Science, Management and Indian Knowledge System

Unit:4

Subject Name
INDIAN TRADITIONS, CULTURE AND SOCIETY

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Course Details
CH 6th Semester

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Unit Objective(s)

- To make the students aware about different Sciences.
- To develop a clear understanding on the management knowledge.
- To aware students about Indian knowledge system.

Course Outcome

1. The course aims at imparting basic principles of thought process, reasoning and inference to identify the roots and details of some of the contemporary issues faced by our nation and try to locate possible solutions to these challenges by digging deep into our past.
2. To enable the students to understand the importance of our surroundings and encourage the students to contribute towards sustainable development.
3. To sensitize students towards issues related to 'Indian' culture, tradition and its composite character.
4. To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
5. To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

CO-PO and PSO Mapping

PO / CO	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
KNC 602.1	M								M
KNC 602.2				H	M				
KNC 602.3					H				M
KNC 602.4						M			H
KNC 602.5				M					H
Average	2			2.5	2.5	2			2.5

Topic Mapping with course outcomes

Unit-4	So. No.	Mapping	
		Topic	Course Outcomes
IV	1	Different Sciences in ancient India.	Co4
	2	Management knowledge in India	Co5
	3	Indian knowledge system.	CO5

Topic objectives

Students will be able to know about the different sciences in India:

- Astronomy
- Chemistry
- Mathematics
- Physics

Astronomy in India

- **Indian astronomy** has a long history stretching from pre-historic to modern times. Some of the earliest roots of Indian astronomy can be dated to the period of Indus Valley Civilization or earlier.
- Astronomy later developed as a discipline of Vedanga or one of the "auxiliary disciplines" associated with the study of the Vedas, dating 1500 BCE or older.
- The oldest known text is the *Vedanga Jyotisha*, dated to 1400–1200 BCE (with the extant form possibly from 700 to 600 BCE).
- Indian astronomy flowered in the 5th–6th century, with Aryabhata, whose *Aryabhatiya* represented the pinnacle of astronomical knowledge at the time.
- Astronomy is necessarily an observational science rather than an experimental one.

Astronomy in India

Astronomy is the science which deals with the study of heavenly bodies. It considers

(a) their motions, both real and apparent, and the laws which govern those motions;

(b) their forms, dimensions, masses, and surface features;

(c) their nature, constitution, and physical condition;

(d) the effects which they produce upon one another by their attractions and radiations;

(e) their probable past history and future development.

Chemistry in India

- Chemical techniques in India can be traced back all the way to the Indus valley or Harappan civilisation (3rd millennium BCE).
- Following Acharya Prafulla Chandra Ray (1861-1944), the eminent Indian chemist of the last century and a historian of chemistry, five stages in its development in India can be recognised.
- They are: (i) the pre-Vedic stage upto 1500 BCE, including the Harappan period, (ii) the Vedic and the Ayurvedic period upto 700 CE, (iii) the transitional period from 700 CE to 1100 CE, (iv) the Tantric period from 700 CE to 1300 CE, and (v) the 'Iatro-Chemical period' from 1300 CE to 1600 CE. The dates cannot be considered definitive.

Chemistry in India

- In Ancient India, an important role in the development of chemistry was made by Ayurveda which used a variety of minerals. Science and technology in ancient and medieval India covered all the major branches of human knowledge and activities.
- In early civilization, metallurgy has remained an activity central to all civilizations from the Bronze Age and the Iron Age, to all other civilizations that followed. The Indus valley civilization was the earliest society, the story of early chemistry in India begins from here.
- According to RigVeda, tanning of leather and dyeing of cotton was practiced during this period. After Vedas classical texts which give valuable information about the chemical activities of this period.

