

Extracts from CSE (Main) syllabus for Compulsory Paper 4 General Studies Paper 3

B. TECHNOLOGY

11. Science and Technology- developments and their applications and effects in everyday life
Achievements of Indians in science & technology; indigenization of technology and developing new technology.
12. Awareness in the fields of IT, Space, Computers, robotics, nano-technology, bio-technology and issues relating to intellectual property rights.
13. Technology missions;
14. e-technology in the aid of farmers,

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2.	The Indian Space Research Organisation (ISRO)
3.	Cobalt as a green economy metal and a super alloy
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1. **India's Computer Emergency Response Team (CERT-In)**: the government's apex watchdog against cyber attacks, had instructed banks to be on heightened alert on October 7, 2016 had warned about “expected targeted attacks from Pakistan“, in the wake of India's counter strike across the border following terrorist attacks in Jammu and Kashmir.

The malware infection put 3.2 million debit cards at risk, although the loss, through unauthorised withdrawals across the world, has been pegged at Rs. 1.3 crore by the National Payments Corporation of India (NPCI). The government and the Reserve Bank of India have ordered banks and payment gateways to investigate the breach.

2. **The Indian Space Research Organisation (ISRO)** on 15.02.2017, successfully launched 104 satellites, including India's weather observation Cartosat 2 Series, in a single mission, onboard its dependable

Polar rocket. It improved upon the standing Russian space agency's record of launching 37 satellites in a single mission in 2014, ISRO injected the Cartosat-2 Series satellite and 103 nano satellites into precise orbit. The previous highest number of satellites launched by ISRO in one mission was 20 in June 2015. So far, ISRO has launched 226 satellites, including 179 belonging to foreign countries. The countdown time has also been reduced from 52 hours to 23 hours.

The Indian National Committee for Space Research, founded in 1962, was transformed into ISRO in 1969. India became a member of the Missile Technology Control Regime (MTCR) in June 2016.

NEWSICLE

TO SPACE BEYOND

PSLV-C38 in its 40th flight will launch 31 satellites, including 29 nano satellites from 14 different countries, from Satish Dhawan Space Centre in Sriharikota at 9.29am on Friday

Rocket | Polar Satellite Launch Vehicle (PSLV)

Orbit | Polar sun synchronous orbit (SSO)

Total payload weight
955kg

Total number of satellites
31

second highest after launching 104 satellites in February

INDIA

Main payload | Cartosat-2 series

Weight | **712kg**

Cartosat | Remote sensing satellite

It is sixth in the Cartosat-2 series also called India's eye in the sky

Application | Panchromatic and multispectral cameras will be used in cartographic applications, coastal land use and regulations, utility managements like road network monitoring, water distribution, as well as Geographical Information System (GIS) applications

NIUSAT | Only nanosatellite from India

Weight | **15kg**

Application | Noorul Islam University, Kanyakumari district, is sending a satellite with an RGB camera that will provide multispectral imagery for agricultural crop monitoring and disaster management support

FOREIGN SATELLITES 29

Weight | **228kg**

Belgium, Italy, UK **3** (each)
USA **10**

Application | Satellites will monitor and measure parameters like density and temperature in thermosphere and radiation

> 1 each from Austria, Chile, Czech Republic, Finland, France, Germany, Japan, Latvia, Lithuania and Slovakia



3. Cobalt as super alloy and the green economy metal:

1 Cobalt is one of the few metals used for superalloys
 Nearly **20%** of all cobalt is used for superalloys. This is a class of high-tech metals that emerged to suit high operating temperatures of jet engines. Today, superalloys are used in all types of turbines, space vehicles, rocket engines, nuclear reactors, power plants, and chemical equipment.

2 The green economy runs on cobalt
 There are many types of lithium-ion batteries, but the vast majority of li-ions sold today use cobalt in some capacity. In fact, by **2020** it is expected that **75%** of lithium-ion batteries will contain cobalt.

3 ...And green uses such as EVs are driving the upwards trajectory of cobalt demand
 By **2020**, almost **1/5** of cobalt demand will stem from electric vehicles.

