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Syllabus heading

Science, Technology and Environment

UPSC Civil Services (Main) Examination · GS III · General Studies Paper III

Science, Technology and Environment

Facts & figures for this syllabus heading.

Numbers move. Confirm the latest Budget, Economic Survey or census round. This sheet is for revision, not a substitute for the model answer.

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Definition & Overview Biotechnology

Use of living organisms or components for technological advancement.; Bioeconomy: Grew from \$10 billion (2014) to \$165.7 billion (2024).; Contributes 4.25% to India's GDP.; India is currently ranked 12th in the world in biotechnology and 3rd in the Asia-Pacific region.

Employment & Startups 11,855 biotech startups as

35,000+ startups by 2030.; Projected to generate 35 million jobs by 2047.

Government Initiatives National Biopharma Mission

Supports MSMEs and vaccine R&D.; BioE3 Strategy - Focuses on economy, environment, employment.; Bio-RIDE Scheme - Promotes biomanufacturing.; Biotech-KISAN - Strengthens farmers through lab-to-land transfer.; Biotech Parks - Innovation clusters for research & entrepreneurship. Policy & Institutional Support; BioRRAP Portal - Single-window clearance for biotech research.; Regulatory reforms in ethical trials...

Nanotechnology

Environmental Applications; Air/soil purification using nano-materials.; Water treatment through nanobubbles and nanofiltration.; Nanocatalysts for reducing industrial pollutants.; Control of oil spills using absorbent nano-structures. Industrial And Construction Use; Fuel cells and catalytic converters enhanced with nano-coatings.; Nano-steel/cement for stronger, corrosion-resistant structures.; Supercapacitors and...

Nanotechnology

Emerging Focus Areas; Precision agriculture through smart nano-sensors.; Nano-enhanced wastewater treatment systems.; Defense and aerospace components using lightweight nanomaterials. Challenges; Safety concerns around toxicity and environmental effects.; Regulatory gaps in testing and monitoring.; High costs of R&D and commercialization.

Space Economy

Size & Potential; India's space economy is estimated at \$8.4 billion (2026).; Expected to grow to \$40-45 billion in the next 8-10 years.

Space Start-Ups 399 space start-ups currently

Launch vehicles 431581403500014; Satellites; Propulsion systems; Space-grade electronics
Government Spending & Revenue; ISRO has launched 434 foreign satellites so far.; Revenue from foreign satellite launches.; €323 million; \$233 million Private Sector Growth Launch Vehicles;
Number of space startups increased from 1; PSLV: 4-stage; 1,750 kg to SSO; 1,425 kg to (2014) to 400+ (2026) GTO; 100% FDI permitted in space...

Space

Planetary And Deep-Space Missions Satellite Observation And Research; Mars Orbiter Mission: 2014-2022; NISAR: NASA-ISRO joint SAR satellite; maps; JUICE Mission: Collaboration for Jupiter earth every 12 days (2023); Spadex: Twin satellite docking test using; Shukrayaan Mission: Planned for Venus PSLV (Dec 2024); LIGO-India: Gravitational wave observatory; Chandrayaan-3: Soft landing, rover (India leg of global...

Navigation System Human Spaceflight

Gaganyaan; NAVIC: Indigenous satellite navigation; Crewed mission to 400 km orbit for 3 days system; Return and recovery in Indian sea waters; NVS-01: Part of second-generation NavIC; Includes plan for Bharatiya Antariksh satellites Station by 2035

Space

Private Initiatives; L&T to deliver first private PSLV by mid-2025; Startups: Skyroot, Agnikul, Pixxel, Dhruva, GalaxEye, Bellatrix, Kawa Space

Nuclear Technology

Global Nuclear Power; Nuclear energy contributes about 10% of global electricity, rising to nearly 20% in developed nations. Nuclear Reactions; Fission: A heavy atomic nucleus is split into smaller ones by neutron absorption, releasing energy.; Fusion: Light nuclei merge to form heavier nuclei, releasing significantly more energy than fission.

India's Nuclear Capacity Installed nuclear power

8,180 MW (25 reactors); Nuclear energy makes up approximately 3% of India's total electricity generation Capacity has nearly doubled in a decade (from 4,780 MW in 2014 to 8,180 MW in 2024) Government aims to expand to 22,480 MW by 2031-32 and ultimately reach 100 GW by 2047.

Nuclear Technology

Key Nuclear Power Plants; Operational reactors located at Tarapur (Maharashtra), Rajasthan, Kakrapar, Narora, Kaiga, Kalpakkam, Kudankulam, with more underway at Mahi Banswara and Jaitapur (EPRs planned) Three-Stage Nuclear Program 1. PHWRs using natural uranium to produce plutonium (stage I) 2. Fast Breeder Reactors (e.g., PFBR at Kalpakkam) using plutonium (stage II) 3. Advanced Thorium Reactors for uranium-233...

C.V. Raman First Asian Nobel Laureate in

C.V. Raman was awarded the Nobel Prize in Physics for his discovery of the phenomenon of light scattering, known as Raman Scattering, which laid the foundation for a new branch of physics.

Bharat Ratna (1954)

He was the first scientist to receive the Bharat Ratna, India's highest civilian award.; Contribution: Best known for the Raman Effect, which showed that light scattered by molecules undergoes a change in frequency thus revealing information about the molecular structure.

