate rather than the cotton-based paper used in conventional currency.**

- Polymer banknotes are lightweight, water-resistant, tear-resistant, and possess a longer circulation life compared to paper notes.
- They also support advanced security features such as transparent windows, holograms, and specialised inks, making counterfeiting more difficult.
- India had earlier attempted pilot testing of ₹10 polymer notes in 2012 across select cities, but the initiative was discontinued due to operational and technological challenges.

Which Countries Already Use Plastic Banknotes?

- More than **60 countries** have introduced polymer banknotes either fully or partially into their monetary systems. **Australia** was the first, issuing a polymer ten-dollar note in **1988**.
- **Romania** was the first European country to introduce a polymer note in **1998**.

TAIWAN STOCK MARKET RACES AHEAD OF INDIA

Context

Taiwan has overtaken India in terms of total stock market valuation and emerged as the world's 5th largest equity market. Taiwan now ranks behind only the U.S., mainland China, Japan, and Hong Kong, while India has slipped to the 6th position.

Key Driver Behind Taiwan's Rise

- **Dominance of TSMC:** Taiwan's surge has been driven primarily by the exceptional growth of Taiwan Semiconductor Manufacturing Company (TSMC), the world's largest semiconductor manufacturer.
- **Impact of AI Boom:** The rapid expansion of Artificial Intelligence (AI), data centres, and advanced computing technologies significantly increased global demand for semiconductors, boosting Taiwan's market valuation.

Why India Fell Behind?

External Factors Domestic Factors

- **Shift in Global Capital Flows:** Global investors increasingly shifted investments towards AI-driven technology markets and semiconductor-focused economies such as Taiwan.
- **Foreign Portfolio Outflows:** Foreign investors sold nearly \$24 billion worth of Indian equities during the year, putting pressure on Indian market capitalisation.

- **Geopolitical Uncertainty:** US-Iran geopolitical tensions and global uncertainties adversely affected investor sentiment in emerging markets, including India.

Domestic Factors

- **Rising Energy Costs:** Higher energy prices contributed to inflationary pressures and increased production costs.
- **Weakening Rupee:** Depreciation of the Indian rupee reduced investor confidence and affected foreign investment inflows.
- **Moderating Corporate Earnings:** Slower growth in corporate earnings weakened overall market momentum.
- **Limited AI Ecosystem Exposure:** India currently has relatively fewer globally dominant companies directly linked to the AI and semiconductor ecosystem compared to Taiwan.

Mains Exam Topics

PRISONS IN INDIA: OVERCROWDING AND RISING UNDERTRIAL POPULATION

Context

According to the NCRB's Prison Statistics India 2024 report, India's prisons remain overcrowded with an occupancy rate of 112.7%, while undertrial prisoners constitute 72.6% of inmates, exposing persistent weaknesses in the criminal justice system

Who is an intertrial prisoner?

A person who is in judicial custody while awaiting investigation, trial, or final judgment. Such individuals have not been convicted and are legally presumed innocent until proven guilty.

Key Findings of the NCRB Report

- **Persistent Overcrowding:** Despite marginal improvement, prisons in several States continue to operate far beyond their sanctioned capacity.
- **Dominance of Undertrial Prisoners:** Nearly three out of every four prisoners are undertrials, while the share of convicted prisoners has steadily declined over the years.
- **Limited impact:** Prison capacity increased by about 24% between 2015 and 2024, more than 120 new prisons were constructed during this period.







Reasons behind the increase in undertrials

- **Judicial Delays:** More than five crore cases remain pending across courts and criminal trials often take several years to conclude.
- **Restrictive Bail Regime:** Special laws such as the NDPS Act, UAPA, and PMLA impose stringent bail conditions. Bail often becomes difficult even before guilt is established.
- **Social Vulnerability:** Many prisoners are unable to furnish surety bonds despite receiving bail and marginalised and economically weaker sections are disproportionately affected.

OVERCROWDING IN PRISONS



Occupancy rate is the percentage of prisoners in relation to the prison capacity.

STATE / UT	OCCUPANCY RATE (%)
 Delhi	194%
 Jammu & Kashmir	180%
 Uttar Pradesh	160%
 Chhattisgarh	127.6%
 Bihar	110%
 National Average	112.7%

- **Limited Access:** Lack of awareness and inadequate legal representation prolong detention.

