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THE HINDU

A Karnataka powered by many economic engines

Prelims : General Studies Paper I

Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

Mains: General Studies 2

Government policies and interventions for development in various sectors and issues arising out of their design and implementation.

Why in Focus?

- **Bengaluru's rapid growth** has increased pressure on roads, housing and infrastructure, with around **12.5 million people** and over **11.5 million vehicles**.
- Karnataka is promoting **"Beyond Bengaluru"** to spread investment, jobs and economic opportunities across different regions instead of concentrating them in the capital.

Key Highlights

- Through the **Karnataka Digital Economy Mission (KDEM)**, clusters in **Mysuru, Mangaluru, Hubballi-Dharwad-Belagavi, Tumakuru, Kalaburagi and Shivamogga** are being developed as new digital and knowledge-economy centres.
- In **June 2026**, 55 industrial projects worth **₹7,506 crore** were approved, with over **28,000 jobs**; 41 projects are planned outside Bengaluru.
- In **August 2026**, 83 projects worth around **₹6,253 crore** were approved, with over **30,000 jobs**; 69 are planned outside Bengaluru.
- The **Local Economy Accelerator Programme (LEAP)** has been allocated **₹1,000 crore over five years** to promote startups, entrepreneurship and emerging technology clusters beyond Bengaluru, targeting **five lakh jobs**.
- The aim is not to copy Bengaluru but to build on the **distinct strengths of each region**.
- **Mysuru** is being developed as Karnataka's **second IT city**, building on its strengths in education, tourism and technology.
- **Coastal Karnataka** can build on ports, maritime connectivity, education, healthcare, banking, fisheries and tourism, linked with technology and the digital economy.
- The **Hubballi-Dharwad-Belagavi** cluster is being developed around **AI, machine learning, Internet of Things (IoT) and advanced manufacturing**, with over 400 startups and more than 4,500 jobs.
- **Tumakuru and Doddaballapura** have been identified as an industrial node with potential investment of around **₹7,000 crore** and more than **88,000 jobs**.
- The model focuses on developing **education, skills, healthcare, connectivity, housing and employment together**, rather than only creating industrial or IT parks.
- The **"Live Near Work"** approach seeks to provide quality housing close to industrial areas, reducing the need for long-distance migration.

- **Agriculture** can also benefit through drones, satellite imagery, digital technology and AI for crop surveys, crop-health assessment and pest and disease monitoring.

Implications

- **Balanced regional development** can reduce excessive pressure on Bengaluru's infrastructure and improve the quality of urban life.
- Development of multiple economic centres can create **local employment**, **reducing migration to Bengaluru from rural areas and other cities.**
- Region-specific economic clusters can make better use of **local skills, resources and existing industries**.
- Growth beyond Bengaluru can strengthen **MSMEs, startups and local supply chains**, spreading the benefits of investment across regions.
- A multi-centre growth model can help Karnataka develop **multiple economic engines** rather than depending heavily on one city.

Way Forward

- Develop regional economic centres based on their **distinct strengths and comparative advantages**.
- Strengthen **industry-academia linkages** and local skill development to ensure local youth benefit from new jobs.
- Integrate **housing, healthcare, education and connectivity** with industrial and technology development.
- Connect **MSMEs, agriculture and rural economies** with emerging technologies and regional supply chains.
- Continue strengthening **Bengaluru while developing new growth centres**, ensuring balanced development across Karnataka.

Mains Question

India's rapid urbanisation and concentration of economic opportunities in a few major cities have widened regional disparities. Discuss how developing multiple regional economic centres can promote balanced and inclusive growth in India.**(250 words)**

Turning economic cooperation into shared prosperity

Prelims : General Studies Paper I

Current events of national and international importance

Mains: General Studies 2

Important International institutions, agencies and fora- their structure, mandate

Why in Focus?

- The **2026 BRICS Chairship of India** provides an opportunity to strengthen economic cooperation focused on **resilience, innovation, cooperation and sustainability**.
- The **UAE's BRICS engagement** highlights the need to turn multilateral cooperation into tangible benefits such as trade, investment, connectivity and resilient supply chains.