J.C. Bose Pioneer of Wireless Communication

J.C. Bose was among the first to demonstrate wireless communication and is regarded as the Father of Radio Science by the Institute of Electrical and Electronics Engineers (IEEE).; Contributions: Bose made significant contributions to plant physiology and laid the foundations of biophysics and wireless communication.; Father of Bengali Science Fiction: He is also known for being the father of Bengali science...

Vikram Sarabhai Founder of ISRO

Vikram Sarabhai is widely regarded as the founder of the Indian Space Research Organisation (ISRO), which transformed India's space capabilities.; Key Achievements: Sarabhai set up India's first rocket launching station at Thumba in 1963, and in 1975, India's first satellite Aryabhata was launched from the Soviet Union.

Homi Jehangir Bhabha Father of India's Nuclear

Homi Bhabha is considered the father of India's nuclear program and played a key role in the development of India's atomic energy policy.; Institutions Founded: He founded and led the Tata Institute of Fundamental Research (TIFR) and the Bhabha Atomic Research Centre (BARC), which is named in his honor.; Three-Stage Nuclear Program: He conceptualized India's three-stage nuclear power program in the 1950s, which...

S. Chandrashekhar Chandrasekhar Limit

S. Chandrashekhar formulated the Chandrasekhar Limit, which states that a star cannot exceed a certain mass if it is to remain stable against gravitational collapse.; Chandra X-ray Observatory: NASA's Chandra X-ray Observatory is named in his honor to recognize his immense contributions to astrophysics.

Impact

Provides information on local and global AI events.; Maintains a repository of cutting-edge startups and companies in the AI sector.; Offers details on investment opportunities, including venture capital.; Compiles a compendium of AI initiatives from the Government of India and other countries worldwide.

AI for BRTS and City Bus Services

Surat, Gujarat To improve public transport efficiency, fare collection, commuter management, and urban mobility by using AI-enabled systems in BRTS and city bus services.

AI-powered Smart Poles

Bhopal, Madhya Pradesh To create multi-functional smart urban infrastructure by integrating LED lighting, AI surveillance, public Wi-Fi, air-quality sensors, edge computing, and energy optimisation into street poles.

National AI Portal - INDIAai

The objective of the National AI Portal (INDIAai) is to serve as a one-stop digital platform for AI-related developments in India, fostering a unified AI ecosystem, promoting knowledge creation, and supporting economic growth and social empowerment. Impact:; Provides information on local and global AI events.; Maintains a repository of cutting-edge startups and companies in the AI sector.; Offers details on...

Innovations for Defence Excellence (iDEX)

Innovations for Defence Excellence (iDEX) is a unique initiative that provides Indian startups a direct link to the defence industry, creating a platform for easier business dealings with the Ministry of Defence. Impact:; Generation of employment, both direct and indirect, through the initiative.; Serves as a procurement avenue under the Defence Acquisition Procedure, which establishes guidelines for defence...

AI for BRTS and City Bus Services - Surat, Gujarat

To improve public transport efficiency, fare collection, commuter management, and urban mobility by using AI-enabled systems in BRTS and city bus services. NITI AAYOG BEST PRACTISES 14 Impact: Surat has used AI-enabled smart city solutions to strengthen urban transport systems, including intelligent traffic management, smart public transport operations, smart parking, surveillance, energy efficiency, and citizen...

AI-powered Smart Poles - Bhopal, Madhya Pradesh

To create multi-functional smart urban infrastructure by integrating LED lighting, AI surveillance, public Wi-Fi, air-quality sensors, edge computing, and energy optimisation into street poles. Impact: Bhopal's AI-powered smart poles combine street lighting, environmental monitoring, surveillance, and energy management in a single system. The poles use adaptive LED brightness control, PM2.5 and PM10 sensors...

AI for Cleaner City Management - Varanasi, Uttar

To improve urban sanitation and public health by using AI and IoT-enabled waste-management systems for real-time litter detection, smart-bin monitoring, route optimisation, and faster civic response. NITI AAYOG BEST PRACTISES 15 Impact: The initiative uses AI and IoT tools such as real-time litter detection, smart bins, sensor-based monitoring, and data-driven routing to improve solid-waste management. It helped...

International Ip Index

India's Status; Ranked 42nd out of 55 countries in 2023 and 2024.; IP score stands at 38.6%, showing marginal improvement.; Reflects moderate performance in enforcement, innovation, and legal mechanisms.

IpR Issues

Key Issues In India's IpR Ecosystem; Low public awareness and limited understanding of IPR among stakeholders.; Weak enforcement of copyright laws and patent protections.; Exclusion of traditional knowledge from formal patenting systems.; Monopolization risks due to lack of safeguards in patent ownership.; Patent approval delays due to backlog and procedural inefficiencies.; Policy instability deters long-term...

Legal Framework On IpR Patents Act, 1970 (amended)

Governs invention protection.; Designs Act, 2000: Protects original product designs.

Trade Marks Act, 1999

Provides for registration and protection of trademarks.; **Protection of Plant Varieties and Farmers' Rights Act, 2001**: Secures farmer innovation and biodiversity.

Indian Biodiversity

Megadiverse Country & Biodiversity Hotspots; India is one of 17 megadiverse countries, home to approximately 7-8% of global biodiversity despite covering only 2.4% of the Earth's land area.; It includes four global biodiversity hotspots; Western Ghats; Eastern Himalayas; Indo-Burma region; Sundaland (covering the Nicobar Islands) Species Richness; India harbors approximately 92,000 to 97,000 faunal species...