Chemistry in India

- The major chemical products of this period were glass, paper, soap, dyeing, cosmetics and perfumes, alcoholic lacquers, pharmaceuticals, gun powder and saltpeter.
- Nagarjuna (metallurgist) and Kanada were chemist of ancient period.
- Indian and Persian army used arrows tipped with iron.
- In the Gupta age metallurgical operations were found. Nataraja statue the god of dance is made of five metals Pancha Dhatu and Iron Pillar, Delhi is as a silent witness to assert the striking metallurgical skill of the Hindus.
- Paintings found on walls of Ajanta and Ellora also testify to the high level of chemical science achieved in ancient India

Mathematics in India

- **Indian mathematics** emerged in the Indian subcontinent from 1200 BC until the end of the 18th century. In the classical period of Indian mathematics (400 AD to 1200 AD), important contributions were made by scholars like Aryabhata, Brahmagupta, Bhaskara II, and Varāhamihira.
- The decimal number system in use today was first recorded in Indian mathematics. Indian mathematicians made early contributions to the study of the concept of zero as a number, negative numbers, arithmetic, and algebra.
- In addition, trigonometry was further advanced in India, and, in particular, the modern definitions of sine and cosine were developed there.
- These mathematical concepts were transmitted to the Middle East, China, and Europe and led to further developments that now form the foundations of many areas of mathematics.

Mathematics in India

- Ancient and medieval Indian mathematical works, all composed in Sanskrit, usually consisted of a section of *sutras* in which a set of rules or problems were stated with great economy in verse in order to aid memorization by a student.
- All mathematical works were orally transmitted until approximately 500 BCE; thereafter, they were transmitted both orally and in manuscript form.
- The oldest extant mathematical *document* produced on the Indian subcontinent is the birch bark Bakhshali Manuscript, discovered in 1881 in the village of Bakhshali, near Peshawar (modern day Pakistan) and is likely from the 7th century CE.

Physics in India

- Over the past century, India has produced stars in physics and astronomy. Think Satyendra Nath Bose and Nobel Prize winner C. V. Raman.
- In 1945 nuclear physicist Homi Bhabha established the internationally respected Tata Institute of Fundamental Research (TIFR) in Mumbai.
- After India gained independence from Great Britain, Jawaharlal Nehru, the first prime minister, emphasized science and technology for his country's future.

Physics in India

- Among large home-grown physics projects, India counts the Giant Metrewave Radio Telescope near Pune, with 30 steerable 45-meter dishes; the Major Atmospheric Cherenkov Experiment, a 21-meter cosmic-ray telescope under construction in the Himalayas; the lunar probe *Chandrayaan*, which flew in 2008–09; *Astrosat*, India's first science satellite, a multiwavelength mission set for launch late next year; a petawatt laser planned for Hyderabad; and the India-based Neutrino Observatory

Daily Quiz

- _____ is necessarily an observational science rather than an experimental one.
- Name an Indian Nobel prize winner physicist.
- State any 2 Indian achievements in Mathematics.
- _____ and _____ were Known chemist of ancient period

Topic objectives

Students will be able to know about the

- Agriculture in India
- Medicine in India
- Metallurgy in India
- Geography, Biology, Harappan Technologies

Agriculture in India

- The history of **Agriculture in India** dates back to Indus Valley Civilization. India ranks second worldwide in farm outputs. As per 2018, agriculture employed more than 50% of the Indian work force and contributed 17–18% to country's GDP.
- In 2016 agriculture and allied sectors like animalhusbandry, forestry and fisheries accounted for 15.4% of the GDP (gross domestic product) with about 41.49% of the workforce in 2020.
- India ranks first in the world with highest net cropped area followed by US and China. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

Agriculture in India

- The total agriculture commodities export was US $ 3.50 billion in March - June 2020. India exported $38 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the sixth largest net exporter.
- Most of its agriculture exports serve developing and least developed nations. Indian agricultural/horticultural and processed foods are exported to more than 120 countries, primarily to the Japan, Southeast Asia, SAARC countries, the European Union and the United States.

Medicine in India

- It is a well-known fact that Traditional Systems of medicines always played important role in meeting the global health care needs. They are continuing to do so at present and shall play major role in future also.
- The system of medicines which are considered to be Indian in origin or the systems of medicine, which have come to India from outside and got assimilated in to Indian culture are known as Indian Systems of Medicine.
- India has the unique distinction of having six recognized systems of medicine in this category. They are-Ayurveda, Siddha, Unani and Yoga, Naturopathy and Homoeopathy.

Medicine in India

- Though Homoeopathy came to India in 18th Century, it completely assimilated in to the Indian culture and got enriched like any other traditional system hence it is considered as part of Indian Systems of Medicine.
- Apart from these systems- there are large number of healers in the folklore stream who have not been organized under any category. In the present review, attempt would be made to provide brief profile of three systems to familiarize the readers about them so as to facilitate acquisition of further information.