4 Getting cobalt is the hard part
98% of cobalt is produced as a by-product of copper and nickel mines. The problem? If copper and nickel production isn't growing, then more cobalt isn't mined to meet demand.

5 Why not find more cobalt?
 The vast majority of the world's cobalt lies in risky regions like the DRC.

6 Meanwhile, the US government definitely doesn't have any strategic stockpiles
 The US Defense Logistics Agency says the gov't sold cobalt until 2008. Now there is only 301 tonnes left in strategic stockpiles.

7 And so supply can tighten...
CHEMICAL COBALT - the kind used in batteries, is expected to fall into a growing deficit over the next few years.

8 Cobalt was one of the best-performing metals in 2016

Year	Total refined cobalt demand (K)	Electronics (%)	EVs (%)
2010	64K	30%	<1%
2015	95K	36%	6%
2020e	124K	31%	17%

World map showing cobalt production by country: DRC (58%), Other (19%), Russia (6%), Philippines (4%), Australia (5%), Madagascar (4%), Cuba (5%).

Bar chart showing metal performance in 2016: Cobalt (47%), Zinc (66%), Nickel (17%), Copper (17%), Silver (17%), Gold (16%), Platinum (1%), Uranium (9%).

9 The refined cobalt market will fall into a 3,000 tonne deficit this year following seven years of overcapacity and oversupply. CRU anticipates prices to increase onward into 2017.
 EDWARD SPENCER, CRU Group

10 With this growth will come further disruption to traditional market structures that have developed in cobalt over last 30 years. A new, more secure supply chain for modern era will need to be created, a task that includes new mines, new refineries...
 ANDREW MILLER, Benchmark Minerals

Source: Business Insider; Graphic: Siddharth

4. [Indian Railway Station Redevelopment Corporation \(IRSDC\)](#) and [World Resource Institute \(WRI\)-India](#), where the Hudson Yards redevelopment project in New York was discussed. The Hudson Yards project involves five 50-90 storeyed commercial-cum-residential towers, malls and large public squares on a 28acre expanse. The entire complex is being constructed over an operational rail yard and the plan is real estate development above the tracks, in Bhopal and Delhi.

WHAT INDIA CAN LEARN FROM THE US

Hudson Yards redevelopment project | Jointly planned, funded and constructed by the City of New York and the Metropolitan Transportation Authority, it's aimed at encouraging development along the Hudson river in Manhattan, NY

Construction began in 2012; the project expected to be completed by 2018

It will have five **50 to 90-storey** commercial, residential and mixed land use towers, a mall and a public square

50% area is open spaces

The public square will be an elevated park spread over an area of 6.5 acres. It will come up above the rail yard

An AC plant will be built between the train yard and the park area to keep the roots of the tree and plants healthy

Two platforms will be constructed to bridge over 30 active train tracks; to be spread over an area of 10 acres

Rainwater harvesting | Rainwater will be collected in a 60,000-gallon tank; to be reused for irrigating the parks

Limited parking spaces

Effective waste disposal system

Smart soil | Specially-created soil to provide effective drainage and nutrient for the plants. The soil depth of plants will be 18 inches and 4 feet for large trees

TOTAL AREA | 28 acres; it's being built over the rail yard using technically advanced network of steel beams, concrete and tunnels

ONGOING PROJECTS

Anand Vihar and Bijwasan in Delhi
Gandhi Nagar in Gujarat
Habibganj in MP

THE INDIAN SCENARIO | Indian Railway Station Redevelopment Corporation (IRSDC) chalks out plans for the redevelopment of stations in Delhi, Gujarat, Madhya Pradesh and Maharashtra

Takeaways from the NY project

- Use of green technology, especially during construction, to increase efficiency
- Integrating the railway stations with the city by providing better transport connectivity
- Making residential component a part of its station redevelopment project
- Bring down the parking spaces
- Focus on public spaces

5. Smart Cities Jul 05 2016 : The Economic Times (Delhi)
Smart Cities Need More Than Smart Talk

Main Points:

1. As India urbanises, the authorities need to change town planning. This alone can avoid the urban sprawl around the developing world.
2. India's Smart City programme must go beyond making the city safe, productive energy efficient.