Forest Conservation

Global Forest Status; Forests cover 31% of Earth's land area (~4.06 billion hectares).; Primary forests account for 1.11 billion hectares.

Water Stress

Water Stress & Per Capita Availability; India is classified as water-stressed.; Per-capita water availability.; 2011: ~1,544 m³/year; 2021: ~1,486 m³/year; Projected: ~1,341 m³ (2025), ~1,219 m³ (2050); Water scarcity threshold: ↓ 1,000 m³/year Water Demand & Supply Gap; Forecasted water demand.; ~833 billion m³ (2025); ~899 billion m³ (2050); 54% of India's land area faces high to extreme water stress. Water...

Water Stress

Energy-Water Nexus; 90% of thermal power plants rely on freshwater for cooling.; 40-70% of thermal plants are or will be in high water-stress areas by 2030.; Water shortages have led to supply interruptions and lower performance of several plants.

Water Stress

Infrastructure & Dams; India has 4,407 large dams, the third-highest globally.; Over 1,000 dams are over 50 years old, raising concerns about safety and efficiency.

Air Pollution

National Clean Air Programme (Ncap); Launched in 2019 with a target to reduce PM levels by 20-30% by 2024 (base year: 2017).; Revised goal: 40% reduction in PM10 by 2026.; As of 2024, an average 27% PM reduction was achieved in targeted cities.

Air Pollution

Current Pollution Trends (2025); Delhi has already breached annual pollution safety norms early in the year.; Mumbai's Deonar and Sion zones recorded some of the highest PM2.5 levels in metro regions.; Punjab cities show consistently high pollution levels, even beyond stubble burning seasons.

Government Measures Ethanol blending

E10 target achieved; E20 targeted by 2025-26.; Performance-based grants awarded under NCAP to cities achieving PM reduction targets.; Measures include expanding air quality monitoring, controlling road dust, enforcing industrial norms, and promoting cleaner fuels.

Soil Pollution

Economic And Ecological Impacts; Soil degradation threatens agricultural productivity and food security.; Global cost of land degradation may reach \$23 trillion by 2050 due to loss of food, ecosystem services and income. Legal And Regulatory Framework; Solid Waste Management Rules, 2016; Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016; Plastic Waste Management Rules, 2016; E-Waste...

Plastic Pollution

Global Plastic Scenario; The world produces ~430 million tonnes of plastic annually; over two-thirds are short-lived.; Plastic production is projected to triple by 2060.; Shifting to a circular economy could reduce plastic pollution by 80% by 2040. Marine Ecosystem Impact; Plastic pollution causes an estimated USD 13 billion in annual marine ecosystem damage.; Around 19 million tonnes of plastic leak into the...

Plastic Pollution

Waste Fate And Recycling; 9% of plastic waste is recycled.; 12% is incinerated.; 79% ends up in landfills or the environment.

Plastic Pollution

Regulatory And Implementation Challenges; 25 states failed to submit action plans under Plastic Waste Management Rules.; Over 90% of the plastic industry operates in the informal sector. Government Measures; Plastic Waste Management Rules (2016, amended 2021-22) implemented.; Ban imposed on selected single-use plastic items.; Extended Producer Responsibility (EPR) mechanism introduced.; 2.5 million tonnes of plastic...

Major Climate Agreements UNFCCC (1993)

Stabilize greenhouse gases.; **Kyoto Protocol (2002)** - Binding emission reduction.; **Paris Agreement (2016)** - Limit global warming below 2°C.; **Montreal Protocol (1992)** - Phase-out ozone-depleting substances.; **Kigali Amendment (2019)** - Reduce HFCs.; **International Solar Alliance (2015)** - Promote solar energy.; REDD+ - Reduce deforestation, enhance forest carbon stocks.; Clean Development Mechanism (CDM) - Investment in...

Climate Change

India's Climate Commitments; Net Zero by 2070; 500 GW non-fossil capacity by 2030; 50% electricity from renewables by 2030; Reduce emission intensity by 45% (2005 baseline); 2.5-3 billion tonnes of CO₂ sink by 2030; Avoid 1 billion tonnes of CO₂ by 2030 Sectoral Actions Power;; 50% installed capacity from non-fossil sources.; Renewable Purchase Obligations, Green Term-Ahead Market. Transport;; FAME India, BS-VI...

India's National Plans NAPCC

8 National Missions.; State Action Plans aligned with NAPCC.

Forest Fires

State-wise Data Madhya Pradesh

Highest forest fires in 2025 (~1,743 incidents).; Maharashtra - ~1,245 large fires (Jan-Apr 2025).; Odisha - Over 27,000 fire incidents (Nov 2024-Jun 2025).; Uttarakhand - Around 1,700 fire alerts during 2025-26 season.

Initiatives

National Action on Forest Fires; The Forest Fire Prevention and Management Scheme (FPM); ISRO developed Moderate Resolution Imaging Spectro- radiometer(MODIS),Suomi-National Polar-orbiting Partnership - Visible Infrared Imaging Radiometer Suite(SNPP-VIIRS)for forest fire detection.

49 key performance indicators (KPIs)

22. National Action Plan For Climate Change Guiding Principles; Protection and Inclusion: Prioritize safeguarding vulnerable communities from climate risks.; Sustainable Development: Harmonize ecological sustainability with national economic growth.; Technological Advancements: Use innovation for emission reductions and climate adaptation.

