(GS PAPER II – GOVERNANCE & SOCIAL JUSTICE)

Surrogacy Age Cap Challenge before Supreme Court

Introduction:

The **Supreme Court recently reserved its verdict** on petitions challenging the age cap prescribed under the **Assisted Reproductive Technology (Regulation) Act, 2021** and the **Surrogacy (Regulation) Act, 2021**. These laws, which ban commercial surrogacy and permit only altruistic surrogacy, have led to disputes over **retrospective application** and their impact on **reproductive rights and personal liberty (Article 21)**.

Key Provisions of Surrogacy Law:

- Intending woman (married): **23–50 years**
- Intending man: **26–55 years**
- Single woman (widow/divorcee): **35–45 years**
- No **transitional ("grandfather") clause** for those who initiated surrogacy prior to the law's enactment.

Petitioners' Arguments:

- **Retrospective application arbitrary:** Couples mid-treatment became ineligible.
- Violates **Articles 14 & 21**: Unreasonable classification and infringement on reproductive autonomy.
- **No transitional safeguards** despite ongoing procedures.
- Discrimination against **unmarried single women**, excluded from eligibility.

Example: A couple (husband 62, wife 56), who lost their only child and began treatment in 2019, became ineligible post-failed embryo transfer in 2022 due to age bar.

Government's Stand:

- Age limits based on **medical expert advice** for safety and child welfare.
- Align with **natural reproductive timelines**; guard against risks of **geriatric pregnancies**.
- **ASG Aishwarya Bhati** cited genetic risks and longevity concerns impacting child-rearing.

Court's Observations:

- Justice B.V. Nagarathna questioned why surrogacy risks are barred when **natural geriatric pregnancies aren't outlawed**.
- Criticised lack of provisions for **genuine couples already in process**, calling it harsh.
- Emphasised law's intent to curb **commercial surrogacy**, not deny genuine parenthood.

Broader Issues:

- Exclusion of **unmarried women** challenged as violative of equality.
- Need for **transitional safeguards** in regulatory laws.
- Raises debate on **state regulation vs. reproductive autonomy**.

Conclusion:

The case underscores the tension between **individual reproductive rights and state regulation**. The SC's verdict could reshape the interpretation of **Articles 14 and 21**, setting crucial precedent on **reproductive autonomy, legislative fairness, and policy design**. A balanced approach accommodating **genuine parenthood while safeguarding ethics** is essential to harmonise law, medical science, and constitutional rights.

(GS PAPER II – HEALTH | GS PAPER III – SCIENCE & TECHNOLOGY)

Malaria's New Frontlines: Vaccines, Innovation, and India's Elimination Goal

Introduction:

India's malaria burden has declined by over 80% (2015–2023), yet persistent hotspots in tribal and forested districts (e.g., Mizoram, Chhattisgarh) pose hurdles to achieving the **National Framework for Malaria Elimination (NFME) 2030 target**. The challenge is compounded by **dual-species prevalence (P. falciparum & P. vivax)**, asymptomatic carriers, and growing drug and insecticide resistance.

Recent Advances in Malaria Vaccines:

1. **RTS,S Vaccine (2021):** First WHO-approved vaccine; ~55% efficacy in year 1, waning by 18 months (needs booster).
2. **R21/Matrix-M Vaccine (2023):** Developed by Oxford & Serum Institute (India); 77% efficacy, low-cost, Indian-made.
3. **Whole-Parasite Vaccines (PfSPZ, PfSPZ-LARC2):** Use weakened parasites; offer up to 79% protection; potential single-dose utility in outbreak zones.
4. **Blood-Stage Vaccines (PfRH5):** Target red blood cell invasion; cross-strain efficacy, complementing pre-erythrocytic vaccines.

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Transmission-Blocking Vaccines (TBVs):

- TBVs prevent parasite transmission via mosquitoes.
- **ICMR's AdFalciVax (2025):** India's first dual-stage (PfCSP + TB antigens) vaccine; stable at room temperature, strong preclinical results.
- **P. vivax TBV (Pvs230D1M):** Human trials in Thailand showed 96% transmission reduction—relevant for India's mixed infections.

