CLASS NOTES
SCIENCE & TECHNOLOGY IN COLONIAL INDIA

- Techno- scientific tradition in South Asia has been largely a synthetic tradition, continuously evolving as a result of each politico-cultural interaction with the outside world and social change within the region (Rahman, 1984).
- In pre-modern times, South Asia was known for its contribution to astronomy, medicine and mathematics.
- Centuries ago Said al Andalusi (1029- 70) in his Tabaqat al Uman – Probably the first work on history of science in any language – referred to India as the first nation which cultivated the sciences.
- But it was during the post-Renaissance epoch (that of Rene Descartes (1596-1650) and Isaac Newton (1643-1727) that Europe began to outdistances all other culture-areas.
- In the eighteenth century this distance became virtually unbridgeable.
- In this century, India saw the decline of pre-colonial systems as well as the inauguration of systematic colonization.
- During this period the rise of modern science itself coincided with the rise of capitalism and colonial expansion (Moraze, 1982).
- Probably they grew in tandem, feeding each other.
- Eighteenth century India, however, remained 'blissfully' ignorant of these developments.
- In the early eighteenth century an amatya (minister) of Kolhapur, Ramchandra Pant, wrote about the activities of the European traders and 'factors'.
- He called them topikars (hat-wearers) & recognised that their strength lay in 'navy, guns and ammunitions'.
- His prompt advice was to avoid the topikars – This was an early sign of withdrawal and of playing safe – this attitude tempted the topikars to attempt conquest along with commerce and their success was virtually assured.
- The Indian world-view remained by and large tradition-bound.
- Even notable exceptions like the scholar- prince Sawai Jai Singh (1688-1743) who invited Jesuits and shared astronomical knowledge with them, could not transcend the cultural limits of his age and people.
- But there were certain areas in which interaction between the East and the West resulted in acceptance and improvement — These were ship-building, armaments, metallurgy, cloth printing and architecture.
- European innovations were conveniently ignored wherever existed an alternative or appropriate indigenous technology which could serve the Indian needs to a reasonable degree (Qaisar, 1982).
- For example, mechanical clocks, the printing press, telescopes, coal, etc. remained mere curios.
- Since these were not found culturally compatible, the Indian nobility simply ignored them.
- While explanations about the acceptance or rejection may not always appear convincing .
- It nevertheless remains true that the eastern knowledge-corpus and its implements were no match to what was then happening in the West.
- The problems of eighteenth century India were compounded by an enormous intellectual failure on the part of the ruling class (Athar Ali, 1979).
- This was true not only of late Mughal India but the Safavids in Iran, the Manchus and the mighty Ottomans had also begun to show signs of crack.

COLONIALISM & SCIENTIFIC KNOWLEDGE

- Some resurgent nations,dominating the waters , came in and through their trading companies chalked out large areas.
- Their sails, their guns, their training were substantially different. They had 'new' knowledge behind them.
- In the midst of political intrigues, plunder and numerous local wars, some official of the East India Company could think of establishing a forum for knowledge (The Asiatic Society, 1784) and a college at their fort (Fort William College, 1801).
- Trained surveyors marched along with their armies.
- The British could succeed against their numerically superior adversaries largely because they possessed a thorough and scientific knowledge of the country through which they marched.
- In 1760s Rennell surveyed Bengal and later Kelly surveyed the Carnatic region.
- Their charts were of immense value for both military operations and revenue settlements.
- Survey and expansion moved side by side.
- Every boat that touched the Indian shores had a medical man on board.
- Trained in the scientific seminaries of Scotland and Northern Europe, he would be known as surgeon-naturalist: he would look for and report on the topography, minerals, flora, fauna and people of his area.
- They were scientific soldiers who willingly and promptly extended the help of 'new' knowledge to the process of colonial expansion and consolidation.
- The 'colonial science', represents an advance over pre-colonial science.
- It was far more systematic, methodical, penetrative and pervasive.
- It involved everything: science, politics, commerce, military operations, administration, etc.

- In any case it is now widely acknowledged that techno-scientific developments & colonial expansion had closer links (Headrick, 1981; Deepak Kumar 1995, 2001; Roy MacLeod, 1995).
- But colonial science lacked sovereignty. Its contours were drawn on the colonial terrain, with a limited autonomy which was further reduced as the colonial grip tightened.
- Several colonial scientists felt uncomfortable, yet they had to perform a dual role-to serve the colonial state and to serve science.
- This state claimed superiority in terms of structure, power, race, etc.