49 key performance indicators (KPIs)

.Other Schemes Related With Environmental Issues Carbon Credit Trading; A strategic initiative by India's Power Ministry, with BEE, to Scheme promote the reduction, removal, or avoidance of greenhouse gas emissions.; Enables trading of Carbon Credit Certificates (CCCs), each representing one tonne of CO₂ equivalent reduced, removed, or avoided.; Open to both obligated entities (with legal emission reduction...

Ganga Prahari

Guardians of the Ganga The objective is to establish a trained cadre of local community members for institutionalizing the conservation efforts of the River Ganga at the grassroots level.

Bio-Decomposer Solution

Fighting Stubble Burning The objective is to combat pollution caused by stubble burning by providing bio-decompose spray to farmers.

Electric Vehicle Policy

Delhi The objective is to implement eco-friendly measures to improve Delhi's air quality by reducing emissions from the transport sector.

Clean Goalpara Green Goalpara

Goalpara, Assam To protect and improve the environment by planting saplings across Goalpara district in a mission-mode effort involving the community and various organizations.

Impact

The initiative successfully planted over 12.6 lakh saplings, increasing the forest coverage area in Goalpara from 19% to 23%.

Implementation of Green Technologies in Road

Goalpara, Assam To provide all-weather connectivity by adopting green technologies, reducing dependence on natural resources, and lowering construction and maintenance costs.

Impact

The initiative has successfully utilized waste plastic and innovative technologies to construct roads, leading to economic benefits and sustainable development for the entire state.

Carbon Neutral Meenangadi

Wayanad, Kerala To develop Meenangadi Gram Panchayat as a carbon-neutral and climate-resilient local body through decentralised climate action, community participation, carbon sequestration, and low-emission development planning.

Bio-village Model

Tripura To promote sustainable rural livelihoods and climate-smart village development by combining organic farming, renewable energy, biogas, improved livestock, and energy-efficient technologies.

LED Street Lighting via ESCO Mode

Thane, Maharashtra To reduce municipal electricity consumption and greenhouse gas emissions by replacing conventional streetlights with energy-efficient LED lights through an Energy Service Company model.

Indira Paryavaran Bhawan

New Delhi To demonstrate energy-efficient and climate-sensitive public infrastructure through a green government building integrating passive design, renewable energy, and efficient resource use.

Sarvajal Project for Providing Safe Drinking Water

Udham Singh Nagar, Uttarakhand To provide community-level safe drinking water to underserved areas using solar-powered, cloud-connected water dispensing kiosks and promote water conservation awareness.

Construction of Subsurface Dams

YSR (Kadapa), Andhra Pradesh To address water shortages in drought-prone Kadapa district by constructing subsurface dams using Z sheet piling technology for sustainable irrigation.

16 Water Resource Conservation

NITI AAYOG BEST PRACTISES 58

16 Water Resource Conservation

NITI AAYOG BEST PRACTISES 59

16 Water Resource Conservation

Recharging Open Wells for Sustainable Water Access - Thrissur, Kerala To ensure sustainable drinking water access by using rooftop rainwater harvesting to recharge open wells through community participation and Panchayati Raj institutions.

16 Water Resource Conservation

NITI AAYOG BEST PRACTISES 60

16 Water Resource Conservation

IMPORTANT CONSTITUTIONAL AMENDMENTS AND ARTICLES

Madhav Gadgil Committee, 2010 [Steps to preserve

Focus Areas Recommendations Classification Classify 64% of the Western Ghats region into Ecologically Sensitive Zones (ESZ1, ESZ2, ESZ3) covering six states, 44 districts, and 142 taluks. Biodiversity Recognize Western Ghats as a UNESCO Biodiversity Hotspot, Hotspot containing over 30% of India's species across various categories. Developmental Restrictions In ESZ-1, halt activities like mining, thermal power...

Shailesh Nayak Committee, 2014 [Regarding Coastal

Focus Areas Recommendations Shift to State Regulate all development and construction activities at the state and Local Bodies local levels, except those requiring environmental clearances. High-Density Reduce the "no-development buffer zone" to 50 meters from the High Rural Areas Tide Line (HTL) for rural areas with population density over 2,161 persons/sq km, and 200 meters for others. IMPORTANT COMMITTEES...

Mihir Shah Committee, 2016 [Augmentation,

Resources] Focus Areas Recommendations National Water Restructure and unify the Central Water Commission (CWC) and Central Ground Commission Water Board (CGWB) into a new National Water Commission (NWC). Irrigation Create an Irrigation Reform Division to assist states with irrigation projects and Reform Division improve water management. River Rejuvena-Establish a River Rejuvenation Division to implement...

Standing Committee Report on Promotion of Climate

The **Standing Committee** on Agriculture chaired by Mr. P.C. Gaddigoudar presented its report on 'Promotion of Climate Resilient Farming' on February 7, 2024. Key findings and recommendations: Impact & Mitigation: Extend the NICRA Scheme to all climate-vulnerable villages using advanced technology for resilience.; Crop Diversification: Promote crop diversification with supportive policies and resources to ensure food...

Ganga Prahari - Guardians of the Ganga

The objective is to establish a trained cadre of local community members for institutionalizing the conservation efforts of the River Ganga at the grassroots level. Impact: Over 2,000 Ganga Praharis (Guardians of the Ganga) identified and registered.; They organize awareness programmes, consultative meetings, and training sessions.; Actively engaged in Ganga Mashal Yatra under NMCG.; Ganga Praharis have used their...

