# 25ALVA201: Indian Knowledge System

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| **w.e.f. Academic Year:** | 2026-27 |
| **Semester:** | 3rd |
| **Category of the Course:** | IKS |
| **Prerequisite:** | The course remains accessible to all engineering disciplines, regardless of specific technical background. |
| **Rationale:** | To provide an in-depth understanding of the evolution of engineering practices in India, from ancient times to the modern period, highlighting key contributions, technological advancements, and the integration of engineering concepts with cultural, social, and economic contexts. The course also aims to connect historical developments with contemporary engineering challenges and future prospects. |

## Course Outcomes:

After Completion of the Course, Student will able to:

| | Course Outcome (CO) | RBT Level (Cognitive Domain) |
|---|---|---|
| CO1 | Describe the evolution of engineering practices in India from ancient to modern times highlighting traditional sustainable practices and indigenous technologies. | Understand |
| CO2 | Explain major engineering innovations and technological developments in various historical periods of India. | Understand |
| CO3 | Analyze the influence of socio-political and economic factors on the development of engineering and infrastructure across dynasties and regimes. | Analyze |
| CO4 | Evaluate the role of engineering in India's industrialization, modernization, and nation-building efforts. | Evaluate |
| CO5 | Assess contemporary engineering advancements and propose sustainable solutions for future challenges. | Analyze |

## Teaching and Evaluation Scheme:

| Teaching Scheme | | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **C** | **Hrs/Week** | **IE** | **EE** | **CIA** | **Practical/ Viva** | **Total Marks** |
| 2 | 0 | 0 | 2 | 2 | 40 | 60 | 30 | -- | 130 |

IE: Internal Exam
EE: External Exam (End Semester)
CIA: Continuous Internal Assessment
Practical: Practical Exam (End Semester)

## Detailed Syllabus:

| Unit No. | Topic | Hrs. | Marks % Weightage (Approx.) |
|---|---|---|---|
| **UNIT: 1** | **Introduction to the Indian History of Engineering**<br>Overview and importance of the study of engineering history in India. Historical context of engineering practices across different periods of Indian civilization. Relationship between engineering, architecture, and technological innovations. Overview of India's contributions to global engineering knowledge including traditional sustainable practices and indigenous technologies Methodologies for studying historical engineering practices (archaeological, literary. | 3 | 10 |
| **UNIT: 2** | **Ancient Engineering Innovations**<br>Indus Valley Civilization, Urban planning and architectural marvels (e.g., drainage systems, granaries, town layouts). Water management systems, wells, reservoirs, docks (e.g., Lothal). Metallurgy and craftsmanship (tools, pottery, bead-making, seals).<br>**Vedic and Post-Vedic Periods**<br>Early construction of temples, fortifications, fire altars.<br>Developments in water harvesting and irrigation techniques. Application of geometry and mathematics in construction (Sulba Sutras) highlighting resource-efficient and sustainable construction methods.<br>Scientific and Engineering Thought in Ancient Texts<br>Arthashastra, Manusmriti: Engineering guidelines, civic planning, metallurgy.Principles of town planning, building design, and resource management. | 3 | 10 |
| **UNIT: 3** | **Classical and Early Medieval Engineering**<br>**Engineering during the Gupta Period**<br>Advances in construction techniques for temples, monuments (e.g., Dashavatara Temple).Rock-cut architecture, structural temples, use of iron pillars.<br>**Medieval India – Sultanate and Early Mughal Period**<br>Fort architecture (e.g., Golconda Fort), palatial structures. Hydraulic engineering: Stepwells (vavs), baolis, irrigation tanks.<br>**Water Management and Agricultural Engineering**<br>Techniques for sustainable agriculture and irrigation across different regions.<br>Case studies: Chola irrigation systems, Delhi Sultanate canal systems. | 3 | 10 |
| **UNIT: 4** | **Engineering and Technology in the Late Medieval and Mughal Periods**<br>Monumental engineering projects (e.g., Taj Mahal, Fatehpur Sikri). Advances in construction materials (lime mortar, sandstone, marble).Urban planning in Mughal cities (e.g., Shahjahanabad). Water supply and drainage systems in Mughal forts and cities. | 3 | 10 |

