Volume 1, Issue 1, July-September 2026
e-ISSN: Awaiting

Journal of INDIAN KNOWLEDGE STUDIES (JIKS)

Basic Science in Indian Knowledge System (IKS)

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ABSTRACT

The Indian Knowledge System (IKS) encompasses millennia of indigenous learning in medicine, astronomy, mathematics, agriculture, ecology, metallurgy and more. The Indian knowledge systems evolved out of experience, observation, experimentation and rigorous analysis and influenced areas from education and health to agriculture. The IKS claims rich heritage of ancient and eternal Indian knowledge and thought, guiding light, referring to Indian knowledge tradition of science technology and medicine. The IKS identify ancient educational institutes like Takshashila, Nalanda, Vallabhi and Vikramshila universities. These universities established in Vedic era in India, it represents multidisciplinary teaching and quality research.

The concept of molecule in its microscopic form is conceptual parallel to atomic theory which described by Maharishi Kanada. The concept of earth's rotation described by Aryabhata it seen in modern astronomy. The Sushruta surgery procedure is parallel to modern surgical techniques. The Charak Ayurveda and disease classification has seen in modern pharmacology. The Patanjali yoga and mental control neuroscience or psychology has parallel to modern psychology and neuroscience. The Varahamihira astronomy and planetary calculations of cosmic bodies are parallel to the principles of modern astrophysics. The concept of gravity interpretation of Bhaskaracharya mention matter of being pulled towards centre is similar to modern concept of gravity. The structure of Panini grammar, linguistics is seen in modern linguistics. The Katyayana describe mathematical logic procedure are parallel to modern mathematical logic. The metallurgy chemistry of Nagarjuna has parallel to principle of modern chemistry. The proof of geometry formula Baudhayan and geometrical concept of Shulba Sutras are parallel to modern geometry. The biology signs and ecological interpretation of Kashyap show interrelationship in environment and organism it is similar to modern biology and ecology. The sutras of ancient sages show conceptual similarities with modern science, reflecting the evolution of knowledge and the continuous journey of human curiosity. These types many Indian philosophers contribute for Indian knowledge system.

KEYWORDS
Indian Knowledge System, Microscopic, Surgery, Neuroscience, Linguistics and Geometry etc.

ARTICLE HISTORY
Received: 02 July 2026
Revised: 15 July 2026
Accepted: 04 August 2026
Published: 05 September 2026

CITATION
Babasaheb, J. S, (2026) Basic Science in Indian Knowledge System (IKS). *Journal of Indian Knowledge Studies (J. Indian Knowl. Stud.)*, 1(1), 45-55. https://doi.org/

In the Indian knowledge system there is four upavedas which describes the ancient knowledge. The first is Ayurveda known as science and life and medicine it related to Rig Veda one of oldest and comprehensive system of medicine in the world. The Ayurveda has focus on science of life, health, healing and longevity. In Ayurveda 'Ayuh' means life and 'Veda' means knowledge its meaning is knowledge of life. It teaches health is balance between body, mind, senses and soul and classifies human constitution in three doshas Vata, Pitta and Kapha its balance ensure health and imbalance causes diseases. The text Charaka Samhita in Ayurveda has focus on internal

medicine, Sushruta Samhita focus on surgery and Ashtanga Hridaya comprehensive guide to Ayurveda practice. The Ayurveda cover different topics like surgery, herbal remedies, detoxification, mental health and rejuvenation therapies. It not influences healing practices but spread to other countries in Asia shapes different traditional medicines. Today Ayurveda recognizes globally part of wellness and alternative medicine movement integrated with modern healthcare for holistic treatment. The second upaved is dhanurveda science of warfare related with Yajur Veda. It is also ancient science of warfare encompasses material of arts, military strategy and archery. The Dhanus means bow it extends beyond archery cover entire spectrum of warfare and duties of Kshatriya (warrior). It cover training of swords, clubs, spears and bows, battle formation, combat techniques and military ethics and psychological preparation and disciplines of worriers. The elements of Dhanurveda are reflected in India's ancient martial traditions, such as Kalaripayattu (Kerala) and Silambam (Tamil Nadu). In the modern context, while its direct application to warfare has reduced, it is preserved in traditional martial arts, military history, and studies of ancient Indian warfare. The third upaved is Gandharvaveda the science of music and performing art, it related with Sama Veda and dealing with music, dance and performing arts. The Sama Veda, being inherently musical, it teaches science of sound and melody, vocal and instrumental music, dance and dramatic performance and rhythmic pattern and aesthetic principals. The Gandharvaveda laid foundation of Natyashastra, the text like Sage Bharata systemized performing art include classical dance and theatre. It considers as root of Indian classical music Hindustani and Carnatic tradition. The Gandharvaveda is not only on entertainment but also on the use of arts in religious rituals, temple ceremonies, and spiritual upliftment through devotional music and dance. The fourth and last upaved is Sthapatyaveda science of architecture and sculpture it related with Atharva Veda and focuses on architecture, sculpture, and town planning and design principles. It consider as origin of Vastu Shastra which deals with spatial harmony and relationship between man, building and nature. It includes construction of homes, temples and palaces, iconography and sculpting of deities and sacred symbols. In which geometric and mathematical principles used for alter design and relationship between architecture and cosmology. This Veda emphasizes structure align with natural force and pattern of harmony and prosperity. Today Sthapatyaveda's influence continues in temple building, sculpture tradition even in urban and residential design.