Innovative Approaches:

- **Immune Boosters & Antibody Therapy:** Engineered antibodies (e.g., D1D2.v-IgG) block parasite immune evasion.
- **mRNA Platforms:** Rapid adaptability (e.g., Pfs25-based mRNA) showed complete transmission block in mice.
- **Gene Drive Technology:** CRISPR edits mosquito fertility or blocks parasite development; promising but ethically complex.
- **Nanoparticle & Adjuvant-based Vaccines:** Ferritin-CpG formulations reduce liver-stage parasite burden by 95% (mice studies).

Indian Context & Challenges:

- Persistent malaria in **tribal belts, remote geographies, and asymptomatic carriers**.
- **P. vivax relapse** complicates elimination.
- Limited vaccine R&D infrastructure, regulatory delays, and need for GMP-grade production.
- **Healthcare gaps:** Low access in remote districts, need for vector control, doctor training, and resistance monitoring.

Way Forward:

- **Strengthen vaccine R&D:** Public-private partnerships, COVID-style funding, and fast-tracked trials.
- **Integrated approach:** Combine vaccines, vector control, diagnostics, and surveillance.
- **Target hotspots:** Tribal outreach, migrant population coverage, and asymptomatic carrier detection.
- **Capacity building:** Train health workers, improve logistics, and enhance disease reporting (malaria to become notifiable).

Conclusion:

India's malaria elimination by 2030 is a **test of science-policy synergy**. Next-gen vaccines (like R21 & AdFalciVax), innovative tools (gene drives, antibodies), and robust health systems must converge to tackle hidden reservoirs and dual-species transmission. Success will hinge on **decisive, sustained interventions** in endemic zones—transforming malaria elimination from ambition to reality.

PRELIM FACTS

1. Marine Heatwaves (MHWs)

96% of ocean surface affected by MHWs in **2023**, risking permanent temperature shift.

What are MHWs?

- Sea surface temp **3–4°C above normal** for ≥ **5 days**.
- Duration: **Weeks to years**.
- Oceans warmed by **1.5°C in 100 years**; MHWs may be **50x more frequent by 2100**.

Causes:

- **Global Warming:** Oceans absorb **90% of excess heat**.
- **El Nino & PDO:** Warm layers, reduce upwelling, shift temp patterns.
- **Reduced Cloud Cover:** More sunlight heats oceans.
- **Weak Gulf Stream:** Raises sea temp, worsens storms.
- **Arctic Feedback:** Sea-ice melt, coral die-offs reduce CO_2 absorption.

Impacts:

- **Climate:** Intensifies storms, hurricanes; disrupts water cycle.
- **Economic:** Affects fisheries/aquaculture (lobster, crab, scallops).
- **Ecological:** Mass mortality, ecosystem collapse (kelp, coral, seagrass), invasive species.
- **Example: 2011 MHW (Western Australia)**—ecosystem collapse.

Mitigation:

- **Ocean Monitoring:** Tracking & predictive models.
- **Ecosystem Protection:** Reefs, mangroves, wetlands, seagrass restoration.
- **Sustainable Fishing:** Heat-tolerant aquaculture, early warnings.
- **Global Cooperation:** Paris Agreement, **UNCLOS**, **UN Decade of Ocean Science (2021–2030)**.

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- **GHG Cuts:** Renewables, carbon pricing.
- **Pollution Control: UN Plastic Treaty**.

Prelims Keywords:
MHWs, El Nino, PDO, Gulf Stream, Coral Reefs, MPAs, UNCLOS.

2. National Cooperative Development Corporation (NCDC)

The Union Cabinet has approved a ₹2,000 crore grant to the National Cooperative Development Corporation (NCDC) over four years.