Constitutional rights of prisoners

- **Article 21 (Right to Life and Personal Liberty):** The Supreme Court has expanded Article 21 to include:
 - Right to speedy trial
 - Right to dignity
 - Protection from torture and inhuman treatment
 - Humane living conditions in prisons
- **Article 22 (Protection Against Arbitrary Arrest):** Provides safeguards such as:
 - Information regarding grounds of arrest
 - Right to legal counsel
 - Production before a magistrate within 24 hours
- **Article 39A (Equal Access to Justice):** Directs the State to provide free legal aid to ensure that poverty does not become a barrier to justice.

Important Judicial Interventions

- **Hussainara Khatoun v. State of Bihar (1979):** Recognised speedy trial as a fundamental right under Article 21 and it led to the release of thousands of undertrial prisoners.
- **Sunil Batra v. Delhi Administration (1978):** Affirmed that prisoners retain fundamental rights and condemned custodial torture and arbitrary solitary confinement.
- **Arnesh Kumar Judgment (2014):** Restricted unnecessary arrests in offences punishable with imprisonment up to seven years and emphasised that arrest should not be automatic.

Legal framework and Governance of Prisons in India

- **Constitutional Position:** Prisons fall under Entry 4 of the State List in the Seventh Schedule. State Governments are responsible for prison administration while the Union government can provide policy guidance, financial assistance, and model legislation.
- **Governance Paradox:** Although prisons are a State subject, the challenges of overcrowding, undertrial detention, custodial violence, and staff shortages are national in scale. This creates a governance gap that requires cooperative federalism and coordinated reforms.
- **Prisons Act, 1894:** Colonial-era legislation focused largely on custody or discipline and is criticised for its punitive orientation.
- **Prisoners Act, 1900:** Regulates transfer and custody of prisoners.
- **Model Prisons Act, 2023:** Key features include:

- Rehabilitation-oriented approach
- Vocational training
- Mental healthcare services
- Open prisons
- Use of technology and video conferencing
- Social reintegration of prisoners

Institutional Mechanisms for Prison Oversight

- **National Legal Services Authority (NALSA):** Provides free legal aid to prisoners and operates legal aid clinics inside prisons.
- **Parliamentary Standing Committee:** Reviews prison conditions and reform measures and highlights issues of overcrowding, infrastructure deficits, and manpower shortages.
- **Human Rights Commissions:** Monitors custodial violence, deaths, violations of prisoner rights and strengthens accountability within prison administration.

Structural Challenges in Prison Administration

- **Overcrowding:** Existing infrastructure remains inadequate in many States and overcrowding adversely affects living conditions, health, and rehabilitation.
- **Staff Shortages:** Nearly half of sanctioned prison posts remain vacant and the lack of personnel undermines prison management and security.
- **Inadequate Healthcare:** Shortage of doctors and mental health professionals showcases limited access to specialised medical services.
- **Poor Infrastructure:** Insufficient barracks, lack of separate facilities for women, poor sanitation and hygiene and limited rehabilitation and skill-development facilities

Open Prisons

- **Concept:** Open prisons are minimum-security institutions where eligible prisoners live with greater freedom and engage in productive work.
- **Benefits:** Reduces overcrowding in conventional prisons, encourages rehabilitation and social reintegration, lowers repeat offending and significantly reduces operational costs
- **Successful Examples:** States such as Rajasthan, Madhya Pradesh, and Maharashtra have experimented with open prison models with encouraging results.

Committees recommendations

- **Mulla Committee (1980):** Recommended comprehensive prison reforms, rehabilitation as the central objective of imprisonment and suggested modernisation of prison infrastructure.
- **Krishna Iyer Committee (1983):** Focused on women prisoners, human rights concerns like dignity, healthcare, and humane treatment.
- **Law Commission of India (268th Report, 2017):** Proposed a separate Bail Act and recommended reducing unnecessary pre-trial detention.
- **Model Prisons Act, 2023:** Provides a modern framework based on correctional and reformative principles.

Way Forward

- **Reform the Bail System:** Enact a comprehensive Bail Act, simplify surety requirements, ensure that poverty does not become a reason for continued detention.
- **Reduce Trial Delays:** Expand Fast Track Courts, increase judicial strength and to improve case management systems.
- **Strengthen Legal Aid:** Enhance the reach of NALSA and legal aid clinics, conduct regular reviews of long-pending undertrial cases.
- **Promote Open Prisons:** Encourage States to establish more open prison facilities, integrate rehabilitation and livelihood opportunities.
- **Improve Healthcare Facilities:** Institutionalise mental health screening, expand telemedicine services, strengthen de-addiction and counselling programmes.
- **Leverage Technology:** Increase use of e-Courts, video conferencing and facilitate faster bail hearings and trial proceedings.