Medicine in India

- The basic foundation is the fundamental doctrine according to which whatever present in the Universe (macrocosm) should be present in the body (the microcosm).
- It has been conceptualized that the universe is composed of five basic elements named *Prithvi* (Earth), *Jala* (Water), *Teja* (Fire), *Vayu* (Air) and *Akash* (Space/Ether).
- The human body is derived from them in which these basic elements join together to form what are known as 'Tridoshas' (humors) named as *Vata, Pitta and Kapha*. These humors govern and control the basic psycho-biological functions in the body.
- In addition to these three humors, there exist seven basic tissues (*saptha dhatus*)- *Rasa, Rakta, Mamsa, Meda, Asthi, Majja* and *Shukra*- and three waste products of the body *(mala)* such as faeces, urine and sweat.
- Healthy condition of the body represents the state of optimum equilibrium among the three doshas. Whenever this equilibrium is disturbed due to any reason- disease condition results. The growth and development of the body components depend on nutrition provided in the form of food.

Types of Treatment

- The treatments are of different types- a- *Shodhana* therapy (purification treatment), b-*Shamana* therapy (palliative treatment), *Pathya Vyavastha* (prescription of appropriate diet and activity), *Nidan Parivarjan* (avoidance of causes and situations leading to disease or disease aggravation), *Satvajaya* (psychotherapy) and *Rasayan* (adaptogens- including immunomodulators, anti-stress and rejuvenation drugs) therapy. *Dipan* (digestion) and *Pachan* (assimilation) enhancing drugs are considered good for pacifying the vitiated doshas (humors).

Ayurveda

- Most of the traditional systems of India including Ayurveda have their roots in folk medicine. However what distinguishes Ayurveda from other systems is that it has a well-defined conceptual framework that is consistent throughout the ages.
- In conceptual base, it was perhaps highly evolved and far ahead of its time. It was among the first medical systems to advocate an integrated approach towards matters of health and disease.
- Another important distinguishing feature of Ayurveda is that unlike other medical systems, which developed their conceptual framework based on the results obtained with the use of drugs and therapy, it first provided philosophical framework that determined the therapeutic practice with good effects.
- Its philosophical base is partly derived from *'Samkhya'* and *'Nyaya vaisheshika'* streams of Indian philosophy. This enabled it to evolve into rational system of medicine quite early in its evolution and to get detached from religious influence. It laid great emphasis on the value of evidence of senses and human reasoning

Ayurveda

- *Atharvaveda*, the last of the four great bodies of knowledge- known as Vedas, which forms the backbone of Indian civilization, contains 114 *hymns* related to formulations for the treatment of different diseases. From the knowledge gathered and nurtured over centuries two major schools and eight specializations got evolved.
- One was the school of physicians called as *'Dhanvantri Sampradaya'* (Sampradaya means tradition) and the second school of surgeons referred in literature as *'Atreya Sampradaya'*. These schools had their respective representative compilations- Charaka Samhita for the school of Medicine and Sushruta Samhita for the school of Surgery.
- Vagabhata's 'Astanga-Hridaya' is considered as another major treatise of Ayurveda. The above three documents are popularly known as *'Brihat trayees'* (the big or major three).

Siddha system of medicine

- Siddha system of medicine is practiced in some parts of South India especially in the state of Tamilnadu. It has close affinity to Ayurveda yet it maintains a distinctive identity of its own. This system has come to be closely identified with Tamil civilization. The term '*Siddha*' has come from '*Siddhi*'- which means achievement. *Siddhars* were the men who achieved supreme knowledge in the filed of medicine, yoga or *tapa* (meditation)
- The materia medica of Siddha system of medicine depends to large extent on drugs of metal and mineral origin in contrast to Ayurveda of earlier period, which was mainly dependent upon drugs of vegetable origin.