Bio-Decomposer Solution - Fighting Stubble Burning

The objective is to combat pollution caused by stubble burning by providing bio-decomposer spray to farmers. Impact: Soil organic carbon increased by 5.36% to 42.11%, and available nitrogen increased by 2.70% to 24.21% in paddy fields where spraying was applied.; Seed germination of wheat increased by 17% to 20%.; Consumption of DAP and Urea reduced by 20-25 kg per acre.; Wheat productivity increased by 3% to 3.25%...

Electric Vehicle Policy - Delhi

The objective is to implement eco-friendly measures to improve Delhi's air quality by reducing emissions from the transport sector. NITI AAYOG BEST PRACTISES 10 Impact: Approximately 22,000 EVs have been registered.; Over 9,000 EVs have been purchased, with INR 34.31 crore in subsidies disbursed to eligible beneficiaries.; 28 private charging points have been installed, with plans for 100 public charging stations...

Clean Goalpara Green Goalpara - Goalpara, Assam

To protect and improve the environment by planting saplings across Goalpara district in a mission-mode effort involving the community and various organizations. Impact: The initiative successfully planted over 12.6 lakh saplings, increasing the forest coverage area in Goalpara from 19% to 23%.; Topics where it can be Applied: Afforestation, Sustainable Development.; How to Use: Illustrate the success of...

Implementation of Green Technologies in Road

To provide all-weather connectivity by adopting green technologies, reducing dependence on natural resources, and lowering construction and maintenance costs. Impact: The initiative has successfully utilized waste plastic and innovative technologies to construct roads, leading to economic benefits and sustainable development for the entire state.; Topics where it can be Applied: Sustainable Infrastructure...

Carbon Neutral Meenangadi - Wayanad, Kerala

To develop Meenangadi Gram Panchayat as a carbon-neutral and climate-resilient local body through decentralised climate action, community participation, carbon sequestration, and low-emission development planning. Impact: Launched in 2016, Carbon Neutral Meenangadi adopted a bottom-up model for integrating climate action into local development. The initiative prepared an emissions baseline using recognised...

Climate Budget - Odisha

To mainstream climate change concerns into public expenditure by identifying, tracking, and analysing climate-relevant and climate-sensitive budgetary allocations. Impact: Odisha became the first Indian state to prepare a Climate Budget. The initiative uses Climate Budget Tagging to integrate climate-related expenditure into the budgeting process. It classifies sectors and schemes using indicators such as Climate...

Bio-village Model - Tripura

To promote sustainable rural livelihoods and climate-smart village development by combining organic farming, renewable energy, biogas, improved livestock, and energy-efficient technologies. Impact: Tripura's Bio-village concept was introduced by the Directorate of Biotechnology, Government of Tripura in 2018 to promote sustainable agriculture and allied sectors. The model includes biogas units, improved livestock...

Sarvajal Project for Providing Safe Drinking Water

To provide community-level safe drinking water to underserved areas using solar-powered, cloud-connected water dispensing kiosks and promote water conservation awareness. Impact: The initiative in Udham Singh Nagar has enabled remote communities to access clean water, fostering sustainable infrastructure and promoting water conservation through school-led campaigns. Topics where it can be Applied: Water...

'Taanka' Technique for Water Conservation -

To ensure long-term sustainable water conservation by employing traditional rainwater harvesting techniques using underground storage tanks. Impact: The initiative in Sonbhadra has significantly increased water storage capacity, ensuring adequate water supply during peak summer months and reducing reliance on water tankers. Topics where it can be Applied: Water Conservation, Sustainable Agriculture; How to Use...

Construction of Subsurface Dams - YSR (Kadapa),

To address water shortages in drought-prone Kadapa district by constructing subsurface dams using Z sheet piling technology for sustainable irrigation. Impact: The initiative has significantly improved the water table and controlled groundwater level fluctuations, enhancing sustainable irrigation in the region. Topics where it can be Applied: Water Conservation, Sustainable Development; How to Use; Discuss how...

Jal Sabha-led Initiative for Sustainable Drinking

To address the drinking water crisis through community-led planning, pond expansion, women's participation, and a financially sustainable water-management system. Impact: Villagers formed a Jal Sabha and created a Jal Kosh to pool community funds and ensure accountability. The capacity of Gawai Talaab was expanded from 2,869 CuM to 5,218 CuM, while Narsingh Nasa pond was expanded from 2,308 CuM to 26,601 CuM. The...

Jal Dal: Children's Institutions for Water

To ensure clean drinking water in schools and improve enrolment, attendance, and water conservation through student-led water management. Impact: In Godawas Khurd village, a 40,000-litre water tank was constructed in the school and a 10-member student body called Jal Dal was formed to maintain it. The Jal Dal ensured cleanliness of the tank, cleaning of silt chambers, proper functioning of the hand pump, and...

Mazhapolima: Recharging Open Wells for Sustainable

To ensure sustainable drinking water access by using rooftop rainwater harvesting to recharge open wells through community participation and Panchayati Raj institutions. Impact: Launched in 2009 by the Thrissur district administration, Mazhapolima promoted decentralised water management by channelling rooftop rainwater into open wells. The initiative improved groundwater recharge, strengthened drinking water...