In the subject like mathematics zero concept introduced by Aryabhata in 5^{th} century CE, in 7^{th} century Brahmagupta formalize operation with zero decimal place value system and revolution global computation trigonometry. The Aryabhata sine tables, Madhava infinite series predicated, Bhaskara II's Lilavati contain quadratic equation and permutation theory in the ancient period. Aryabhata proposed earth's rotation and calculated $\pi = 3.1416$, explained eclipses significantly. Bhaskara II calculated planetary position with remarkable accuracy it helps in Jyotisaveda the Vedic astronomy is timekeeping and ritual timing. The Ujjain observatory is centre for astronomical calculations; it is equivalent to Greenwich meridian. Vaisesika School in 6^{th} century BCE proposed atomistic theory which similar to modern atomic theory. Brahmagupta describes gravitational force polling object to earth, Kanand work on light particles, and the reflection motion Newton's law prefigured in Nyaya-Vaisesika text with velocity and force chemistry. In chemistry preparation of medicine using sulphur and mercury metals occur ancient time, the dye like indigo, turmeric and saffron applied in that time, perfume and medicine distillation process also available at that rime. In the medicine and biology Sushruta Samhita describe more than three hundred surgical processes and with their instruments. In Charaka Samhita process of digestion, metabolism and immunity described. More than one thousands medicinal plants describe with their pharmacological properties in ancient Indian Knowledge System. The ancient Indian botany Vriksayurveda describes botanical treatise classified more than one thousands plants by Parasara in 400 BCE. The Vrikshayurveda has focus on horticulture, tree care and plant propagation rather than field crops, details organic methods for more than 170 species. In Vedic period Rigveda mentions process of photosynthesis practice of manure and crop rotation. The Krsi-

Parasara is agriculture science text and Upavana-vinoda is Arbor-horticulture treatise. . The nature act as living barometer, in ancient text describes specific behaviours which signal arrival of monsoon.

OBJECTIVES OF STUDIES

- To study the role of Indian knowledge system in modern science
- To study the ancient basic science knowledge
- To focus on ancient knowledge of India as compare to world
- To aware young generation about basic science in Indian knowledge system

ANALYSIS

The Indian Knowledge system principles promote sustainable living, ecological balance and harmony with nature. It reflects deep understanding of environmental interconnections. The Indian Knowledge system demonstrates ability to evolve and adapt over time, incorporate new insights when retain on core principles. The basic science is branches of natural sciences that seek to understand the underlying principles of the universe. It covers disciplines like physics, biology, chemistry and mathematics like subjects. In the Indian knowledge system there is many texts and knowledge available, some texts are destroyed but knowledge is occurs in the society.

1. Mathematics and astrology in Indian Knowledge System-

The concept of zero in India holds significant historical and mathematical importance, the numerical zero understand today is integral part of the decimal numerical system. In India decimal system and zero use track back to Indus Valley civilization which is existed around 2500-1500 BCE. The archaeological findings indicate the use of symbols for counting and recording quantities. The zero is number with its own value and significance start to evolve later. The Aryabhata is known for his work ‘Aryabhatiya’ it is Sanskrit text contain 121 verses, it consist wide range of topics in mathematics and astronomy. Aryabhata was Indian mathematician and astronomer in the period 476-550 CE. He developed zero concepts and used symbol represent it. The concept of π (pi) represents as mathematical constant which is equal were widely respected and studied in India and to 3.14159, it calculated by mathematicians and astronomers in various ways over the centuries also developed by him. Aryabhata made significant contributions to trigonometry. He introduced trigonometric concepts and the sine function, which he referred to as ‘jya’. His trigonometric tables and methods laid the foundation for further developments in Indian mathematics. Aryabhata work in astronomy included calculations related to the positions of planets, the lunar eclipse, and the solar eclipse. He proposed a heliocentric model of the solar system in which he correctly stated that the Earth revolves around the Sun. This heliocentric idea was well ahead of its time and predated similar ideas in Europe by many centuries. The Brahmagupta in the period 598-668 CE has given significant contribution for understanding zero. He introduce rule for arithmetic operation involve zero like addition and subtraction zero which known as fundamental concept in mathematics. Brahmagupta is best known for his mathematical treatise titled ‘Brahmasphutasiddhanta,’ which translates to ‘The Corrected Treatise of Brahma.’ This work covers a wide range of mathematical topics and is considered one of the most important mathematical texts from ancient India. He introduced the concepts of positive and negative numbers, including zero, and discussed their properties and operations. His work laid the foundation for the systematic study of integers and rational numbers. In the contributions is his treatment of zero as a number with its own mathematical properties. He discussed zero's role as a placeholder in numerical notation and explained rules for arithmetic operations involving zero. He also an accomplished astronomer his work included observations of celestial phenomena, such as planetary positions, eclipses, and the positions of stars and planets. He developed methods for calculating the positions of celestial objects. He made contributions to geometry as well. He studied various geometric shapes and properties, including the area of triangles and cyclic quadrilaterals. His work on geometric theorems and proofs was influential in the field. Brahmagupta contributed to trigonometry by developing formulas and relationships involving trigonometric functions, particularly for right-angled triangles. His works were later translated into other languages,

including Arabic and Persian, which contributed to the spread of his mathematical ideas to other parts of the world.