3. Being prepared for future growth needs to become a necessary condition of smartness.
4. A number of urban clusters can be envisaged across the nation and the growth of each cluster planned taking the rest into account.
5. India values capital too much to adopt a policy of building towns first, expecting them to be filled up sooner or later.
6. Demand has to precede supply, at the level of actual construction. But planning should run ahead of actual demand.
7. Sufficiently large part of the surface plan of town's future expansion that is made up of roads, parks, playgrounds and other public spaces must be laid in advance. Retrofitting vital infrastructure on a densely settled stretch of urban sprawl will be hugely expensive.
8. The challenge here is summoning the political will to stop encroachment as well. For example, even after a Supreme Court directive, the government of Chhattisgarh is finding it difficult to demolish a temple built on unauthorized land.

6. Mar 21 2017 : The Economic Times (Delhi)
[The Pure Sciences Matter, Stupid!](#)

It's not just engineering that the economy needs

Main Points:

1. New insights in physics, chemistry, biology, etc, will drive the commercial opportunities of the future. There is a need to encourage pure science,
2. India's dreams of building a knowledge economy and staying competitive, will depend on overhauling its education system.
3. Basic sciences and research remuneration structure needs to be overhauled for those who pursue pure science.

4. the insights of quantum mechanics are being put into a range of activities from computing to communications and cryptography to mineral exploration and creation of new materials.
 5. Cell biology offers new ways to store information.
 6. Nano technologies derive from new advances in chemistry and the science of materials. Countries that do not generate indigenous capacity in these emerging fields of world changing technology will suffer in future.
 7. India's approach to science education is complicated. At school, those who excel are pushed into engineering or medicine. This has to change.
 8. India spends less than 1% of its GDP on research and development (R&D). South Korea and Singapore are 4.3% and 2.2%.
 9. In India, 60% of R&D spend is by government, 4% by universities, and the remaining by business.
 10. The research spending by universities needs to increase.
 11. The reward for those who create new knowledge in the universities, has to be increased by re examining research priorities in government labs.
7. Artificial Intelligence.

**FUTURESCOPE:
WHAT'S
COOKING
IN AI**

• **VIDEO**

DESCRIPTION

A lot of work is being done on image search. This allows an AI programme to study a particular image, say of a man wearing a turtleneck grey shirt, and offer recommendations of similar shirts. Scientists and programmers are exploring if the same can be done with videos.

• **FASHION ASSISTANTS**

Imagine you are going on a vacation to Goa but do not know what clothes to pack. Give it a year or two and maybe you ask an intelligent chat bot for suggestions. Such machines will need tonnes of data to be able to understand such queries in context.

• **WAREHOUSE ROBOTS:**

Computer vision and robotics are already used in the warehouses to automate and keep track of manual processes. In a few years, these will be more streamlined as AI machines gather more information. A day might come when there will be bare minimum human intervention even in warehouses.

Artificial Intelligence has been talked ABOUT FOR THE LAST 60 YEARS



Introduction of Turing test



IBM Deep blue defeats Gary Kasparov



Watson became Jeopardy Champion

DeepMind's self-taught AI can beat human players at 29 of 49 old Atari games

1950



First AI program to play Tic Tac Toe

1980

Douglas Lenat, entered a war gaming tournament with an AI fleet

2007

Polaris from University of Alberta became Poker champion

2015

Computational Power



- **512:** Core GPU
- **2880:** Core GPU
- **12000:** Core GPU

Cost of Computing

*TRANSISTORS



- \$200: Per million*
- \$50: Per million*
- \$0.05: Per million*

Better Algorithms



- **LOGIC THEOREMS:** Single layer learning, Perceptron, Adaline
- **NEURAL NETWORKS:** Multilayer Back propagation
- **DEEP LEARNING:** Convoluted Neural Network

SOURCE : ZINNOV CONSULTING REPORT- THE AI SPRING- INNOVATIONS FOR THE NEXT DECADE