Farm Ponds for Water Conservation and Aquaculture -

Pradesh To conserve water, manage liquid waste, promote aquaculture, and create community-friendly public spaces through the construction and maintenance of farm ponds. Impact: Nallajerla Mandal constructed and maintained 827 farm ponds for water conservation. Its 625 km underground drainage system was used to channel liquid waste into these ponds. A special fish species was introduced to prevent foul odour and...

6 Disaster Management

The Sendai Framework for Disaster Risk Reduction (2015-2030) is a non-binding global agreement aimed at reducing disaster risks and losses in various sectors over 15 years.

Vulnerability 59% of the Indian landmass Last

10 major earthquakes that have resulted in over 20,000 deaths

6 Disaster Management

Seismic Zonation; The Bureau of Indian Standards, based on the past seismic history, divided the country into four seismic zones, viz. Zone II, III, IV and V.

Recent incidents Baramulla Earthquake

4.2 magnitude; Japan Earthquake 2024; Turkey Earthquake 2023; Indonesia Earthquake 2023

Human induced 1967

Koyna Dam, 2011 - Oklahoma earthquake earthquakes; 2015 - Nepal Earthquake

6 Disaster Management

Initiatives; Risk assessment and mapping by GIS; NDMA guidelines; Earthquake Early Warning System (EEWS); India Quake - Mobile App; Promoting Traditional Earthquake Resilient Construction Practices like Koti Banal and Dhajji Dewari.

6 Disaster Management

Vulnerability; More than 40 million hectare area is flood prone out of the total geographical area of 329 million hectares (mha); 12% of India's area is flood-prone.; Assam, West Bengal and Bihar are among the high flood prone states.

6 Disaster Management

Recent incidents; Assam Floods 2026; Punjab Floods 2025; Bihar floods 2025

6 Disaster Management

Vulnerability; One of the top four countries with highest landslide risk.; 12.6% area prone to landslide; 29% of the area falls in the moderate landslide susceptible zone; 56% in the low to very low landslide susceptible zone.; 30% of the World's landslides occur in the Himalayan ranges.

6 Disaster Management

Recent incidents; Wayanad Landslides, Uttara Kannada Landslides 2024, Raigad Landslide

6 Disaster Management

Pettimudi Landslide 2020, Joshimath Landslide 2023

6 Disaster Management

Initiatives; Landslide Early Warning System (LEWS); India's landslide susceptibility mapping by GSI; NDMA guidelines for Landslide Hazard Zonation

6 Disaster Management

Vulnerability; 68% of cultivable area is prone to droughts.; 2/3rds of India suffer from drought .; According to the report, the water shortage will cost the economy 6% of GDP by 2050.

6 Disaster Management

Flash Droughts; Flash drought is characterised by rapid onset and intensification caused by high evapo- transpiration rates due to abnormally high temperatures, winds, and high incoming solar radiation.

Recent incidents 2024

Karnataka; 2009 : Bundelkhand drought; 2014-16 : Central India/Bundelkhand Drought; 2019 : Tamil Nadu, Karnataka, Andhra Pradesh

6 Disaster Management

Vulnerability; 8% of the land and 76% of the coastline is prone to cyclones; 12 districts, all along the east coast, are "very highly prone"; 41 districts are "highly prone" to cyclones .

Indian Institute of Tropical Meteorology (IITM)

52% increase in Arabian Sea between 2001 and 2019; 8% decrease over the Bay of Bengal, compared to the 19 years between 1982 and 2002.

Recent incidents Remal - 2024

Indian Ocean - Odisha, West Bengal, Jharkhand, Northeast India; Michuang-2023: Bay of Bengal - Andhra Pradesh; Tej-2023: Arabian Sea - West Coast; Mandous - 2022: Bay of Bengal - Chennai; Ockhi-2017: Bay of Bengal : claimed lives of 200 fishermen

6 Disaster Management

Initiatives; Early Warning Systems; National Cyclone Risk Management Project; Integrated Coastal Zone Management Project; Coastal Regulation Zones; Color Coding of Cyclones by IMD; Hydro-meteorological Resilience Action Plan (HmRAP) study to strengthen ULBs

6 Disaster Management

Vulnerability; On an average, 5-6 heat wave events occur every year over the northern parts of the country.; Criteria of IMD: If the maximum temperature of a meteorological- substation reaches :; at least 40°C or more in the plains.; 37°C or more in coastal areas and; at least 30°C or more for hilly regions.; 23 states are heat wave prone.

13 Disaster Mitigation Initiatives

1. Shifting Gears from Disaster Management to Disaster Risk Reduction The initiative focuses on improving drought preparedness and response in the worst-affected areas of Chitrakoot, through multi-sectoral convergent community-based efforts to combat drought impacts.

13 Disaster Mitigation Initiatives

2. Flood and Landslide Disaster Management, Wayanad (Kerala) The Wayanad district administration implemented a Standard Operating Procedure (SOP) to reduce casualties during the 2018 floods in Kerala, focusing on preventive evacuation, timely relief, and post- disaster support.

Impact

Preventive evacuation from disaster-prone areas minimized casualties; 223 relief camps were set up in safe public buildings to house the rescued population.; Special communication devices and counseling sessions were used to aid the affected people.; Immediate relief included free rations for 3 months, 50 days of additional wage employment under MGNREGA, and provision of food, clothing, drinking water, and...