Unani system of medicine

- Unani medicine has its origin in Greece. It is believed to have been established by the great physician and philosopher- Hippocrates (460–377 BC). Galen (130–201 AD) contributed for its further development. *Aristotle* (384–322 BC) laid down foundation of Anatomy & physiology.
- *Dioscorides* - the renowned physician of the 1st Century AD has made significant contribution to the development of pharmacology, especially of drugs of plant origin. The next phase of development took place in Egypt and Persia (the present day Iran). The Egyptians had well evolved pharmacy; they were adept in the preparation of different dosage forms like oils, powder, ointment and alcohol etc.

Homeopathy system of medicine

- Homeopathy is a medical system based on the belief that the body can cure itself. Those who practice it use tiny amounts of natural substances, like plants and minerals. They believe these stimulate the healing process.
- It was developed in the late 1700s in Germany. It's common in many European countries.
- A basic belief behind homeopathy is "like cures like." In other words, something that brings on symptoms in a healthy person can -- in a very small dose -- treat an illness with similar symptoms. This is meant to trigger the body's natural defenses.
- For example, red onion makes your eyes water. That's why it's used in homeopathic remedies for allergies.
- Homeopathic doctors (who also are called "homeopaths") weaken these ingredients by adding water or alcohol. Then they shake the mixture as part of a process called "potentization." They believe this step transfers the healing essence. Homeopaths also believe that the lower the dose, the more powerful the medicine. In fact, many of these remedies no longer contain any molecules of the original substance. They come in a variety of forms, like sugar pellets, liquid drops, creams, gels, and tablets.

Naturopathy

- **Naturopathy** is a form of healthcare that combines modern treatment with traditional methods. It includes alternative, natural therapies to modern medicine.
- **Naturopathy** focuses on : the body's capacity to heal itself. preventing health problems.
- Naturopathic medicine is a system that uses natural remedies to help the body heal itself. It embraces many therapies, including herbs, massage, acupuncture, exercise, and nutritional counseling.
- Naturopathy was brought to the United States from Germany in the 1800s, but some of its treatments are centuries old.
- The goal of naturopathic medicine is to treat the whole person -- that means mind, body, and spirit. It also aims to heal the root causes of an illness -- not just stop the symptoms.

Metallurgy in India

- **Metallurgy** is a domain of materials science and engineering that studies the physical and chemical behavior of metallic elements, their inter-metallic compounds, and their mixtures, which are called alloys.
- The **history of metallurgy in the Indian subcontinent** began prior to the 3rd millennium BCE and continued well into the British Raj. Metals and related concepts were mentioned in various early Vedic age texts.
- The Rigveda already uses the Sanskrit term **Ayas(आयस)** (metal). The Indian cultural and commercial contacts with the Near East and the Greco-Roman world enabled an exchange of metallurgic sciences.
- With the advent of the Mughals, foreign Mughal Empire (established: April 21, 1526—ended: September 21, 1857) further improved the established tradition of metallurgy and metal working in India.

Metallurgy in India

- The first evidence of metal in the Indian subcontinent comes from Mehrgarh in Baluchistan, where a small copper bead was dated to about 6000 BCE; it is however thought to have been native copper, not the smelted metal extracted from ore.
- The growth of copper metallurgy had to wait for another 1,500 years; that was the time when village communities were developing trade networks and technologies which would allow them, centuries later, to create the Harappan cities.
- Harappans also used gold and silver (as well as their joint alloy, electrum) to produce a wide variety of ornaments such as pendants, bangles, beads, rings or necklace parts, which were usually found hidden away in hoards such as ceramic or bronze pots. While gold was probably panned from the Indus waters, silver was perhaps extracted from galena, or native lead sulphide.

Geography

- The **study of Geography** and the formation of the earth systems is quite challenging and most insightful to gain the knowledge. **Study** also includes climate systems, regional developments, irrigation systems, agricultural activities, rural-urban settlements, formation of demography and its migrations.
- The study of geography as a systematic science was a significant gap in Indian knowledge during ancient times. However, geographical facts were presented in a nonsystematic manner in the whole range of Sanskrit, Pali, and Prakrit literature.