About National Cooperative Development Corporation (NCDC):

- **What it is**?
  - NCDC is a statutory body that promotes and finances cooperative development in agriculture, rural industries, and allied sectors.
- **Established in**: Set up in **1963** under an Act of Parliament and functions under the **Ministry of Cooperation**.
- **Headquarters:** Based in **New Delhi**, with 18 regional and state offices across India.
- **Objective:**
  - Promote **self-reliant and sustainable cooperatives** in agriculture and rural industries.
  - Enable cooperatives to access **long-term credit, working capital**, and modern infrastructure.
- **Key Functions:**
  - Finance **production, processing, marketing, and storage** of agricultural produce.
  - Support **import and export** of notified commodities such as fertilizers, machinery, rubber, textiles, etc.
  - Fund **income-generating activities** like dairy, poultry, fisheries, handloom, and sericulture.
  - Extend financial assistance to cooperatives for **rural infrastructure** such as irrigation, sanitation, and animal health.
  - Provide both **grants and loans** to State Governments and directly to eligible cooperative societies.
  - Offer **technical guidance and project preparation** support through its regional offices.
- **Significance of NCDC:**
  - Serves over 13,000 cooperative societies with 2.9 crore members.
  - Enables inclusive rural growth through job creation, especially in women-led and labour cooperatives.
  - Supports cooperatives in cold storage, food processing, fisheries, dairy, and textiles, enhancing value chains.

3. Human Outer Planetary Exploration (HOPE)

Bengaluru-based space company Protoplanet has launched the Human Outer Planetary Exploration (HOPE) station in Ladakh's Tso Kar region to simulate lunar and Martian conditions.

About Human Outer Planetary Exploration (HOPE):

- **What It Is?**
  - HOPE is a **moon and Mars simulation research station** located in Ladakh's high-altitude Tso Kar basin, mimicking off-Earth terrain and environmental conditions.
- **Developed By:** The project is spearheaded by Protoplanet, a Bengaluru-based space outreach organisation, with technical and financial assistance from ISRO.
- **Aim of the Project:**
  - To examine **psychological, physiological, and epigenetic responses** of humans in extreme isolation.
  - To support India's long-term goals of a **crewed lunar mission (by 2040)** and a **space station (by 2035)**.
- **Key Features:**
  - Located at high-altitude, cold-desert terrain resembling lunar and Martian environments.
  - Two scientists will live in isolation for 10 days to test deep space stress resilience.
  - Research includes studies on mental health, biological adaptation, and mission planning.
  - ISRO guided the selection criteria for crew participants.
  - Periodic crew rotation planned to test individual variability in confined conditions.
- **Significance:**
  - Marks a vital step towards India's crewed spaceflight capability and interplanetary mission readiness.
  - Enhances India's presence in the global space research ecosystem, alongside facilities in the US, Canada, and Russia.
  - Provides actionable data for future Bharatiya Antariksh Station and Gaganyaan-type missions.

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4. India commissioned its first indigenously developed 1 MW green hydrogen plant

India commissioned its first indigenously developed 1 MW green hydrogen plant at Deendayal Port, Kandla — a milestone under the National Green Hydrogen Mission and Maritime India Vision 2030.

About India commissioned its first indigenously developed 1 MW green hydrogen plant:

What it is?

- A **1-megawatt green hydrogen facility**, part of a planned 10 MW project to support India's clean maritime operations.
- Located at **Deendayal Port Authority (DPA), Kandla**, Gujarat — the first such facility at an Indian port.

Developed By:

- Fully **Make-in-India initiative** led by Indian engineers.
- Executed by DPA in collaboration with engineering partner **Larsen & Toubro (L&T)**.

Technology Used:

- Uses **indigenously manufactured electrolyzers** to produce green hydrogen via electrolysis using **renewable energy sources**.
- Demonstrates indigenous capacity for **complex clean energy systems**.

Aim:

- To support India's Net Zero goals and transition to clean fuel in maritime transport.
- Aligns with National Green Hydrogen Mission (2023) and Maritime India Vision 2030.

Key Features:

1. **Fast Execution:** Constructed within **4 months** — a model for speed, scale, and skill.
2. **Capacity:** Will produce **~140 metric tonnes of green hydrogen annually**.
3. **Phase-wise Expansion:** First phase (1 MW) commissioned and **5 MW to be added by FY-end**, full 10 MW by mid-next fiscal.
4. **Pilot Use:** Powers **11 hydrogen buses** and port street lighting initially.
5. **Scalable Model:** Aims to run entire port operations on green hydrogen in future.