13 Disaster Mitigation Initiatives

NITI AAYOG BEST PRACTISES 47

'We for Wayanad' Campaign for Effective Disaster

Wayanad, Kerala To establish an effective disaster management and warning system to mitigate the impact of natural calamities and ensure community safety in Wayanad District.

Impact

The initiative significantly reduced casualties during the 2018 floods and enhanced community involvement in disaster preparedness and relief efforts.

Flood Hazard Atlas

Uttar Pradesh To strengthen flood mitigation and planning by using geospatial data, flood-risk mapping, and scientific identification of flood-prone areas.

Impact

Uttar Pradesh developed a Flood Hazard Atlas in collaboration with the National Remote Sensing Centre to identify flood-prone areas and support flood-management planning. The atlas helps authorities assess vulnerable areas, plan flood-control measures, improve preparedness, and guide disaster-risk reduction strategies. It supports evidence-based decision-making by using geospatial information for flood zonation and...

Lightning Warning Systems

Uttar Pradesh To reduce lightning-related deaths and injuries by installing sensor-based early warning systems that provide advance alerts to vulnerable communities.

13 Disaster Mitigation Initiatives

NITI AAYOG BEST PRACTISES 48

Impact

Uttar Pradesh is installing 30 lightning sensors and 1,500 warning systems across 37 districts. These systems can provide alerts around 30-40 minutes before lightning events, enabling people to take timely protective action. The initiative is part of the state's broader early-warning architecture, which also includes automatic weather stations, rain gauges, Doppler radars, river sensors, and public-address systems...

13 Disaster Mitigation Initiatives

NITI AAYOG BEST PRACTISES 49

Shifting Gears from Disaster Management to Disaster

The initiative focuses on improving drought preparedness and response in the worst-affected areas of Chitrakoot, through multi-sectoral convergent community-based efforts to combat drought impacts. Impact:; A mobile app has been developed for hazard communication, providing online and offline notifications, with 649 villages mapped for real-time updates.; Multi-sectoral measures have been implemented, ensuring...

Flood and Landslide Disaster Management, Wayanad

The Wayanad district administration implemented a Standard Operating Procedure (SOP) to reduce casualties during the 2018 floods in Kerala, focusing on preventive evacuation, timely relief, and post-disaster support. Impact:; Preventive evacuation from disaster-prone areas minimized casualties; 223 relief camps were set up in safe public buildings to house the rescued population.; Special communication devices and...

'We for Wayanad' Campaign for Effective Disaster

To establish an effective disaster management and warning system to mitigate the impact of natural calamities and ensure community safety in Wayanad District. Impact:; The initiative significantly reduced casualties during the 2018 floods and enhanced community involvement in disaster preparedness and relief efforts.; Topics where it can be Applied: Disaster Management, Community Participation.; How to Use...

Flood Hazard Atlas - Uttar Pradesh

To strengthen flood mitigation and planning by using geospatial data, flood-risk mapping, and scientific identification of flood-prone areas. Impact: Uttar Pradesh developed a Flood Hazard Atlas in collaboration with the National Remote Sensing Centre to identify flood-prone areas and support flood-management planning. The atlas helps authorities assess vulnerable areas, plan flood-control measures, improve...

Lightning Warning Systems - Uttar Pradesh

To reduce lightning-related deaths and injuries by installing sensor-based early warning systems that provide advance alerts to vulnerable communities. NITI AAYOG BEST PRACTISES 48 Impact: Uttar Pradesh is installing 30 lightning sensors and 1,500 warning systems across 37 districts. These systems can provide alerts around 30-40 minutes before lightning events, enabling people to take timely protective action. The...

Green-Blue Infrastructure on Ema River - Urban

To build climate-resilient urban infrastructure by integrating riverfront development, green spaces, water management, biodiversity conservation, and public-use urban spaces. Impact: The Green-Blue Infrastructure model on the Ema River focuses on using natural systems as part of urban infrastructure. It combines water-body rejuvenation, green corridors, biodiversity protection, flood-risk reduction, and improved...

Transforming Connectivity with Baster Net Scheme -

To bridge the digital connectivity gap in remote and Left-Wing Extremism-affected areas by strengthening telecom and internet infrastructure in Bastar district. Impact: The Baster Net Scheme focuses on improving digital connectivity in Bastar, a difficult and under-served region of Chhattisgarh. NITI for States lists "[Transforming Connectivity with Baster Net Scheme in Bastar District](#)" under Urbanization best...

AKAR: Residential School for Differently-abled

To ensure the inclusion of differently-abled students and reduce their dropout rates by providing comprehensive education and specialized therapies. Impact"; Nearly 800 differently-abled children in Sukma, Chhattisgarh, receive inclusive education and therapies, enhancing their overall development and opportunities in sports and arts.; Topics where it can be Applied: Inclusive Education, Differently-abled...

BAL SANSAD - Shrawasti and Bahraich, Uttar Pradesh

To sensitize young minds to the idea of democracy and promote inclusiveness by providing a platform for students to express their views and experience democratic processes. Impact;; Over 3,200 schools in Shrawasti, Uttar Pradesh, have adopted Bal Sansad, encouraging student participation in democratic activities and promoting inclusiveness through school assemblies and cleanliness drives.; Topics where it can be...

