COURSE TITLE	**SCIENTIFIC AND TECHNOLOGICAL HERITAGE OF INDIA**
COURSE CODE	**01IK0001**
COURSE CREDITS	**0**

Objective:

1 To explore India's rich scientific and technological heritage, highlighting ancient innovations, traditional knowledge systems, and their relevance to modern science and sustainable development.

Course Outcomes: After completion of this course, student will be able to:

1 Identify key scientific and technological contributions of ancient India across diverse domains such as mathematics, astronomy, metallurgy, medicine, and engineering. (Bloom's Level: Understanding)

2 Analyze traditional Indian engineering systems (e.g., water management, architecture, materials) to interpret their design, sustainability, and relevance to modern engineering. (Bloom's Level: Analyzing)

3 Compare and evaluate ancient Indian innovations with contemporary technologies to appreciate indigenous knowledge systems and their scientific foundations. (Bloom's Level: Evaluating)

4 Create hands-on projects or models applying traditional scientific principles and propose innovative, sustainable solutions inspired by India's scientific heritage. (Bloom's Level: Create)

Pre-requisite of course:NIL

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
2	0	0	0	0	0	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Indian Knowledge Systems** Philosophy of Indian Science: Observation, Experimentation, Holistic Thinking; Relevance to Engineering Ethics, Innovation, and Sustainability, Overview of Ancient Texts: Vedas, Upanishads, Arthasastra, and Scientific Treatises	2
2	**Mathematics and Computational Thinking** Sulbasutras and Early Geometry; Tools for Trigonometry like Clinometer, Contributions by Aryabhata, Brahmagupta, and Bhaskaracharya, Concept of Zero and the Decimal System, Ancient Indian Calendars and Astronomical Instruments (Jantar Mantar, Sundial, Armillary Sphere, Water Clock, etc.)	5

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Contents : Unit	Topics	Contact Hours
3	**Metallurgy and Materials Science** Iron Pillar of Delhi and Its Metallurgical Significance, Wootz Steel and Zinc Distillation at Zawar Mines, Coin Minting, Corrosion Resistance, and Nanocrystalline Structures, Relevance to Materials, Mechanical, and Production Engineering	4
4	**Water Management and Civil Engineering** Stepwells, Dams, Canals, and Rainwater Harvesting Systems, Town Planning: Harappa, Dholavira, and Temple Complexes, Sustainability Lessons for Civil and Environmental Engineering	4
5	**Medicine, Biotech, and Life Sciences** Ayurveda and Surgery: Charaka, Sushruta, and Plant-Based Pharmacology, Sanitation, Hygiene, and Preventive Healthcare in Ancient India, Modern Biotech Parallels: Biosystems, Drug Design, and Sustainable Healthcare	4
6	**Textile Technology and Chemical Engineering** Dyeing, Spinning, and Fabric Engineering in Ancient India, Organic Dyes and Mordants: Indigo, Turmeric, Madder, Relevance to Chemical Engineering, Materials, and Sustainable Fashion	4
7	**Maritime Engineering and Navigation** Dockyards (Lothal), Shipbuilding, and Knowledge of Ocean Currents, Navigation and Timekeeping Tools; Applications in Naval Architecture, Marine Engineering, and GIS	3
8	**Legacy, Innovation, and Future Directions** Rediscovery through Modern Science: CSIR, IITs, and Heritage Tech Initiatives, Case Studies on Traditional Knowledge-Inspired Technologies; Multidisciplinary Innovation and Sustainability in Engineering	2
Total Hours		**28**

Textbook :

1 Samvandsangrah – A Compilation of Lecture Notes, IKS Division of Ministry of Education , New Delhi and University Grants Commission (UGC), 2024

References:

1 The Astronomical Achievements of Ancient India, The Astronomical Achievements of Ancient India, S. Balachandra Rao , B.R. Publishing Corporation, New Delhi, 2020

2 A Concise History of Science in India, A Concise History of Science in India, D.M. Bose, S.N. Sen, B.V. Subbarayappa, Indian National Science Academy (INSA), New Delhi, 1971

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	40.00	20.00	5.00	5.00	10.00

Instructional Method:

1. Project/Presentation: Analyze a traditional technology and propose modern applications
2. Field Visit: Museum, archaeological site, or stepwell
3. Seminar: Guest lecture by historian or scientist
4. Mini DIY Activity: Recreate ancient instruments/models (e.g., sundial, armillary sphere, water clock, clinometer, etc.)
5. Design Thinking Workshops: Encourage students to reframe ancient innovations for modern problems using design thinking: empathize, define, ideate, prototype, and test.
6. Flipped Classroom: Students read/view curated resources before class and participate in discussion, debates, or concept modeling in class.
7. Case-Based Learning: Use real-world case studies of successful technologies inspired by heritage (e.g., herbal-based medical devices, sustainable architecture) for group analysis and innovation brainstorming.
8. Collaborative Learning: Cross-disciplinary team activities involving students from different engineering branches to appreciate the interconnected nature of traditional Indian sciences.
9. Students may be asked to propose solution to current engineering challenges inspired from the knowledge of India's scientific heritage.
10. Students may be asked to prepare presentation, project, case study as part of submission.
11. Understanding of the subject can be evaluated by arranging traditional viva-voce or group discussion.

Supplementary Resources:

1. Online: Jantar Mantar Website - https://www.jantarmantar.org/
2. LinkedIn Article by Sambreen Shamim on Traditional Dying Techniques in India, Dt. July 21, 2024 https://www.linkedin.com/pulse/traditional-dyeing-techniques-india-sambreen-shamim-62xbc/
3. Virtual Labs: https://vlabs.iitb.ac.in – For heritage simulations and models
4. Portal: https://iksindia.org – Indian Knowledge Systems Division, Ministry of Education, Govt. of India
5. SWAYAM/NPTEL Course: Indian Knowledge Systems (IIT Gandhinagar / IIT Kharagpur)
6. Report: Stepwells of Gujarat – INTACH + ASI (Available online as PDF)

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