Key Highlights

- The UAE became a full member of **BRICS in January 2024**, viewing the grouping as a platform for **multilateralism, dialogue and economic cooperation**.
- The UAE argues that BRICS should focus on **practical outcomes**, including easier trade, stronger investment flows, better connectivity and resilient global value chains.
- The **UAE-India Comprehensive Economic Partnership Agreement (CEPA)** has strengthened trade and investment ties between the two countries.
- In **2025, non-oil bilateral trade between the UAE and India grew by 17% to over $76 billion**, with both countries aiming to increase bilateral trade to **$200 billion by 2032**.
- Economic connectivity extends beyond trade to **investment, innovation, education, tourism, research and cultural exchange**, which help build long-term trust between countries.
- The UAE's economic model is strongly based on **connectivity**, supported by ports, airports, logistics networks, financial centres, universities and innovation institutions.
- **Non-oil sectors accounted for nearly 79% of UAE GDP in 2025.**

- The UAE's **sovereign wealth assets exceeded $2.9 trillion**, and it had **38 Comprehensive Economic Partnership Agreements**.
  - **Sovereign Wealth Funds (SWFs)** are pools of assets owned and managed directly or indirectly by governments to achieve national objectives.
- During India's BRICS Chairship in **2026**, the focus is on building **resilience without closing markets**, promoting innovation and expanding opportunities among businesses, institutions and people.
- The UAE expects **China's BRICS Chairship in 2027** to build on the momentum created by India's leadership.

Implications

- BRICS can strengthen the **Global South's economic resilience** by improving trade, investment, connectivity and development finance.
- The **New Development Bank (NDB)** has approved more than **$40 billion in financing** for infrastructure and **sustainable development** across member countries since its establishment.
- Greater economic cooperation can help members respond to **trade restrictions and supply-chain disruptions** without retreating from global economic integration.
- Stronger links among businesses, institutions and people can build **trust and long-term economic partnerships** beyond government-to-government agreements.
- India's leadership provides an opportunity to make BRICS more **outcome-oriented**, with greater emphasis on implementation rather than only dialogue.

Way Forward

- Focus BRICS cooperation on **tangible outcomes** in trade, investment, connectivity and sustainable development.
- Strengthen **resilient global value chains** while keeping markets open and inclusive.
- Improve **connectivity among member countries** through infrastructure, logistics, digital networks and financial linkages.
- Promote greater **business, academic, research and people-to-people exchanges** to build long-term economic trust.
- Use institutions such as the **New Development Bank** to mobilise finance for infrastructure, innovation and sustainable development.

Mains Question

BRICS has the potential to strengthen economic cooperation among emerging economies and advance the interests of the Global South. Discuss the opportunities and challenges before India in using its BRICS Chairship to promote resilient, inclusive and sustainable global economic cooperation. (250 words

How scientists are using menstrual blood in osteoarthritis treatment

Prelims: General Paper 1

Current events of national and international importance.

Mains: General studies 3

Science and Technology- developments and their applications and effects in everyday life.

Why in Focus?

- Menstrual blood, once treated mainly as biological waste, is now being studied as a valuable source of **biological information**. Research shows its potential in **early disease detection, stem-cell therapy and regenerative medicine**.

Key Highlights:

- Menstrual fluid contains **immune cells, endometrial tissue, proteins and genetic material**. These components can provide biomarkers that may help detect diseases without invasive medical procedures.
- A **2025 population-based study published in the British Medical Journal (BMJ)** found that menstrual blood collected from sanitary pads could detect **Human Papillomavirus (HPV) DNA and precancerous cervical lesions** with accuracy similar to samples collected through clinician-led cervical screening.
- This could make cervical cancer screening

simpler, cheaper and more accessible, as samples could potentially be collected at home. It may also help address barriers such as discomfort, cost, limited healthcare access and embarrassment.