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| **UNIT: 5** | **Early Colonial Period and Transformation of Indian Engineering**<br>British Influence on Indian Engineering. Introduction of Western surveying, mapping, Civil engineering practices. Establishment of Thomason College of Civil Engineering (Roorkee).<br>**Growth of Infrastructure under Colonial Rule**<br>Railways, bridges, ports, telegraph networks. Canal building and irrigation projects (e.g., Ganges Canal).<br>**Indian Engineers under British Rule**<br>Contributions of Indian engineers (e.g., Sir M. Visvesvaraya). Challenges faced by indigenous engineers. | 3 | 10 |
| **UNIT: 6** | **Rise of Modern Engineering Post-Independence**<br>**Institution Building**<br>Founding of IITs, NITs, engineering research centers.<br>Civil Engineering Achievements. Key projects: Bhakra Nangal Dam, Hirakud Dam, Sardar Sarovar Project.<br>Development of national highways (Golden Quadrilateral).<br>**Agricultural and Irrigation Engineering**<br>Green Revolution technologies. Role of engineering in rural development and food security. | 3 | 10 |
| **UNIT: 7** | **Industrialization and the Engineering Sector in India**<br>Early Industrialization Steel plants (TISCO), textile mills, Chemical plants. Machine tool development and mechanical engineering initiatives.<br>**Public Sector Enterprises and Engineering Innovations**<br>Establishment of Bharat Heavy Electricals Limited (BHEL), Hindustan Aeronautics Limited (HAL).<br>**Technological Modernization of Industry**<br>Automation, manufacturing advancements, materials engineering. | 3 | 10 |
| **UNIT: 8** | **Modern Technological Advancements**<br>**Space Technology**<br>Formation and growth of ISRO. Major achievements: Aryabhata, SLV-3, PSLV, Chandrayaan, Mangalyaan.<br>**Nuclear Engineering**<br>Role of Bhabha Atomic Research Centre (BARC).<br>Development of nuclear energy for power generation.<br>**IT and Software Engineering**<br>Growth of IT hubs (Bengaluru, Hyderabad). Impact of software exports and services. Role of Indian engineers in global tech innovation. | 3 | 10 |
| **UNIT: 9** | **Emerging Frontiers and Sustainability in Indian Engineering**<br>Biotechnology and Biomedical Engineering Advances in pharmaceutical research, genetic engineering, and medical devices.<br>**Green Engineering and Sustainable Technologies**<br>Renewable energy (solar, wind, hydropower initiatives).<br>Engineering solutions for climate change mitigation. Environmental sustainability projects. | 3 | 10 |

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| **UNIT: 10** | **Challenges and the Future of Indian Engineering**<br>**Contemporary Challenges**<br>Infrastructure gaps, urbanization pressures, rural engineering needs. Challenges in engineering education and innovation ecosystem.<br>**Future Trends**<br>AI, robotics, IoT, smart city projects. India's role in global collaborations (e.g., QUAD tech initiatives, space cooperation). Policy frameworks: "Make in India", "Atmanirbhar Bharat", National Education Policy (NEP) 2020 initiatives. | 3 | 10 |
| | | **30** | **100** |

## List of Tutorial and /or Practical: NA

## Learning Resources:

### 1. Reference Books


1) Engineering in India Through the Ages, INSA, INSA New Delhi, 2004
2) Science and Technology in Ancient India by Debiprasad Chattopadhyaya, People's Publishing House,2022
3) India’s Ancient Past by R. S. Sharma, Oxford University Press, 2020
4) History of Science, Philosophy and Culture in Indian Civilization edited by D. P. Chattopadhyaya,Centre for Studies in Civilizations, 2000–2010
5) From Temples to Dams: Engineering and Civilizations in India by R. Balasubramaniam, Aryan BooksInternational, 2021
6) Sir M. Visvesvaraya: The Builder of Modern India by N. K. Dikshit, National Book Trust, 2018
7) India After Gandhi by Ramachandra Guha, HarperCollins India, 2017


