

WRAP Exams · wrapexams.com

Prelims PYQ, Mains model answers, and copy evaluation. Write to the desk for this paper, a doubt, or the AI waitlist.

ask@wrapexams.com · +91 85951 84903 · wrapexams.com

Syllabus heading

Science and Technology in Everyday Life

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

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

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.

<https://wrapexams.com/upsc/mains-answers/gs-3/science-technology-everyday-life/>

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...