Significance:

- First port-based hydrogen plant in India, pushing maritime decarbonisation.
- Reduces dependence on fossil fuels in logistics and transport.
- Boosts Aatma-Nirbhar Bharat through indigenous tech and execution.

5. US Sanctions 6 Indian Companies Over Iran Trade

The US Department of State sanctioned 20 global firms, including 6 Indian companies, for engaging in petrochemical trade with Iran.

About US Sanctions 6 Indian Companies Over Iran Trade:

What Are the Sanctions?

- The United States imposed sanctions under **Executive Order 13846**.
- Six Indian companies were identified among the 20 entities globally.

Reason for Sanctions:

- These firms **knowingly engaged** in trade of Iranian petrochemical products.
- The US accuses Iran of using oil revenue to fund **terrorist groups**, **oppress its citizens**, and **destabilize** the Middle East.
- The US policy aims to **cut off economic flows** to the Iranian regime.

Implications:

- All **assets under US jurisdiction** belonging to these companies are now frozen.
- US individuals and companies are **barred from doing business** with them.
- Secondary sanctions risk applies to others trading with these firms.
- The move strains India–US economic diplomacy and raises compliance risks for Indian exporters.

About Iran:

- **Location:** Southwestern Asia
- **Capital:** Tehran
- **Borders:** Armenia, Azerbaijan, Turkmenistan, Afghanistan, Pakistan, Iraq, Turkey**,** Persian Gulf, and Gulf of Oman.
- **Geographical Features:**
- **Mountains**:
    - Zagros Mountains (west–southwest)
    - Alborz Mountains (north, includes Damavand, Iran's highest peak at 5,671 m)

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- **Plateaus and Deserts**:
  - **Central Plateau** bordered by high mountains
  - **Dasht-e Kavir** and **Lut Desert** dominate the interior
- **Rivers**:
  - **Karun River** – only navigable river, flows into the Persian Gulf
  - **Zayandeh River** – vital to Isfahan but heavily depleted
  - **Sefid River** – flows into the Caspian Sea

ANSWER WRITING

Q."The challenge to the surrogacy age cap before the Supreme Court highlights the conflict between reproductive autonomy and state regulation. Discuss in the context of Articles 14 and 21 of the Constitution of India."

The Supreme Court is currently examining petitions against the age cap in the **Assisted Reproductive Technology (Regulation) Act, 2021** and **Surrogacy (Regulation) Act, 2021**, which restrict surrogacy to altruistic cases and prescribe age limits (23–50 years for women, 26–55 years for men, and 35–45 years for single women who are widows/divorcees).

Issues Raised:

1. **Retrospective Application:** Couples who began surrogacy prior to the law's enactment became ineligible, with no transitional or "grandfather" provisions.
2. **Violation of Fundamental Rights:**
   - **Article 14 (Equality):** Arbitrary classification excluding unmarried women and older couples without reasonable justification.
   - **Article 21 (Reproductive Autonomy):** Parenthood is intrinsic to personal liberty, and state interference in reproductive choices raises constitutional concerns.
3. **Case Example:** A couple (husband 62, wife 56) who began fertility treatment in 2019 became ineligible post-failed embryo transfer in 2022, despite medical progress and genuine intent.

Government's Defence:

- Age caps are based on **medical expert advice** to ensure maternal and child health.
- Align with **natural reproductive timelines** and mitigate risks of geriatric parenthood, including genetic complications and longevity concerns.

Court's Observations:

- Justice B.V. Nagarathna questioned why surrogacy risks are barred while **natural geriatric pregnancies remain legal**.
- Criticised lack of provisions for **genuine couples mid-process**, terming it harsh and contrary to the Act's intent of curbing **commercial surrogacy**, not parenthood.

Broader Implications:

- Highlights need for **transitional safeguards** in regulatory laws.
- Opens debate on balancing **public health regulation with individual autonomy**.
- Raises gender justice issues, given the exclusion of **unmarried single women**.