Geography

- Compositions of a geographical character are often found embedded in the religious, legendary and astrological literature of ancient India. Both religious and secular literature contain numerous isolated references to cities, mountains, rivers, regions, and society, which collectively amount to a considerable addition to geographical knowledge.
- India is the home of an ancient civilization that originated over 5,000 years ago and attracted many travelers, scholars, ambassadors, and missionaries. Many conveyed impressions back to their compatriots through lively tales, anecdotes, and travel journals. These writings also became important sources of geographical knowledge

Biology

- The **history of biology** traces the study of the living world from ancient to modern times. Although the concept of *biology* as a single coherent field arose in the 19th century, the biological sciences emerged from traditions of medicine and natural history reaching back to ayurveda, ancient Egyptian medicine and the works of Aristotle and Galen in the ancient Greco-Roman world.
- This ancient work was further developed in the Middle Ages by Muslim physicians and scholars such as Avicenna. During the European Renaissance and early modern period, biological thought was revolutionized in Europe by a renewed interest in empiricism and the discovery of many novel organisms.

Biology

- Prominent in this movement were Vesalius and Harvey, who used experimentation and careful observation in physiology, and naturalists such as Linnaeus and Buffon who began to classify the diversity of life and the fossil record, as well as the development and behavior of organisms.
- Antonie van Leeuwenhoek revealed by means of microscopy the previously unknown world of microorganisms, laying the groundwork for cell theory.

Harappan Technologies

- Harappan Civilization was one of the oldest civilizations of ancient India, also known as Indus Valley Civilization. The Harappan civilization stretched from the Montgomery District (the former Punjab province of British India) to modern-day northeast Afghanistan, Pakistan, and northwest India. Harappan cities have their urban planning, baked brick houses, detailed drainage systems, water supply systems, clusters of large non-residential buildings.
- Harappan civilization people also used new techniques in Handicrafts, Karelian products, Seal carving, and metallurgy such as copper, bronze lead, and tin. Archaeological remains at various sites of the Indus Valley Civilization help us learn about the science and technological progress there.
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Architecture, Town Planning and Civil Engineering of Harappan Civilization

- Architecture of well-planned urban centers based on fixed-layout patterns with scientific roads; Drainage systems (with the use of corbelled technology), public structures (such as granaries and great baths), were far ahead of time and precursors to the modern concept of architecture and civil engineering.

Transportation Technology of Harappan Civilization

Terracotta boat in the shape of a bull, and female figurines. Kot Diji period (c. 2800-2600 BC). | Intuition (Palazzo Fortuny 2017 exhibition)

Irrigation System of Harappan Civilization

- Research published in the Journal of Archaeological Science confirms that the Indus people were the first to use complex multi-cropping strategies in both seasons, growing foods during the summer such as rice, millet, and beans etc. and in winter wheat, barley, and pulses, which required separate sorting management.

knowledge of Metallurgy

- The people of the Indus Valley civilization were technically very developed and had a good knowledge of metallurgy, they also used standardized burnt bricks, precision weights, and cotton. Many subdivisions also had a standardized system of weights and measurements with calibration. According to the evidence found in the excavations, they used gold, silver, copper, lapis lazuli, turquoise, amethyst, alabaster, jade etc.

Medical Science in Harappan Civilization

- Harappans were familiar with medical science and used various herbs and medicines to treat diseases. The people of the Indus Valley Civilization practiced trephination which is a kind of medical intervention, in which a hole is made in the skull to treat skull and brain disorders. Evidence of traction has also been found at Lothal, Kalibangan, and Burjholm, but not at Harappa or most other sites.

Daily Quiz

- India has the unique distinction of having _____recognized systems of medicine.
- Harappan Civilization was one of the oldest civilizations of ancient India, also known as _____.
- State the significance of Agriculture in India.
- Name any 2 technologies used in Harappan civilization.

Topic objectives

Students will be able to know about the

- Water Management in India
- Textile Technology in India
- Writing Technology in India
- Pyrotechnics in India
- Trade in Ancient India

Water Management in India

- We all know water is essential, but too many of us think it's unlimited. In reality, fresh water is a finite resource that is rapidly becoming scarce. In India, a warming climate is drying up lakes and rivers, while rapid urbanisation and water pollution are putting enormous pressure on the quantity and quality of surface and ground water.
- The country's fragile agricultural system still depends primarily on rainfall and a bad monsoon season can wreck havoc on the national economy.
- Archaeological evidence shows that the practice of water conservation is deep rooted in the science of ancient India. Excavations show that the cities of the Indus Valley Civilisation had excellent systems of water harvesting and drainage.