BALA Implementation - All Aspirational Districts,

To transform school environments into child-friendly, learning-oriented spaces by utilizing physical infrastructure for educational purposes. Impact;; The adoption of BALA in Shrawasti, Uttar Pradesh, and other districts has made schools and Anganwadis more attractive and vibrant, significantly improving student retention rates.; Topics where it can be Applied: Child-Friendly Schools, School Infrastructure.; How to...

'BETI BACHAO, BETI PADHAO' Citizen Recognition -

To raise awareness about the importance of girl children, their education, and achieving a balanced sex ratio through public recognition of local girls' and women's achievements. Impact;; Inspirational graffiti and statues in Firozpur, Punjab, motivate local girls and women to excel, while fostering pride among parents and promoting social awareness about the significance of educating and nurturing girls.; Topics...

Library Campaign - Education for Change -

To enhance the imagination of children and prepare them to face the world by establishing model libraries in all schools. Impact;; The initiative in Sitamarhi, Bihar, has established 1,431 model libraries in Phase-I, with 600 more planned in Phase-II, fostering a culture of reading and overcoming social barriers to education.; Topics where it can be applied: Literacy Promotion, Reading Culture.; How to Use...

Motivational Campaigns to Increase School

nagar, Uttar Pradesh; To raise awareness about the importance of education and motivate parents to enroll their children in school.; It ensures active parental involvement in their children's educational progress. Impact; In Balrampur, around 54,000 previously out-of-school students were enrolled, significantly improving attendance rates.; While Siddharthnagar's initiative fostered parental engagement in monitoring...

Project Second Innings - Dahod, Gujarat

To increase student attendance and learning outcomes by engaging retired teachers to teach primary and upper primary classes. Impact; The initiative in Dahod has increased the pass percentage of students from 37.35% to 49.18%, while revitalizing the lives of both retired teachers and students.; Topics where it can be Applied: Retired Teachers in Education, Improved Learning Outcomes.; How to Use;; Discuss the...

Smart Classrooms for Visually Impaired Children -

To improve Braille literacy among visually impaired K-12 students using cutting-edge technology, enhancing their learning outcomes and employability. Impact; The installation of 20 Braille-teaching devices in Ranchi, Jharkhand, has reinvigorated students' interest in learning Braille, promoting self-learning and potentially increasing the employability of visually impaired individuals.; Topics where it can be...

Shiksha Saarthi Yojna - Singrauli, Madhya Pradesh

To address the shortage of teachers in rural primary schools by appointing local educators, ensuring consistent and quality education. Impact; The initiative in Singrauli, Madhya Pradesh, has led to significant improvements in student enrolments, attendance, and proficiency levels across 16 primary schools.; Topics where it can be Applied: Teacher Recruitment, Quality Education.; How to Use;; Use this case to...

Teach Gajapati: A Jan Andolan for Quality Education

To improve the quality of education in schools by engaging alumni and community members as voluntary teachers under the 'Mo School' Abhiyaan. Impact;; The campaign in Odisha has significantly enhanced educational quality through volunteer participation, fostering a participative and accountable learning environment.; Topics where it can be Applied: Community Participation, Quality Education.; How to Use;; Discuss...

'Mera Mobile, Mera Vidyalaya' Unnayan Banka - Smart

Bihar To provide quality education for all using modern technologies, ensuring 24/7 access to comprehensive learning materials through various platforms, especially mobile phones. Impact; The initiative has significantly improved learning outcomes from 17% to 54% and achieved attendance rates of over 90% in Banka, Bihar, while being successfully replicated in several other districts across India.; Topics where it...

Vidyadaan Campaign - Bahraich, Uttar Pradesh

To enhance primary education by facilitating weekly interactions between students and intellectuals from various fields, promoting good values and ethics. Impact;; The initiative in Bahraich, involving over 400 Government Primary Schools, has yielded positive results with volunteers actively participating and students benefiting from the guidance and values imparted by intellectuals.; Topics where it can be Applied...

Establishing Model Anganwadi Centres - Ramgarh,

The scheme aims to improve learning outcomes and health standards by upgrading Anganwadi facilities and incorporating community outreach programs. Impact; Its impact includes enhanced educational quality and better nutrition and hygiene practices among children and families.; Topics where it can be Applied: Early Childhood Care, Capacity Building.; How to Use.; Discuss the role of model anganwadis in improving early...

My School - My Pride Initiative - Nashik,

To reconnect alumni with their former Zilla Parishad schools and mobilise community support for improving school infrastructure, learning resources, and student motivation. Impact: Nearly 58,995 alumni participated across 3,240 Zilla Parishad schools in Nashik. They contributed around ₹3.41 crore, including ₹65.76 lakh in cash and materials worth ₹2.74 crore. Contributions included educational material, sports...

Padhe Dantewada, Likhe Dantewada - Dantewada,

To improve learning outcomes in remote areas by using digital tracking, level-based learning, local- language teaching material, teacher training, and health monitoring of students. Impact: The initiative covered more than 38,000 students, 2,493 teachers, and 885 public schools through the Padhe Dantewada mobile application. Over 2,000 teachers were trained in digital literacy. After implementation, students unable...

Viksit Kaushambi Abhiyaan - Kaushambi, Uttar Pradesh

To increase student attendance and improve education quality by revitalizing school infrastructure, strengthening monitoring, mobilizing community participation, and introducing technology-enabled learning. Impact: The initiative improved average school attendance from 54% to 78%. School renovation increased from 109 to 158 schools, showing a 45% improvement. A total of 83 primary schools, 26 upper primary schools...

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