Conclusion:

This case represents a critical test of constitutional interpretation. The SC's verdict may redefine the scope of **Articles 14 and 21** concerning reproductive rights. A balanced approach—preserving ethical safeguards while respecting genuine parenthood—is essential to harmonise law, medical science, and constitutional liberties in India's surrogacy framework.

MCQ

1. Consider the following statements regarding Marine Heatwaves (MHWs):
   1. They are defined as sea surface temperature rising 1–2°C above normal for at least five days.
   2. The Pacific Decadal Oscillation (PDO) is often described as a long-lived El Nino-like pattern of Pacific climate variability.
   3. Oceans have warmed by 1.5°C in the past century, making MHWs up to 50 times more frequent by 2100.

   Which of the above statements is/are correct?
   (a) 1 and 2 only
   (b) 2 and 3 only
   (c) 1 and 3 only
   (d) 1, 2 and 3
2. Which of the following statements about the **National Cooperative Development Corporation (NCDC)** is correct?
   (a) It is an autonomous society under NITI Aayog.
   (b) It was set up in 1963 under an Act of Parliament and functions under the Ministry of Cooperation.
   (c) It is a regulatory authority for cooperative banks.

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(d) It is exclusively responsible for fisheries cooperatives.

3. The Human Outer Planetary Exploration (HOPE) station, recently in news, is:
(a) India's first deep-sea research station in the Indian Ocean.
(b) A Mars mission simulation research station in Ladakh's Tso Kar basin.
(c) An ISRO project for crew training inside the Gaganyaan spacecraft.
(d) A NASA-ISRO joint project for asteroid exploration.

4. The first indigenously developed 1 MW green hydrogen plant in India has been commissioned at:
(a) Jawaharlal Nehru Port, Maharashtra
(b) Paradip Port, Odisha
(c) Deendayal Port, Kandla, Gujarat
(d) Cochin Port, Kerala

5. Which of the following statements regarding India's 1 MW green hydrogen plant is/are correct?
1. It uses indigenously manufactured electrolyzers for hydrogen production.
2. It is part of a larger 10 MW project aligned with the National Green Hydrogen Mission.
3. Initially, it will power hydrogen buses and port street lighting.
Select the correct answer using the code below:
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

6. The recent US sanctions on six Indian companies were imposed under:
(a) CAATSA (Countering America's Adversaries Through Sanctions Act)
(b) Executive Order 13846
(c) International Emergency Economic Powers Act
(d) Iran Nuclear Agreement Act

7. Which of the following rivers of Iran flows into the **Caspian Sea**?
(a) Karun River
(b) Zayandeh River
(c) Sefid River
(d) Euphrates River

8. With reference to the Surrogacy (Regulation) Act, 2021 and the Assisted Reproductive Technology (Regulation) Act, 2021, consider the following statements:
1. The Surrogacy Act permits only altruistic surrogacy and bans commercial surrogacy in India.
2. The age limit for an intending woman (married) under the Surrogacy Act is 21–45 years.
3. Unmarried single women are eligible to avail surrogacy under the Act.
Which of the above statements is/are correct?
(a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

9. With reference to recent advances in malaria vaccines, consider the following statements:
1. RTS,S is the first WHO-approved malaria vaccine with around 55% efficacy in the first year.
2. R21/Matrix-M vaccine, developed by Oxford and Serum Institute of India, has shown over 75% efficacy and is low-cost.
3. Transmission-blocking vaccines (TBVs) prevent malaria infection in humans by targeting liver-stage parasites directly.
Which of the statements given above is/are correct?
(a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

10. Consider the following innovations in malaria prevention and control:
1. AdFalciVax is India's first dual-stage vaccine targeting both pre-erythrocytic and transmission stages of malaria.
2. Gene drive technology uses CRISPR to alter mosquito fertility or parasite development.
3. P. vivax TBV (Pvs230D1M) showed over 90% transmission reduction in human trials.
Which of the statements above is/are correct?
(a) 1 and 2 only
(b) 2 only
(c) 1 and 3 only
(d) 1, 2 and 3

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