1. Highlight the key climatic characteristics of Telangana. Analyze their impact on the state's environment and economy.

Introduction

Telangana, situated on the **Deccan Plateau**, experiences a **semi-arid climate** characterized by hot summers, moderate rainfall, and dry winters. The interplay of its **geographical location, elevation, monsoonal winds, and physiography** shapes its distinct climatic profile. These climatic conditions have far-reaching implications for the state's **environmental sustainability** and **economic development**.

Key Climatic Characteristics of Telangana

➢ **Temperature**

- The state experiences high temperatures, especially during summer (March–June), with **mean maximum temperatures reaching 40°C–43°C**.
- Winters (December–February) are mild and dry, with **minimum temperatures dropping to 13°C–17°C**, occasionally going below 10°C.

➢ **Rainfall**

- **Average annual rainfall is 905.4 mm**, with **80% received from the southwest monsoon** (June–September).
- The **northeast monsoon** (October–December) contributes marginally.
- Rainfall distribution is uneven and often erratic, making agriculture dependent on irrigation.

➢ **Wind Patterns**

- **Northeast dry winds** dominate winters; **southwest monsoon winds** bring rainfall in summer.
- Wind shifts during April–May due to intense land heating, drawing moist air from the southwest.

➢ **Seasonal Variation**

- **Summer**: Extremely hot and dry
- **Monsoon**: Wettest period, vital for agriculture
- **Winter**: Mild, with low precipitation

Impact on Environment and Economy

Environmental Impacts

1. Agriculture

- Semi-arid conditions and irregular rainfall affect **crop yields**, particularly in rain-fed areas.
- **Irrigation from Krishna and Godavari basins** is critical for sustaining agriculture.
- *Example*: Studies in Nalgonda show reduced productivity of paddy and chillies due to climate variability.

2. Biodiversity

- Changes in temperature and precipitation threaten forest ecosystems.
- *Example*: **Forest fires** in **Amrabad Tiger Reserve** have increased due to rising summer temperatures.

Economic Impacts

1. Tourism

- Seasonal climate variations influence footfall in destinations like **Bogatha Waterfalls** and **Somasila**.
- Extreme heat during summers may deter tourists and reduce seasonal income.

2. Industry and Manufacturing

- Water scarcity and heat waves affect **industrial operations**, raising costs and disrupting production.

3. Transport Infrastructure
- Prolonged heat can **damage roads and rail lines**, causing deformation, potholes, or expansion-related risks.

Way Forward

1. **Climate-Resilient Agriculture**
- Promote **drought-resistant crops** and traditional grains (e.g., **MAHARISHI** millet initiative).

2. **Crop Diversification**
- Encourage **oilseeds, legumes**, and **vegetables** to reduce dependence on water-intensive crops.

3. **Irrigation Management**
- Enhance irrigation infrastructure using **river basin systems**.

4. **Monitoring & Research**
- Establish **early warning systems** and invest in **localized climate studies**.

Conclusion

Telangana's climatic profile deeply influences its ecological and economic landscape. Addressing these impacts through **sustainable agriculture, infrastructure resilience, and integrated water management** is crucial for mitigating vulnerabilities and ensuring long-term prosperity in the face of climate change.

2. Critically evaluate the role of the coal sector in ensuring energy security in Telangana. What measures can be taken to enhance the state's overall energy sustainability?

Introduction

Telangana, endowed with the **largest coal reserves in South India**, primarily in the **Godavari Valley coalfields**, relies heavily on **coal-based thermal power** for its energy needs. The **Singareni Collieries Company Limited (SCCL)** plays a pivotal role in supporting the state's energy security. However, the ecological costs and global shift towards clean energy demand a critical reassessment of this dependence.

Role of Coal in Telangana's Energy Security

1. **Reliable Energy Source**
- Coal-fired thermal power plants form a **backbone of Telangana's electricity grid**, ensuring **base-load power** crucial for industrial growth and urbanisation.
- SCCL recorded its **highest-ever production of 671 lakh tonnes in 2022–23**.

2. **Employment & Livelihoods**
- The sector directly employs nearly **44,000 workers** and sustains thousands more indirectly.

3. **Revenue Generation**
- SCCL contributes significantly to state revenues via **royalties, taxes, and CSR funding**. In FY 2019–20, it earned nearly **₹25,828 crore**.

Challenges to Sustainability

➢ **Environmental Degradation**

✓ Open-cast mining in **Ramagundam and Mancherial** regions causes **air pollution, dust emissions**, and **biodiversity loss**.

✓ Water contamination from **acid mine drainage** threatens rivers and aquifers.

➢ **Climate Change Contribution**

✓ Coal-based power is a major source of **greenhouse gas emissions**, inconsistent with India's net-zero ambitions.

➢ **Land Use Conflicts**

✓ Forest clearance and **land degradation** affect agriculture and tribal habitats in **Adilabad, Peddapalli**, and **Jayashankar Bhupalpally**.

➢ **Health Hazards**

✓ Increased **respiratory disorders** in mining zones due to high **PM10 and PM2.5** levels.

➢ **Economic Volatility**
✓ **Coal price fluctuations** and rising logistics costs impact energy affordability and supply planning.

Measures to Enhance Energy Sustainability

➢ **Renewable Energy Expansion**
- Invest in **solar, wind, and hybrid parks**; leverage Telangana's solar potential through rooftop initiatives.
- Example: Telangana's **Electric Vehicle and Energy Storage Policy** supports battery-based grids.

➢ **Clean Coal Technologies**
- Promote **Coal Gasification** and **Ultra Mega Power Projects (UMPPs)** for cleaner thermal output.
- Implement **Carbon Capture and Storage (CCS)** at large thermal stations.

➢ **Energy Efficiency & Diversification**
- Improve efficiency in **industrial, transport, and residential** sectors.
- Develop a **mixed energy basket**—including hydro, nuclear, and bioenergy—to reduce over-reliance on coal.

➢ **Policy & Regulatory Support**
- Enforce **stricter environmental norms** for mining and power plants.
- Incentivize **solar subsidies, net metering**, and private investments in green energy.

➢ **Sustainable Mining Practices**
- Rehabilitate mined land with **afforestation and eco-restoration** projects.
- Engage local communities in **eco-development and CSR-based employment**.

Conclusion

While the coal sector remains a cornerstone of Telangana's energy infrastructure and economy, its long-term sustainability is under scrutiny. A **balanced energy policy**—combining **efficient coal utilization** with aggressive **renewable expansion** and **environmental safeguards**—is critical to securing both Telangana's energy future and ecological integrity. Transitioning smartly today will ensure energy security and environmental resilience tomorrow.