The Bhaskara I in the period 7th century CE has given an approximation of pi in his work 'Mahabhaskariya'. He used a different method involving a polygon with 384 sides to estimate pi more accurately. The Madhava of Sangamagrama a prominent figure of this school, developed series expansions for trigonometric functions, including pi. He predated his work European developments in calculus and infinite series by several centuries. It's important to note that while Indian mathematicians made notable contributions to the understanding and approximation of pi, the concept of pi and its accurate calculation were also pursued in various other ancient civilizations, such as Babylon, Egypt, and Greece. Mahavira is known as Mahaviracharya was Jain philosopher and mathematician in the period 9th century CE. His work Ganita Sara Sangraha which has translates to "Compendium of the Essence of Mathematics." The work of Mahavira focused on number theory, including the study of prime numbers, factors, divisibility, and algebraic equations. He made important contributions to understanding the properties of numbers. He also developed a novel method for prime factorization, which involved a systematic procedure for finding the prime factors of a given number. His method was more efficient than earlier techniques and is still studied by mathematicians today. He made advancements in the study of continued fractions, which are expressions in which a number is represented as an infinite series of fractions. His work on continued fractions was pioneering and contributed to the broader field of mathematics. The Bodhayana is known as Bodhayanaacharya is an ancient Indian mathematician and scholar known for his significant contributions to mathematics. In the period around the 6th century BCE, makes him a prominent figure in the history of Indian mathematics. His work primarily focused on geometry and geometric principles. His notable contributions are his commentary on the 'Brahmasphutasiddhanta' which was originally written by the renowned Indian mathematician and astronomer Brahmagupta. His commentary provided valuable insights and explanations for the mathematical concepts and principles presented in the 'Brahmasphutasiddhanta'. The Bodhayana elaborated on various mathematical topics, including arithmetic, algebra, and geometry. Bodhayana contributed to the understanding of algebraic concepts and equations. His commentary contained explanations of algebraic expressions and equations, demonstrating his mathematical prowess.

The Bhaskaracharya is known as Bhaskara II was a renowned Indian mathematician and astronomer in the period 12th century CE. He made important contributions to mathematics, particularly in the areas of algebra, arithmetic, and calculus. His work "Lilavati" is one of his most famous mathematical treatises. He also an accomplished astronomer wrote the astronomical treatise known as the 'Siddhanta Shrimani. It divided into four sections such as Lilavati (arithmetic and geometry), Bijaganita (algebra), Grahaganita (mathematics of the planets), and Goladhyaya (spherical trigonometry). In the Grahaganita section, he made significant contributions to understanding planetary motion and eclipses. Bijaganita is a comprehensive work on algebra. It covers topics like solving equations, indeterminate equations, and algebraic methods for finding square roots. He proposed calendar reforms and made adjustments to the Indian calendar system. His insights into the calculation of leap years and the adjustment of months contributed to the accuracy of Indian calendars. Varahamihira is best known for his astronomical and astrological works, his work 'Brihat-Samhita', is a comprehensive treatise that covers a wide range of topics, including astronomy, astrology, mathematics, architecture, and more. It provided valuable information about planetary positions, eclipses, and other celestial phenomena. He has given contributions to mathematics, particularly in the context of astronomy and mathematical calculations related to calendars. He was skilled in the use of numbers and mathematical techniques for astronomical and astrological predictions. His work about meteorology in 'Brihat-Samhita,' has offer insights into weather patterns, forecasting, and related phenomena. His work included observations about natural disasters and atmospheric conditions. He proposed reforms to the Indian calendar system to make it more accurate. His recommendations influenced the development of Indian calendars

and their adjustment for leap years. In the field of Jyotisha (Indian astrology), he given significant contributions to the study of horoscopes, planetary movements, and the interpretation of celestial events. Brihat-Samhita remains an important source of information for understanding ancient Indian knowledge systems, especially in the fields of astronomy and astrology.

In the mathematics text like 'Shulba Sutras' is collection of ancient Indian texts dealing with geometry and construction, include approximations of the value of pi. The text key Vedic text, introduces advanced mathematical principles for constructing altars. This knowledge reflects an early understanding of geometry and measurement, demonstrating the integration of science into daily life. The Brahmi script played a significant role in the development of numeral systems in India. It had symbols for numbers, and these symbols are considered some of the earliest written representations of numerical values in India. The Kharosthi numerical system was a positional decimal system similar to the more widely known Indian numeral system. It used symbols to represent numbers, and the position of a symbol in a number determined its value, just as in the Indian numeral system. The system included various lines and curves to represent different numbers. They had symbols for numbers from 1 to 9, and a symbol for zero, making it a decimal system. The Kharosthi script and numerals have been found on inscriptions, coins, and other ancient artifacts. This type Indian knowledge system has given contribution in the field of mathematics and astronomy field.