- **Menstrual-blood-derived stem cells** were first isolated in 2007. They come from the **endometrium (inner lining of the uterus)**, which naturally breaks down and regenerates every month. This regenerative ability makes these cells important for medical research.
- Researchers are also studying **Extracellular Vesicles (EVs)** released by these stem cells. EVs are tiny membrane-bound particles released by cells that carry proteins, lipids, **RNA (Ribonucleic Acid)** and signalling molecules that can influence other cells.
- Early research suggests that these EVs may support **cartilage regeneration** and reduce inflammation. This could eventually help treat **osteoarthritis**, which affects hundreds of millions of people worldwide.

Implications:

- Most applications are still at the **experimental or pre-clinical stage**. Strong evidence from large-scale human clinical trials is still needed.
- The **long-term safety** of menstrual-blood-derived stem cells is not yet fully known. Scientists also face difficulties in tracking how long the cells survive inside the body.
- The quality and behaviour of these cells can differ between donors due to factors such as **age, hormonal status and contraceptive history**. This makes standardisation difficult.
- There are currently no universally accepted **quality-control standards** for producing consistent and safe batches of these cells and EVs.
- Menstrual-blood-based screening cannot be used for **non-menstruating individuals**, so it cannot completely replace existing screening methods.
- **Menstrual stigma and lack of awareness** may discourage people from participating in research or using such diagnostic methods, despite their potential benefits.

Way Forward:

- Conduct **large-scale human clinical trials** to establish the safety, effectiveness and long-term benefits of these technologies.
- Develop common **standards and quality-control protocols** for collecting, processing, storing and using menstrual blood, stem cells and EVs.
- Strengthen **regulation and ethical oversight** to ensure that new cell-based therapies are safe and scientifically validated.
- Increase **menstrual health awareness** and reduce social stigma so that people can participate more comfortably in research and screening programmes.
- Promote collaboration between **research institutions, healthcare systems and biotechnology industries** to convert promising laboratory research into affordable and accessible healthcare solutions.

Mains Question:

Menstrual blood is emerging as a potential resource for non-invasive diagnostics and regenerative medicine. Discuss its applications, challenges and the way forward for its safe and effective use. (15 marks, 250 words)

Did OpenAI solve Navier-Stokes problem?

Prelims: General Paper 1

Current events of national and international importance.

Mains: General studies 3

Awareness in the fields of IT, Space, Computers, robotics, nano-technology, bio-technology and issues relating to intellectual property rights.

Why in Focus?

- A controversy has emerged over an **Artificial Intelligence (AI)-generated solution to the Navier-Stokes problem**, one of the biggest unsolved problems in mathematics.
- The issue has raised concerns about **AI use in research, privacy, academic credit and research ethics**.

Key Highlights:

- The **Navier-Stokes equations** are mathematical equations used to explain how **fluids such as water and air move**. They are useful in areas such as aircraft design, weather forecasting and blood-flow studies

> **Navier-Stokes problem = A mathematical problem about whether the equations describing fluid movement always have smooth, predictable solutions.**

- The **Clay Mathematics Institute** has included this problem among the **seven Millennium Prize Problems**. A correct solution can win a **$1 million prize**.
- The main question is simple: **Will the mathematical equations always give a normal, realistic flow, or can they reach a point where the predicted speed becomes impossibly large?**
- Mathematicians **Tristan Buckmaster and Levent Alpöge** were working on one possible method to solve this problem. They used AI tools to help with their mathematical work.
- Later, **OpenAI claimed that its AI system had also found a solution** to the same problem. This created controversy because the route used by OpenAI appeared to be very similar to the route being followed by Buckmaster and Alpöge.
- Buckmaster had reportedly used **OpenAI Codex**, an AI tool that helps convert natural-language instructions into computer code, while working on his research. This led to questions about whether his private research data was used by OpenAI.
- The controversy also raises an important question about **who should receive credit** when AI helps make a scientific discovery, especially when the work is based on ideas developed by human researchers.

Implications:

- **Privacy concern** arises if researchers' private work entered into AI tools is later used to train or improve AI systems without their knowledge or consent.
- **AI-generated results need human checking.** An AI may produce a mathematical answer, but experts must confirm whether the proof is actually correct.
- **Giving academic credit becomes difficult** when AI, current researchers and earlier researchers all contribute to the final result.
- AI can make scientific research **faster and more powerful** by handling large amounts of information and calculations. However, it should not replace human understanding and judgement.
- The incident shows the need for clear **rules for using AI in universities and scientific research**, especially regarding private data, authorship and intellectual property.