Water Management in India

- The settlement of Dholavira, laid out on a slope between two storm water channels, is a great example of water engineering. Chanakya's *Arthashashtra* mentions irrigation using water harvesting systems.
- Sringaverapura, near Allahabad, had a sophisticated water harvesting system that used the natural slope of the land to store the floodwaters of the river Ganga. Chola King Karikala built the Grand Anicut or Kallanai across the river Cauvery to divert water for irrigation (it is still functional) while King Bhoja of Bhopal built the largest artificial lake in India.

Water Conservation Systems in India- 1. Jhalara

2. Talab/ Bandhi

3. Bawari

4. Taanka

5. Johads

6. Kund

7. Baoli

8. Nadi

Textile Technology in India

- Textiles was also a great industry in ancient India. It was known that some of the finest cloth you could get anywhere in the world was from India. Textiles became one of the major commodities of trade between India and other countries. Cotton was also cultivated in India before anywhere else. From cotton came cloth through the development of the spinning wheel, another early contribution of India, and which dates back to over 5000 years. With textiles also came the art of making and the use of dyes and colors.
- In Our Oriental Heritage, Will Durant explains, growing of cotton appears earlier in India than elsewhere; apparently it was used for cloth in Mohenjodaro. During the excavations at Mohenjodaro a small fragment of cotton fabric and a small piece of cotton string in the neck of a vessel were recovered. The quality of both fabric and the string leaves no doubt that a mature textile craft had existed in the Indus Valley civilization.
  Dr. Stanley Wolpert, professor of history at UCLA wrote in the publication India: AAncient Indians were the first humans to spin and weave cotton into cloth that continues to provide our most comfortable summer attire.

Textile Technology in India

THE ANTIQUITY OF CLOTH MAKING

- The making of cloth goes back to ancient times in Bharatvarsha (India). It is even described in the Vedas how Sage Gritsmad made the first cloth from sowing cotton, then making thread with a wooden bobbin, and then cloth. Making saris from silk, or with colored dyes, or embroidered with gold or silver thread, have made them into a desirable item in all parts of the world.
- Cotton was cultivated, then spun into threads and woven into cloth since ancient times in India, dating back at least 4000 to 5000 years ago. The Greeks did not know of cotton until Alexander invaded India where they found cotton for the first time.
- From the findings at Mohendjodaro, a piece of cotton has been discovered that shows people at that time, 5000 years ago, were aware of the means to make and use it for clothing.
- Later, Kashi also became a major center for its silk manufacturing and products. The area of Gandhara (modern northwest India and Pakistan) and Vahika, near the Sindhu, Sutlej and Beas Rivers, were also known for its fine woollen chadars and shawls.
- A History of Printed Textiles reports that the export of printed fabrics to China can be dated back to the fourth century BCE.

Writing Technology in India

- Today paper is the main material used for writing, but its origin is not in India. Modern paper is a Chinese invention and the word 'paper' is from Greek papyros, the tall paper-reed plant oncevery common in Egypt.
- The Hindi word Kagaja (paper) is of Persian origin. Paper is has been used in India only for about a thousand years. Before that the main writing materials in our country were birch-bark, palm-leaves and copper-plates. Besides these, agaru-bark, bricks, earthenware, shell, ivory, cloth, wood, etc. had also their uses as materials for writing.Today all the inscribed materials from the past are in the custody of museums, both Indian and foreign.

Writing Technology in India

- Prehistoric rock paintings have been discovered at Bhimbetka,Pachmarhi, Adamgarh, Mirzapur and many other Indian sites. Here the paintings, in vivid and panoramic detail, depict the day-to-day life of the cave-dwellers. These paintings, which can be called the early pictorial writing, are done mostly in red and white and occasionally in green and yellow. The colours were taken from local minerals and were mixed with water and a fixative resin of some local tree or animal tallow. The brushes used were made of twigs or, for finework, quills.
- Indus inscriptions, usually short and numbering about 4000, are found on a variety of objects : (1) steatite seals, (2) sealings on clay, miniature stone, terracotta or faience tablets, (3) copper tablets, (4) bronze implements, (5) bone and ivory rods, (6) pottery graffiti, and (7) miscellaneous objects, such as the unique inscription found at Dholavira lying face down on the floor in front of a crumbled gate and made of a white, crystalline material.