2. Biology (Botany Medicine and Agriculture) in Indian Knowledge System-

The Parashara was grandson of Varshitha and father of Vyasa per Puranic lore, authored many texts on astrology, meteorology and farming with name denote institution across disciplines rather than single figure. The textual evolution composes in 213 shloka. The Krishi Parashara shaped medieval Indian agronomy provide Vedic blueprint for practical farming that later texts expand into region specific manuals embedded its principles of lunar calendars, organic input and soil science across diverse ecologies. Vrikshayurveda is a dedicated text signifying the importance of agricultural science. Vrikshayurveda means the science of plant life, mainly dealing with various species of trees and their healthy growth and productivity. It suggests that planting of trees is a means to attain the four components of life i.e. Dharma, Artha, Kama and Moksha. This holistic approach of the science enabled the proper cultivation and care needed for the growth of plant kingdom. In Vrikshayurveda, the cultivation of about 170 plant species are described including water management, soil conservation, fertilizers to cultivate the plants, the various diseases affecting the plants and their treatment. Atharvaveda has mention about conservation and utilization of nature. It says, that first and foremost in the process of harvest is that no damage should be done to the earth and secondly all humans can use nature for survival but not to be overuse or abuse. People in antiquity had profound knowledge regarding ethnic methods of farming, agriculture, horticulture etc. Being totally dependent on rains, they knew the art of rain harvesting for their personal and agricultural needs. The ancient sages had proper understanding of preservation of plant life and in-depth knowledge of the relationship of plants with other plants, animals, soil moisture, temperature and another geological phenomenon.

India was blessed with a vast forest area which is the second greatest economy in ancient India after agriculture. About ten thousand different plant species were found in India out of which about 5000 were having medicinal properties and about 2500 different plants had been used as food. The forest in India is the principal repository of large number of medicinal and aromatic plants, which are largely collected as raw materials for manufacture of drugs and perfumery products. The ancient Indian scriptures have mentioned the number of trees. The Rigveda has recorded 67 medicinal plants, Yajurveda 81 species, Atharvaveda 290 species, Charak Samhita (700 BCE) and Sushruta Samhita had described properties and uses of 1100 and 1270 species respectively. The Vrikshayurveda deals with various tree and plant species and ensure the healthy growth and productivity. It consists of about 170 different plant species including herbs, shrubs and trees. The different chapters of Vrikshayurveda deal with agro -horticulture, home gardening, intercropping and storage etc. The book

emphasizes on plant procurement and preservation along with soil treatment, ground water management and fertilizers. Two ancient books are completely dedicated to Vrikshayurveda. Vrikshayurveda wrote by Salihotra around 400 B.C. E consists of twelve vast chapters namely Bhumi nirupana (Graphical representation of Soil classification according to Bhumi nirupana), Bijoptivithi (illustrate about the process of seed germination), Padapavivaksa (exposed to the medicated smoke which can serve as an antimicrobial agent), Ropana vidhana (method of cultivation), Nise canavidhi (the life of plant), Posana (nurture),vidhi (method), Drumaraksa (protect trees from weather), The taru cikitsa (methods of curing), Upavanakriya, Nivasa sanna taru Subhasubha Laksana (perfect dwelling), Taru Mahima was a little away from roof and window and Citrikarana make it blossom throughout the year. The Vrikshayurveda was written1400 years after Salihotra by Surapala in 1000 CE. Surapala lived and worked in Bundelkhand in central India, under the royal patronage of King Bhimapala. He carried out his various experiments in horticulture and botany. His text was forgotten and fell into oblivion for several centuries. It was translated from Sanskrit into English by Dr. Nalini Sadhale in 1996 and in Hindi by Dr. S.L. Choudhary in 2003.Surapala's book deals with different subjects such as planting a garden, importance of various trees, collection, examination and treatment of seeds, selection of suitable land, soil characteristics, digging of planting pits, different methods of irrigation, plant nutrition, fertilizers, diseases of trees and their treatment, the wonders of horticulture, plant conservation, underground water resources etc. He wrote about all these basic information, a millennium ago when chemical fertilizers and pesticides were unknown. In those days' plant diseases and pests were dealt with by natural means available to the farmers who were using the locally available materials. The basic techniques of agriculture enunciated by him yielded magnificent results in the past decade. This manuscript on horticulture gives methods to prepare various kinds of manures for more yield and preparation for various solutions to treat plant diseases. Acharya Surapala is referred to be a prominent physician of his time. The science of mother's womb. Another is Vatatapika it was for plant life, avers that the reference must have been to some other Surapala of the seventh century, the author of Vrikshayurveda must be in 10th Century C.E. He also claims that an ancient work on plants Ganikarika was there before Surpala and which must have guided him to write the book. Ayurveda is an ancient holistic medical system. Its classical texts like Charaka Samhita, Sushruta Samhita, and Ashtanga Hridaya) describe personalized health, diet and herbal therapies. In the period 400 BC 200AD Charaka and Sushruta listed 700 medicinal plants and 6,000 formulations for treating ailments. The system emphasizes prevention, lifestyle, and understanding individual constitution. Today Ayurveda remains institutionalized: India has over 400,000 registered Ayurvedic practitioners and formal regulatory structures for education and quality. Sushruta was known as father of surgery, he described 120 surgical instruments and techniques including rhinoplasty (nose reconstruction), cataract couching, and caesarean section. He emphasized cleanliness, use of anaesthesia by wine and herbal sedatives, and cadaver dissection for anatomical learning.