THE PM SVANIDHI COMPLETES SIX YEARS OF EMPOWERING STREET VENDORS

Context

The Prime Minister Street Vendor's AtmaNirbhar Nidhi scheme has completed six years of public implementation since its initial launch in June 2020.

Key Features of PM SVANidhi:

- **Progressive Collateral-Free Loans:** Provides credit in three separate tranches of ₹15,000, ₹25,000, and ₹50,000. Successive higher limits are unlocked automatically upon the timely repayment of previous loans.
- **Interest Subsidy Incentive:** Incentivizes timely or early loan repayments by offering an **interest subsidy of 7 percent per annum**, which is credited directly to the vendor's account.
- **UPI-Linked RuPay Credit Cards:** Vendors who successfully repay their second tranche become eligible for special UPI-linked RuPay Credit Cards with an operating limit of **up to ₹30,000**.
- **Digital Adoption Cashback:** Offers an annual digital cashback incentive of **up to ₹1,600** to reward and encourage retail or wholesale transactions through digital payment gateways.
- **SVANidhi se Samridhhi (SSS):** Conducts detailed socio-economic profiling of vendors and their families to seamlessly link them with **eight selected Central Government welfare schemes**, creating an institutional safety net.
- **FSSAI Food Safety Training:** Collaborates directly with the Food Safety and Standards Authority of India (FSSAI) to provide specialized capacity building in local financial literacy, digital workflows, and hygiene standards.

Current Status of PM SVANidhi:

- **Massive Loan Disbursals:** More than **75.5 lakh unique street vendors** have accessed the scheme, accounting for over **1.12 crore loan sanctions**.
- **Total Disbursed Capital:** Financial assistance totaling more than **₹17,800 crore** has been funneled directly into India's informal urban markets.

- **Massive Digital Footprint:** Over 55 lakh vendors have been digitally onboarded, executing more than **841 crore digital transactions** worth an estimated **₹8.96 lakh crore**.
- **Extensive Social Net Sanctions:** The SVANidhi se Samridhi sub-program has profiled over 50 lakh families, resulting in **1.52 crore formal welfare benefits** being sanctioned.

Success of the Scheme:

- **First-Time Access to Institutional Credit:** The program successfully broke dependence on high-interest local informal moneylenders by opening standard bank channels for the urban poor.
- **Measurable Growth in Household Vendor Incomes:** Regular access to affordable cash allowed hawkers to expand inventory and secure better long-term earnings.
- **Deepening Gender and Social Inclusion:** The scheme has acted as a powerful tool for equity, targeting funding directly to vulnerable and marginalized urban groups.
- **Unlocking Expanded Secondary Credit Mobility:** The scheme acts as a financial stepping stone, allowing micro-entrepreneurs to build up their credit scores for larger future business goals.

Challenges Associated with the Scheme:

- **Disparities in Regional and Inter-State Outreach:** While some states have utilized the program extensively, others show lower coverage due to varying local implementation speeds..
- **Persistent Friction in Initial Turnaround Timelines:** Despite a strong end-to-end digital portal, documentation delays can still slow down fast-paced urban businesses.
- **Vulnerability of Small Vendors to Harsh Seasonal Closures:** Extreme weather and heavy monsoons cause seasonal losses that make fixed repayment schedules a burden.
- **Sustaining Long-Term Digital Literacy and Cashback Utilization:** Onboarding a vendor does not automatically mean they understand or regularly use digital accounts.

Way Forward:

- **Deploying U-WIN Style Mapping for Regional Balances:** Use advanced data dashboards to spot low-coverage urban municipal wards, helping local field teams onboard vendors in lagging states.

- **Integrating FSSAI Hygiene Training with Smart Cart Upgrades:** Expand the ongoing food safety courses for street vendors by offering extra, low-interest micro-loans to help them buy clean, modern vending carts.
- **Automating Tranche Transitions via AI Credit Scoring:** Program the central SVANidhi app to instantly approve higher loan tranches the moment a vendor successfully settles their previous balance, skipping repetitive paperwork.
- **Introducing Flexible Repayment Windows During Peak Monsoons:** Restructure repayment models to allow lower, flexible daily terms during rainy or off-season months, helping vendors protect their credit scores when sales are low

