



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Subject Code: BE03000241

Subject Name: Indian Knowledge System for Engineering

w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	Humanities and Social Science, including Management Courses (Elective)

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.
Pedagogy	The course employs a blended pedagogical approach combining lectures, storytelling, case studies, and multimedia presentations to enhance student engagement and understanding. Historical engineering practices and developments are explored through archaeological evidence, textual references, and documentary resources. Interactive discussions will be encouraged to critically reflect on India's indigenous knowledge systems and their relevance in modern engineering contexts. Students will be guided to connect historical examples with contemporary engineering challenges and innovations. NPTEL resources, archival material, and visual documentaries will supplement classroom teaching, promoting contextual and interdisciplinary learning.

Course Outcomes:

Sr. No.	CO statement	Bloom's Taxonomy Level	Marks% weightage
CO-1	Describe the evolution of engineering practices in India from ancient to modern times.	UN	20
CO-2	Explain major engineering innovations and technological developments in various historical periods of India.	UN	20
CO-3	Analyze the influence of socio-political and economic factors on the development of engineering and infrastructure across dynasties and regimes.	AN	20
CO-4	Evaluate the role of engineering in India's industrialization, modernization, and nation-building efforts.	EL	20
CO-5	Assess contemporary engineering advancements and propose sustainable solutions for future challenges.	CR	20



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Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	SL	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA / CA (M)	PA/CA (I)	TW/SL (I)	ESE (V)	
30	00	30	00	60	2	70	30	20	00	50	170

Content:

Sr. No.	Content	Total Hrs
1	Introduction to the Indian History of Engineering 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. Methodologies for studying historical engineering practices (archaeological, literary, and architectural sources).	3 hours
2	Ancient Engineering Innovations 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). Vedic and Post-Vedic Periods Early construction of temples, fortifications, fire altars. Developments in water harvesting and irrigation techniques. Application of geometry and mathematics in construction (Sulba Sutras). Scientific and Engineering Thought in Ancient Texts Arthashastra, Manusmriti: Engineering guidelines, civic planning, metallurgy. Principles of town planning, building design, resource management.	3 hours



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3	Classical and Early Medieval Engineering Engineering during the Gupta Period Advances in construction techniques for temples, monuments (e.g., Dashavatara Temple). Rock-cut architecture, structural temples, use of iron pillars. Medieval India – Sultanate and Early Mughal Period Fort architecture (e.g., Golconda Fort), palatial structures. Hydraulic engineering: Stepwells (vavs), baolis, irrigation tanks. Water Management and Agricultural Engineering Techniques for sustainable agriculture and irrigation across different regions. Case studies: Chola irrigation systems, Delhi Sultanate canal systems.	3 hours
4	Engineering and Technology in the Late Medieval and Mughal Periods 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 hours
5	Early Colonial Period and Transformation of Indian Engineering British Influence on Indian Engineering Introduction of Western surveying, mapping, civil engineering practices. Establishment of Thomason College of Civil Engineering (Roorkee). Growth of Infrastructure under Colonial Rule Railways, bridges, ports, telegraph networks. Canal building and irrigation projects (e.g., Ganges Canal). Indian Engineers under British Rule Contributions of Indian engineers (e.g., Sir M. Visvesvaraya). Challenges faced by indigenous engineers.	3 hours
6	Rise of Modern Engineering Post-Independence Institution Building Founding of IITs, NITs, engineering research centers. Civil Engineering Achievements Key projects: Bhakra Nangal Dam, Hirakud Dam, Sardar Sarovar Project. Development of national highways (Golden Quadrilateral). Agricultural and Irrigation Engineering Green Revolution technologies. Role of engineering in rural development and food security.	3 hours



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7	Industrialization and the Engineering Sector in India Early Industrialization Steel plants (TISCO), textile mills, chemical plants. Machine tool development and mechanical engineering initiatives. Public Sector Enterprises and Engineering Innovations Establishment of Bharat Heavy Electricals Limited (BHEL), Hindustan Aeronautics Limited (HAL). Technological Modernization of Industry Automation, manufacturing advancements, materials engineering.	3 hours
8	Modern Technological Advancements Space Technology Formation and growth of ISRO. Major achievements: Aryabhata, SLV-3, PSLV, Chandrayaan, Mangalyaan. Nuclear Engineering Role of Bhabha Atomic Research Centre (BARC). Development of nuclear energy for power generation. IT and Software Engineering Growth of IT hubs (Bengaluru, Hyderabad). Impact of software exports and services. Role of Indian engineers in global tech innovation.	3 hours
9	Emerging Frontiers and Sustainability in Indian Engineering Biotechnology and Biomedical Engineering Advances in pharmaceutical research, genetic engineering, and medical devices. Green Engineering and Sustainable Technologies Renewable energy (solar, wind, hydropower initiatives). Engineering solutions for climate change mitigation. Environmental sustainability projects.	3 hours
10	Challenges and the Future of Indian Engineering Contemporary Challenges Infrastructure gaps, urbanization pressures, rural engineering needs. Challenges in engineering education and innovation ecosystem. Future Trends 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 hours
TOTAL		30 Hours



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Suggested Specification table with Marks (Theory): (For B.E. only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	10	10	20

R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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 Books International, 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

List of Experiments: NA

Major Equipment: NA

List of Open Source Software/learning website:

- **NPTEL Courses:**
 - History of Science and Technology in India (IIT Madras)
 - Science, Technology and Society
- **YouTube / Documentary Channels:**
 - *Pradhanmantri Series* (by ABP) – for post-1947 policy
 - *History Channel India* – for ancient technology features
- **Web Portals:**
 - INSA India – Publications on Indian Science History
 - [Vigyan Prasara Digital Library](https://www.vigyanprasardigital.org/) – Rich source of science communication and heritage