3. Chemistry and Metallurgy in Indian Knowledge System-

In India the origin of alchemy can be traced back to the Vedic age. Medicinal plants are classified into two categories according to Atharvaveda; ayusani (promoting longevity) and bhaisajya (curing diseases). In the Ayurvedic period the term ayusani gave place to Rasayana. The Rasayana represents drugs which improve the circulation of body fluids and thus helps in prolongation of life. The Vedic people had a strong appeal for gold and for an exhilarating drink called soma. Both were exalted to a divine position. The Atharva Veda mentions about gold as a heavenly blessing which confers longevity on a person who wears it. Soma rasa according to Rig-Veda was drink of immortal gods. The extraction of juice of soma was itself an elaborate ritual. It was offered to the gods by priests. Soma rasa like gold was also considered to bring immortality. The Rasayana has two types one is Kuti Praveshika which is undertaken in a specially built three chambered house. This method every cell of the body gets rejuvenated. It is designed on the basis of first state of life in those who found it impossible to undergo the first

method because of its strict rules. In this method one was exposed to sun and wind during Rasayana therapy.

India has had a high tradition of metallurgical skills; two important sources for the history of Indian metallurgy are archaeological excavations and literary evidences. The first evidence of metal in Indian subcontinent comes from Mehrgarh in Baluchistan, where a small copper bead was dated to about 6000 B.C.E. It is, however, thought to be native copper, which has not been extracted from ore. The archaeological excavations have shown that Hiarappan metal smiths obtained copper ore from Aravalli Hills, Baluchistan or beyond. Many bronze figurines of humans and animals have been unearthed from Hiarappan sites. The systematic excavations at Mohenjo-Daro in Sindh and Harappa in Punjab show that during the mature Hiarappan period, the metal workers perfected the metallurgical skill. Harappa's used metals like tin, arsenic, lead, antimony, etc., for alloying. They had also perfected the wax technique of metal casting in as early as the third millennium B.C.E. They melted and forged a variety of objects from metals such as lead, silver, gold and copper. They improved the hardness of copper for making artefacts by using tin and arsenic. Iron Pillar of Delhi is ancient Indian metallurgy is exemplified by the Iron Pillar at Delhi. This 7-ton forged iron column has stood for 1600 years with negligible rust. Scientific studies show it was made by hammer-welding high-purity iron blooms step by step. Its remarkable corrosion resistance is attributed to its unusual high-phosphorus iron composition and the formation of a passive 'misawite' film (a rare crystalline iron hydrogen phosphate) on the surface. In short, the amazing technology of a metallic object fabricated over fifteen centuries ago and its phenomenal corrosion resistance continue to fascinate modern metallurgists.

The metals which have been mentioned in rasashastra texts are gold, silver, copper, & iron which are considered pure while lead and tin are considered as odorous. In the alchemical texts various plants have been mentioned some of which have medicinal value. The roots, leaves or seeds of these plants aid indigestion. According to Alberuni most of the medicines prepared in Rasayana Were from plant sources regarding animal products, their excreta, flesh or some other parts of their bodies were processed and used but comparatively the use of metals and minerals in alchemy was more pronounced. According to rasavadins minerals and metals desired alchemical properties unless they were treated or digested with some medicinal plant. Even mercury that was considered the king of rasas had to undergo treatment with different plants. It was solidified using plant juices, metals and sulphur. Gold was also used in preparing a variety of medicine. Different methods of preparing compounds of mercury having medicinal value were developed by the alchemists. The alchemical texts have given the details of processes for the preparation of different types of bhasmas. In the preparation of bhasmas the desired substance is heated for a long period which plays an important role in obtaining an effective product of fine particle size. Some of the bhasmas prepared by rasavadins showing their experimental skills are:

Gold bhasma- In this thin gold leaf were to be coated with a paste made of mercuric sulphide and the juice of custard lime, dried and incinerated. This process was to be repeated ten times, after which bhasma could be used as medicine. It could also be prepared by a process that involved cinnabar, sulphur, realgar and sal ammoniac (ammonium chloride) as well as gold and citrus juice.

Silver bhasma- One method of preparing this was that silver foils were to be coated on both sides with kajali prepared from mercury and sulphur, and ground in citrus juice. These were dried and powdered sulphur was spread over them above and below. These were then placed between two earthen plates, sealed and heated in a sand-bath for a day, over a strong fire. When it got cold, the product was mixed with powdered pyrites in equal quantities and ground well with lime juice and then heated for a long time till the silver was reduced to its bhasma form.

Copper bhasma- It was prepared by keeping copper leaves immersed in cow's urine for 15 hours and then taken out. Copper leaves are placed in the paste of Cangeri (oxalis corniculata) and kajali (prepared from mercury and sulphur) is also put in it. The pot was closed with lid and heated on high flame for three hours. After cooling it, the mass is powdered and thus the product called copper bhasma became ready for use.