Way Forward:

- Protect researchers' **private data** and clearly inform users about how their research material may be stored or used.
- Ensure that important AI-generated discoveries are **independently checked by human experts** before being accepted.
- Create clear rules about **authorship and credit** when AI is used in academic research.
- Maintain proper records of **how AI reached a particular result** so that researchers can verify and reproduce it.
- Promote **human-AI cooperation**, where AI helps researchers work faster while humans remain responsible for verification and final decisions.

Mains Question:

Artificial Intelligence can transform scientific research, but its growing use also raises concerns about privacy, academic credit and human oversight. Discuss with reference to recent developments in mathematical research. (15 marks, 250 words)

KEYWORDS

PM-KUSUM

- **Launched in 2019** by the **Ministry of New and Renewable Energy (MNRE)**, the **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM)** aims to **reduce the use of diesel in agriculture, provide energy security and increase farmers' income**.
- Three Core Components:
  - **Component A** involves setting up **small, decentralised, grid-connected renewable power plants** on barren or fallow land.
  - **Component B** supports the installation of **standalone, off-grid solar agriculture pumps**.
  - **Component C** focuses on **solarising existing grid-connected agriculture pumps**, including **Feeder Level Solarisation (FLS)**.
- Under the financing pattern, **30% Central Financial Assistance (CFA)** and **30% State government subsidy** are provided. The remaining **40% is borne by the farmer**, of which up to **30% can be covered through bank loans**, reducing the farmer's upfront payment to around **10%**.
- Farmers can earn **additional income by selling surplus solar power** to State electricity distribution companies (**DISCOMs**) through long-term **Power Purchase Agreements (PPAs)**.
- Solar pumps can also help **reduce dependence on diesel, carbon emissions and excessive groundwater extraction**, supporting both **farmers' income and environmental sustainability**.

New Development Bank (NDB)

- **NDB** is a **multilateral development bank** established in **2015 by BRICS countries- Brazil, Russia, India, China and South Africa**.
- It aims to **mobilise resources** for **infrastructure and sustainable development projects** in **BRICS and other emerging markets and developing countries.**
- NDB supports projects in both the public and private sectors.
- It provides support through **loans, equity investments and other tailored financial instruments**.
- Its focus is on promoting **sustainable and inclusive development**, economic growth and improving living standards in member countries.

Places in News

Kenai Fjords National Park

- Situated on the **Kenai Peninsula** in south-central Alaska (U.S), the park is known for its dramatic landscape, where **rugged, glacier-carved mountain valleys meet the northern Pacific Ocean**, forming deep coastal fjords.

- More than half of the park is covered by ice, dominated by the **Harding Icefield**, a remnant of the last Ice Age. It is the source of nearly **40 active glaciers**.
- The park is famous for **tidewater glaciers**, which flow directly into the sea. These glaciers often undergo **calving**, where large pieces of ice break off and fall into the water, forming icebergs.
- The meeting of **fresh glacial meltwater and saline seawater** creates highly productive **estuarine ecosystems**.
- These nutrient-rich waters support diverse wildlife, including **humpback whales, orcas, sea otters and Steller sea lions**.
- The coastal region also contains **temperate rainforests**, adding to the park's rich biodiversity.

United Arab Emirates (UAE)

- The **UAE** is a federation of **seven emirates** located along the eastern coast of the **Arabian Peninsula**.
- **Abu Dhabi** is the largest emirate and is known for its **oil wealth**, while **Dubai** is a major global hub for **business, finance and travel**.
- It shares land borders with **Saudi Arabia** to the west and south, and **Oman** to the east and northeast.
- Nearly the entire country is **desert**, with extensive sand areas and some of the world's **largest sand dunes** in the Liwa Oasis region.
- The UAE has **no perennial streams or regularly occurring bodies of surface water**, reflecting its **arid climate**.