### 2. Online References

1) **NPTEL Courses:**

   History of Science and Technology in India (IIT Madras)

   Science, Technology and Society
2) **YouTube / Documentary Channels:**

   Pradhanmantri Series (by ABP) – for post-1947 policy

   History Channel India – for ancient technology features
3) **Web Portals:**

   INSA India – Publications on Indian Science History

Vigyan Prasar Digital Library – Rich source of science communication and heritage

## Teaching Learning Method:

- Interactive classroom Teaching
- Problem based learning
- Power Point Presentations
- Group discussions

## Course Outcomes Mapping:

| CO No. | Course Outcome (CO) | POs/ PSOs Mapped | Cognitive Level (RBT) | Knowledge Category | Class Sessions (Lecture) |
|---|---|---|---|---|---|
| CO1 | Describe the evolution of engineering practices in India from ancient to modern times highlighting traditional sustainable practices and indigenous technologies. | PO1, PO2, PO11, PSO1 | Understand | Conceptual | 6 |
| CO2 | Explain major engineering innovations and technological developments in various historical periods of India. | PO1, PO2, PO3, PO11, PSO1 | Understand | Conceptual | 6 |
| CO3 | Analyze the influence of socio-political and economic factors on the development of engineering and infrastructure across dynasties and regimes. | PO2, PO3, PO6, PO11, PSO1 | Analyze | Analytical | 6 |
| CO4 | Evaluate the role of engineering in India's industrialization, modernization, and nation-building efforts. | PO3, PO6, PO7, PO11, PSO1 | Evaluate | Procedural | 6 |
| CO5 | Assess contemporary engineering advancements and propose sustainable solutions for future challenges. | PO3, PO5, PO6, PO9, PO10, PO11, PSO1, PSO2 | Analyze | Metacognitive Knowledge | 6 |

## Mapping of COs with POs & PSOs:

| CO | PO | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 1 | - |
| CO2 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | - |
| CO3 | - | 3 | 2 | - | - | 2 | - | - | - | - | 2 | 2 | - |
| CO4 | - | - | 2 | - | - | 3 | 2 | - | - | - | 2 | 2 | - |
| CO5 | - | - | 3 | - | 2 | 3 | - | - | 2 | 2 | 3 | 2 | 3 |

**3: High, 2: Medium, 1: Low**

## Sustainable Development Goals (SDG) Integration

This course integrates sustainability by highlighting traditional and modern engineering practices that promote efficient resource utilization, sustainable infrastructure, and environmentally responsible development. It connects historical knowledge with contemporary engineering solutions to address future challenges, aligning with SDG 4, SDG 9, SDG 11, and SDG 12.

## SDG Mapping with Course Outcomes

| CO | Course Outcome | Relevant SDGs | Justification |
|---|---|---|---|
| CO1 | Describe the evolution of engineering practices in India from ancient to modern times highlighting traditional sustainable practices and indigenous technologies. | SDG 4, SDG 12 | Promotes knowledge of sustainable traditional practices and responsible resource use |
| CO2 | Explain major engineering innovations and technological developments in various historical periods of India. | SDG 9 | Highlights innovation and technological advancement in engineering |
| CO3 | Analyze the influence of socio-political and economic factors on the development of engineering and infrastructure across dynasties and regimes. | SDG 11 | Supports understanding of sustainable infrastructure and societal development |
| CO4 | Evaluate the role of engineering in India's industrialization, modernization, and nation-building efforts. | SDG 9, SDG 11 | Emphasizes infrastructure growth and sustainable national development |
| CO5 | Assess contemporary engineering advancements and propose sustainable solutions for future challenges. | SDG 9, SDG 12 | Encourages sustainable innovation and responsible engineering solutions |