Lead bhasma- For its preparation mercury was added to molten lead along with barks of Arjuna (Terminalia arjuna), Vibhitaki (Terminalia belerica), Ashwagandha (Withania somnifera), pomegranate and apamarga (Achyranthes aspera). These were heated together for 21 nights, all along constantly stirring by an iron ladle. The product obtained is finely powdered. According to alchemical texts lead bhasma was excellent for rasayana therapy.

In the metallurgy India dates back to the beginning of Chalcolithic culture in the sub-continent. Copper and bronze were used for making weapons, tools and cheaper ornaments. Copper found at Mohenjo-Daro contains an appreciable amount of lead and also some objects made of copper which also contain nickel. An alloy of copper and arsenic was also used at Mohenjo-Daro. Copper was smelted from ore and afterwards refined in clay crucible. The fragment of such crucible with slag sticking at the edges has been found at the excavation of Mohenjo-Daro. One of the resource zones for copper was Aravalli range. There are deposits of copper, lead, silver and zinc ores in the Aravalli hills. The copper ore of this region contains 4 per cent to 8 per cent arsenic. Many copper objects obtained from Harappa and Mohenjo-Daro contains high level of arsenic. Radiocarbon dating shows that the mines are of the last quarter of the second millennium B.C.E. Large heaps of broken stones have been found near the mining area. It seems that ore bearing rocks were taken to the valley, where they were roasted, crushed, concentrated and smelted. The excavations in the central parts of Ganges Valley and Vindhya Hills have shown that the art of iron smelting and manufacturing of iron artefacts was well known in eastern Vindhyas and it was in use in the Central Ganga Plain. In the recent excavations conducted by Uttar Pradesh State Archaeological Department, iron furnaces, artefacts, tuyers and layers of slag have been obtained. Radiocarbon dating places them between 1800 and 1000 B.C.E. The quantity and types of iron artefacts and the level of technical advancements in India indicate that the introduction of iron work took place even earlier.

India in the first millennium C.E. Greek accounts report the manufacture of steel in India by crucible process. In this process, iron, charcoal and glass were mixed together in a crucible and heated until the iron melted and absorbed the carbon. With the passage of time, blacksmiths of ancient India gained specialised skills in the hot and cold working and hot and cold forge welding. They gained experience about the effect of carbon on the physical properties of iron. They developed the process of carburisation. This resulted in hardening of the material. This process has been known as ‘steeling’. This was used for making arrow heads, swords and knives, etc. India was a major innovator in the production of advanced quality steel. Indian steel was called the wonder material of the Orient.

There is archaeological evidence of zinc production in Rajasthan at Zawar around the sixth or fifth B.C.E. Due to low boiling point, zinc tends to vaporise while its ore is smelted. As a result, its vapours present in the furnace are re-oxidised and the metal is lost. Therefore, zinc is produced by distillation technique. India was the first country to master zinc distillation. The technique used for distillation in Zawar was designed for downward distillation in which vapours were condensed in a lower container. The distillation of the pallets of roasted ore mixed with charcoal powder, salt, etc., and borax as flux was carried out in brinjal shaped retorts. In excavation at Zawar, these retorts have been found. Each distillation unit had two chambers. Lower chamber was separated from the upper chamber by perforated bricks. Hiarappan also used gold and silver as well as their joint alloy electrum. Variety of ornaments such as pendants, bangles, beads, rings, etc., have been found in ceramic or bronze pots. Early gold and silver ornaments have been found from Indus Valley sites such as Mohenjo-Daro (3000 B.C.E). These are on display in the National Museum, New Delhi. India has the distinction that the deepest ancient mines in the world for gold are in Maski region of Karnataka with carbon dating from mid first millennium B.C.E. The river Sindhu was an important source of gold in ancient times. It is interesting that the availability of alluvial placer gold in the river Sindhu has been reported in modern times also. It has been reported that there are even now, great mines of gold in the region of Mansarovar and in Thokjalyug.

The dyeing in ancient India was a highly developed craft that combined botanical knowledge with chemistry and textile expertise.