Writing Technology in India

- In the Buddhist Jatakas there are many references to the art of writing. Panini (c. 500 BC) in his Ashtadyayi refers to granth (book), lipikara (writer) and Yavanani lipi (Greek script). In Panini's grammar writing was an essential element in the technical arrangement of his rules. But we have no definite knowledge of the writing materials used in those days.
- Stone was the principal writing material in use in ancient India.Engravings on stone, as emperor Ashoka himself expresses, are "such as to endure for a long time". Such engravings were made on rocks, slabs, smoothed or rough pillars, images, caskets, vases, etc. Stone slabs or columns used to be inscribed with grant-deeds, royal eulogy, proclamations, agreements between individuals or kings and even with literary works. For example, the Kurmashataka, a poetical work in Prakrita by the scholar-king Bhoja of Dhara (Malwa) is engraved on stone slabs.
- Putting inscriptions on stone pillars is a very old tradition. Emperor Ashoka (272-232 BC) got his edicts inscribed on rocks and also on stone pillars. Some of the pillars are 15 m high and weigh nearly 50 tons. These Ashokan pillars can be seen in Delhi, Allahabad, Lumbini and several other sites.

Pyrotechnics in India

- The wedding of Dara Shikoh, Shah Jahan's eldest son, in 1633 was a grand affair organised by his sister Jahanara Begum in accordance with the wishes of her dead mother Mumtaz Mahal. It cost nearly Rs 32 lakh and included a magnificent display of fireworks, which was witnessed by an English traveller, Peter Mundy.
- But it is uncertain when exactly fireworks began to be used in India. While some historians suggest they came with the Mongols in the 13th century, Mukhoty says they surely existed in the subsequent Mughal era. The Mughals, she adds, associated themselves with light, fire, and the sun – a symbolism that matched the firecrackers.

Pyrotechnics in India

- “Akbar used to say that we must celebrate everything to do with fire and fireworks. It was very much a part of their tradition. When Akbar defeated Hemu Vikramaditya [Second Battle of Panipat, 1556] in Delhi, he apparently made a Ravana-style effigy of Hemu, using fireworks. This was the 16th century. So they certainly existed from the 16th century onwards.”
- Another historian, PK Gode claimed in an account titled *History of Fireworks in India between 1400 and 1900* (1953) that firecrackers existed in India two centuries before that. He refers to various texts that mention the use of firecrackers. One of the earliest mentions Gode found was by Kamal-ud-din Abdur Razzaq, the ambassador from the court of the Persian Sultan Shah Rukh, who stayed in Vijaynagar in 1443, and mentioned the use of pyrotechny in the Mahanavami festival.

Pyrotechnics in India

Elaborate description of fireworks in mythological works also bring in imaginations of pyrotechnic exuberance around epic events.

Trade in Ancient India

- During ancient times Hindus were the masters of the seaborne trade of Europe, Asia and Africa. Till about the beginning of the 18th century almost every nation on earth obtained to a large extent its supplies of fine cotton and silk fabric, spices, indigo, sugar, drugs, precious stones and many curious works of art from India in exchange of gold and silver. This traditional prosperity of India began to vanish only at the dawn of the Industrial Revolution in the west.
- In industrial production ancient India was far ahead in comparison with other countries of those times. According to Prof. Weber the skill of the Indians in the production of delicate woven fabrics, in the mixing of colours, the working of metals and precious stones, the preparation of essences and in all manner of technical art, has from early times enjoyed a world-wide celebrity. For instance surgical instruments of great delicacy and accuracy were manufactured in India and it was from Indians that the art of tempering steel was learnt by other people.

Trade in Ancient India

Factors favouring India to emerge as the number one country in trade, commerce and manufacturing activities were-

- The Hindu mercantile community was very enterprising and known for their entrepreneurship, trustworthiness and resilience.
- Indian goods were known for its excellence. The skilled artisans of India manufactured varieties of goods which people in other parts of the world could not find elsewhere.
- Fairs were an important means for commercial activities and were held in every part of the country. Huge number of people assembled at these fairs for the purpose of exchanging merchandise as well as discussing religious and national topics.