Evidence from archaeological sites like Mohenjo-Daro and Harappa indicates the early use of natural dyes extracted from plants, minerals, and insects. Techniques such as resist-dyeing, mordanting, and block printing were already in practice by 1000 BCE. India was especially known for its madder-based red, indigo blue, turmeric yellow, and myrobalan black dyes. These colours were not only vibrant but also fast and long-lasting, thanks to the use of mordants like alum, iron, and tannins, which fixed dyes to cloth. The Ajanta frescoes, dating back to the 5th century CE, preserve vibrant colours even after centuries, reflecting advanced understanding of pigments and binders. Among all dyes, Indigo (Indigofera tinctoria) holds a special place in India's economic and cultural history. Known as ‘nila’ in Sanskrit, indigo dye was extensively cultivated and used in India long before it reached Europe. The dyeing process involved fermentation, oxidation, and sun-curing, requiring considerable technical skill. India was the world's largest supplier of indigo for centuries. Ancient trade routes carried Indian indigo to Rome, Egypt, and later Islamic and European markets. The technique was closely guarded, and dyers' guilds regulated its production. Indigo was not just used for clothing, but also for manuscripts, paintings, and ritual purposes. Kalamkari and Block Printing Traditions was one of India's oldest textile arts is Kalamkari, which literally means ‘pen-work’. The Ajanta and Ellora caves (2nd century BCE to 6th century CE) are prime examples of India's mastery over wall painting using lime plasters, plant-based colours, and organic binders. The artists used colours derived from: Red from hematite and madder root; Blue from indigo and lapis lazuli; Yellow from turmeric and orpiment; and Black from lamp soot and charred bones. Such art often served religious and philosophical purposes, adorning Buddhist, Hindu, and Jain cave complexes. The integration of storytelling, geometry, and symbolism into these paintings reflects the interdisciplinary knowledge base of ancient Indian artists. India has a long tradition of perfumery, known as Gandhashastra or the science of fragrance. The use of incense, oils, resins, and scented powders can be traced back to the Indus Valley Civilization, where archaeologists have unearthed clay distillation apparatus believed that Kanada who also founded the school of to be used in the production of perfumes. The texts such as Charaka Samhita, Sushruta Samhita, and Brhat Samhita by Varahamihira mention fragrant substances used in cosmetics, medicine, and religious rituals. Ingredients included sandalwood, agar wood, rose, vetiver, camphor, and saffron. Perfumers mastered the extraction of volatile oils through methods like: Hydro-distillation; Effleurage (absorption in fat); and Steam distillation using clay retorts. This knowledge anticipated modern aromatic chemistry and played a central role in Ayurveda and temple rituals. Attars and traditional Perfumes the word 'attar' (from Persian ittar) refers to natural essential oils derived from flowers, herbs, and spices. Indian perfumers developed this form of scent production over 2000 years ago. Kannauj, in Uttar Pradesh, remains a centre for traditional attar distillation. Floral waters like rose water and kewda were used in culinary, medicinal, and ritual contexts. Attars were often stored in leather bottles or glass flasks, and royal courts had specialists in fragrance blending. Scented pastes like chandan and kumkum were applied on the body during festivals and ceremonies. Indian perfume culture was intertwined with weather cycles, where heavier attars were worn in winter and lighter ones in summer. Saffron was used in tonics and as a dye; turmeric acted as an anti-inflammatory dye in bandages; and sandalwood paste cooled the skin. These show how science, aesthetics, and healing converged in ancient Indian life.

4. Physics in Indian Knowledge System-

Rishi Kanada was an Indian philosopher who drafted the ideas about the atom in a systematic manner. His real name was to be known as ‘Kashyap’. Since his childhood, even small things tempted his attention. He is being been called as the father of the atomism, who propounded the parmanu (atoms), an approach to physics and philosophy in the approach to physics and philosophy in the Sanskrit text ‘Vaisesika Sutra’. His imputation to physics is the understanding of the universe which follows from his invariance principles. Kanada propounded that parmanu (atom) is an indestructible particle of matter. The atom is indivisible because it is a state at which no measurement can be assigned. It is also believed philosophy considered the atom to be

indestructible and hence eternal. They observed that atoms which are very minute objects are invisible to the human being's naked eyes which come into being and vanish in an instant.

Vaiseshikas further claimed that atoms of the same substance combined with each other create dvyanuka (diatomic molecules) and tryanuka (triatomic molecules). The electricity is an essential part of our daily lives, powering everything from our smartphones to the appliances in our homes and the machines in our workplaces. However, the history of electric charges goes back several centuries, beginning with the ancient Greeks, who discovered the phenomenon of static electricity. The electricity from thunder and lightning has also fascinated us since primitive ages. We are still working on how to safely store and use the enormous electric energy discharged from thunder and lightning. We have ample evidence which proves the use of electricity and battery way back around 10000 – 8000 BCE Hence forth, it can be assumed from the above verse, that use of Sunlight during day time and Electricity at night was used during the Vedic age. The great Sage Agastya mentioned the process of making Battery in his composition Agastya Saṃhitā (around 8000 BCE). The electricity has different types like Tadita means generated by rubbing silk cloths, Saudamini generated by rubbing two gems, Vidyut generated by thunder, Shtakkumbhi generated by hundred cells of pillars, Hrdani was stored electricity with portable properties and Asani is generated from magnetic rods. The electricity is also described in Mahabharata composed by Vedavyasa described the method of generating electricity from the atmosphere. The two technical terms ‘Rayi’ and ‘Praṇa’ are used to mean ‘Positive’ and ‘Negative’ charges in ancient language. These are always in compound state together naturally. The process of spark generation in the clouds, which has now been established by modern scientists, was already mentioned in Mahabharata around 6th century BCE. In the Vedas, Yojana is a unit of distance and Nimisha is a unit of time. Distance travelled=2202 Yojanas. The one Yojana equal to nine miles, 110 yards equal to 21,144,705 miles, The time taken 1/2 Nimisha equal to 0.114286 seconds, so the ancient speed of light=185,016.169 miles / seconds and modern. The sound in modern scientific terms refers to the pressure waves in air received by human beings in the audible range is generally 20 cycles/sec to 20000 cycles/ sec. The infra- and ultra-sound refers to the frequencies below and above the audible range respectively. Acoustics has also received a very high importance in Vedas and Vedic literature. The classical literature of Hinduism or Santana Dharma is rooted in Vedas. It is known that the Vedas are collection of mantras. In Vedas and Vedic literature several terms such as Nada and Shabda are used. The use of natural materials like mud, stone, and wood in construction illustrates an understanding of material science, with Agni symbolizing transformative power and Prithvi being central to building practices.

CONCLUSION

Ancient India was not only a land of deep philosophy and scientific inquiry but also a centre of artistic and sensory innovation. The production and use of dyes, the creation of fine arts, and the development of perfumes and aromatics reveal a sophisticated cultural consciousness, technological ingenuity, and refined aesthetic values. From hand-painted textiles and vibrant wall frescoes to herbal-based fragrances and incense, these elements formed an integral part of Indian life-serving spiritual, medicinal, commercial, and ornamental purposes. Here is the presentation of the rich heritage of dyeing, artistic production, and perfumery in ancient India, demonstrating their deep connection to science, environment, and culture. The basic science is branches of natural sciences that seek to understand the underlying principles of the universe. It covers disciplines like physics, biology, chemistry and mathematics like subjects. India in the first millennium C.E. Greek accounts report the manufacture of steel in India by crucible process. In this process, iron, charcoal and glass were mixed together in a crucible and heated until the iron melted and absorbed the carbon. With the passage of time, blacksmiths of ancient India gained specialised skills in the hot and cold working and hot and cold forge welding. They gained experience about the effect of carbon on the physical properties of iron. The Indian knowledge system has contain more knowledge about basic science which has given world top position once time to India.

REFERENCES-

1. Bhattacharyya, S. (2011) Vedic science and technology. Prabhat Prakashan.
2. Bandyopadhyay, R., and Singh, R. K. (2019) Ancient metallurgy in India: Contributions to modern material science. Journal of Material Science and Technology, 35(5), 479-490
3. Brokensha, David et al. (1980) Indigenous knowledge system: The role of local knowledge in the sustainable management of resources. International Development Research centre, 1980.
4. Choudhary S. K. and Sharma V. K. (2022) scientific validation of ancient Indian Agricultural practices: A review, Journal of Pharmacognosy and phytochemistry, 11(2), 45-52, www. Phytojournal.com.
5. Gadgil, M., and Guha, R. (1992) This fissured land: An ecological history of India. Oxford University Press.
6. Gopakumar S. (2021) Vedic agriculture and its relevance in the 21st century, International journal of Indian culture and business management, 23(1), 12-25.
7. Iyengar, M. V. (2009) Ancient Indian astronomy and its influence on modern physics. Indian Journal of History of Science, 44(3), 301-316.
8. Jyoti Pathak, Chemistry in Ancient India, International Research Journal of Management Science & Technology, Vol. 7 Issue 3, 2016, ISSN 2250 – 1959 (0nline) 2348 – 9367 (Print)
9. Knowledge Traditions and Practices of India, Book code 11151, Chemistry and Metallurgy in India, Class XI, NCERT Publication.
10. Kumar, R. (2010) Vedic mathematics and its applications in modern science. Research Journal of Applied Sciences, 5(4), 322-331.
11. Mishra A. and Gupta R. (2024) Integrating IKS with modern natural farming: A study of soil health, Indian Journal of traditional knowledge, 23(3), 567-574, op.niscpr.res.in
12. Narayana, P. (2015) The application of traditional Indian knowledge in modern energy systems. Renewable and Sustainable Energy Reviews, 41, 1369-1381.
13. Nene Y. L. (2012) The science of plant life by Surapala, Secunderabad Asian Agri-history foundation publication.
14. Pandey, S., and Sharma, N. (2019) Integrating Ayurveda with modern pharmaceutical sciences: A critical review. Journal of Ethno pharmacology, 238, 122-130.
15. Prakash, S. (2003) Ayurveda and modern science: Reconciliation of old and new. Vikas Publishing.
16. Saha, R. (2018) Reinterpreting Vedic texts: Bridging ancient wisdom with modern science. Journal of Scientific Thought, 24(2), 123-132.
17. Saraswat, K. S. (2016) Vedic physics and its impact on modern material sciences. Physics Education, 51(2), 197-204.
18. Sharma, A., and Bansal, A. (2017) Sustainable architecture and ancient building techniques: A study of Vastu Shastra. Journal of Architectural and Environmental Design, 12 (3), 203-215.
19. Sharma, R. (2012) The Sulba Sutras and their influence on Indian engineering and architecture. History of Science, 47(3), 217-229.
20. Singh, H., and Kumari, M. (2015) The role of Indian Knowledge Systems in sustainable agriculture practices. Environmental Science and Policy, 55, 92-101.
21. Soni, P. (2014) The philosophical foundations of the Vedas and their implications on modern science. Journal of Indian Philosophy, 42(1), 85-97.
22. Subrahmanyan, S. (1993) Indian science: Tradition and modernity, Indian Academy of Sciences.
23. Warren D. M. (1991) indigenous knowledge system and development: The role of traditional knowledge in sustainable development, International development research centre publication.