Trade during the Vedic times

- The Rig-Veda contains several references to sea voyages undertaken for commercial and other purposes. God Varuna is credited with the knowledge of sea routes followed by ships. Later when urban culture flourished in cities like Harappa and Mohenjodaro, India had established trade and commercial relations with Sumer, Egypt and Crete.
- Lothal in Gujarat was one of the biggest port towns of that period with a huge dockyard constructed out of brick.
- In the Old Testaments, we have reference to trade between India and Syrian coast dating back to 1400 B.C.
- According to the chronicles of the Jews, during the reign of King Solomon (c.800.B.C.), a navy equipped by Hiram, King of Tyre, undertook a triennial voyage to the eastern countries and brought back with it gold, silver, ivory, apes, peacocks, Almug trees, jewels and precious stones.
- Ophir was the port at which they loaded these goods in the ships and this Ophir have been identified with the port Abhir or Sopara on the western coast of India by scholars

India’s Dominance up to Pre-colonial Times

- Before the advent of colonial rule, India was a self-sufficient and flourishing economy. Evidently, our country was popularly known as the golden eagle. India had already established itself on the world map with a decent amount of exports. Although primarily it was an agrarian economy, many manufacturing activities were budding in the pre-colonial India.
- Indian craftsmanship was widely popular around the world and garnered huge demands. The economy was well-known for its handicraft industries in the fields of cotton and silk textiles, metal and precious stone works etc. Such developments lured the British to paralyze our state and use it for their home country’s benefits.
- The famous Kohinoor diamond has been doing rounds in the news. It was a prized possession of pre-colonial India which the British took with them on their way back home. The talks of taking it back have caused a stir in the recent past. However, it forms a very small fraction of what our colonizers took away. As a consequence, our country was in a grim state when they left. This forms the basis that governs our current policies and future prospects.

Video Link

- Youtube/other Video Links:
- https://youtu.be/1kUkWRnkEaY?list=PLhDPmw02TYsnl85_953po60uI_-R8CQY8
- https://youtu.be/Hw6J5uOm7E8

Daily Quiz

1. Discuss the different sciences that prevailed in Ancient India.
2. Define Ayurveda.
3. Name the different forms of water conservation in India.
4. Define Pyrotechnics.
5. Enlist different modes used for Writing in primitive times.
6. What was India called in Pre colonial times?
7. What is Geography?
8. Explain how trade used to take place in India.

MCQs

1. An ancient book of 1000 B.C. deals with health, hygiene, longevity etc?

A. Sushruta Samhita

B. Atatharvaveda

C. Bhela Samhita

D. Charaka Samhita

2. Name a concise and scientific exposition of Ayurveda in verse form. It is distinguished by its knowledge of chemical reactions and laboratory processes etc.

A. Vrdukunta

B. Vaghata

C. Kasyapa Samhita

D. None of the above

3. Who is considered as the father of western medicines?

A. Hesiod

B. Hippocrates

C. Both 1 and 2

D. Neither 1 nor 2

MCQs

4. Indian astronomy flowered in the 5th–6th century, with this great scientist.

A. Aryabhata
B. Charaka
C. Sushruta
D. None of these

5. The _____ number system in use today was first recorded in Indian mathematics.

A. Binary
B. Digital
C. Decimal
D. Fraction

6. Pyrotechnics refers to the use of _____

A. Chemicals
B. Fireworks
C. Perfumes
D. Technology

Assignment

Q.1. Explain Astronomy as a science in India.

Q.2 Discuss the contribution of India in Mathematics.

Q.3Throw light on the different Harappan Technologies.

Q.4 Discuss the development of Writing Technology in India.

Q5. Write a note on Trade in Ancient India.

Expected Questions for University Exam

Q.1. Explain Astronomy as a science in India.

Q.2 Discuss the contribution of India in Mathematics.

Q.3Throw the light on the different Harappan Technologies.

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Q5. Write a note on Trade in Ancient India.

Old Question papers

Subject introduced for the first time!!

Summary

This unit gives overview on the different sciences –Geography, Biology, Astronomy during the ancient times and also gives insights about the different technological advances that have been taking place in India. It also tells us about our rich cultural heritage from pre colonial times till date.

References

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