DUAL MANDATE

- As the Company rule in India owed its origin primarily to mercantilist activities, the notion of 'science for profit' makes an early appearance.
- Yet, in the early stage, the colonial scientists (mostly surgeon-naturalists) had more freedom and flexibility.
- There were many difficulties but also enormous opportunities to discover and sight new things.
- Support from metropolitan scientists added to their confidence and their agenda was not entirely derivative.
- They did enjoy a certain amount of autonomy and they too influenced metropolitan discourses (for example, deposition of coal-seams, nature of cholera, etc.).
- Richard Grove has shown that the idea of environmental conservation came from the colonies, and colonial planters, botanists and foresters contributed a great deal to the initiation and maturation of conservation debates in the metropolitan circles.
- The concept of a state scientist emerged in the colonies and this shows how aware the trading companies, were of the importance of scientific explorations.
- A knowledge of the local terrain, local resources, customs and traditions was vital for the founding of a colonial state.
- The process of acquiring this knowledge was not an easy one
- The early colonizers in India realized that, the state they sought to establish had to adapt to, and yet be substantially different from, the pre-colonial structures of power.
- In order to legitimize their own rule, they first had to delegitimize several pre-colonial structures and texts.
- For this, the condemnation of the immediate past was considered necessary.
- Indians were declared unscientific,superstitious and resistant to change; India was 'identified with dirt and disease'.
- Travellers, scholars and officials of both the Orientalist and Anglicist variety subscribed to this view.
- William Jones, the foremost Orientalist, declared that in scientific accomplishments the Asiatics were 'mere children' when compared with the Europeans (Adas, 1990).
- Thus was established a paternalistic Raj which would be caring and dismissive at the same time.
- It was to be based on claims to not only superior musketery, but to a superior knowledge as well.
- This sense of superiority came from western discourse on rationality and progress, and was promptly used to denounce whatever scientific knowledge e.g. in astronomy and medicine the Indians could boast of.
- Several early colonial scholars showed respect for certain indigenous scientific traditions and techniques.
- They wanted western knowledge to permeate gradually and cause gradual displacement
- There were certain individuals who largely determined what was advantageous to both trade & the country
- Thus James Rennell (Surveyor General of Bengal), Thomas Kyd (English Elizabethan dramatist 1558-1594), Roxburgh, William Carey (Baptist missionary to India, 1761-1834), John George Lambton (1792-1840, British statesman who played an important role in drafting the reform bill of 1832), Williams, O'Shaughnessy and others emerge as pioneers.
- These colonial scientists tried their hand in several fields simultaneously and were in fact botanists, geologists, zoologists, physicists, chemists, geographers and educators-all rolled into one
- For example, while seeking lectureship at the Calcutta Medical College, O' Shaughnessy offered not only to teach chemistry and experiment with medical plants but also to give practical instructions to non-medical as well as Indian and European students, on the chemical arts of dyeing, bleaching, calico-printing, distilling, sugar-refining, melting of ores and manufacture of drugs'
- They had to depend on the metropolitan scientific culture whose offshoots they were and from which they drew sustenance.

ORGANIZATIONAL OBLIGATIONS

- Geological and survey department , received the maximum patronage from the government. Next ranked botany.
- Agriculture remained unnoticed till the 1890s, though a few private agricultural and horticultural societies did try to give it a commercial drift.
- Private scientific bodies were often more vigorous than the government machinery itself.
- Among them can be counted the Asiatic Society of Bengal, the Bombay Branch of the Royal Asiatic Society and the medical and physical societies.
- in Presidency towns Changing economic needs, the proliferation of scientific establishments, and the growing concern shown for them by the educated

Indians made the government to think in terms of an apex body to regulate scientific affairs in India.

- In 1898, the Royal Society formed an Indian Advisory Committee, and in 1902 the Government of India established a Board of Scientific Advice.
- These experiments unfortunately generated more heat than light and ended in a whimper.
- Still these institutions had brought the government, science, and economic consideration into a close relationship.
- The economic interest-group desired research to gain immediate and practical ends.
- The economic ramification can well be spotted in the growth of industries fed on applied science, viz. coal, cotton, jute, tea, etc.
- Excessive government control of scientific undertakings often hampered the logical development of modern science in India.
- The government would always goad the various organizations to work only along economically beneficial lines.
- Most of them buckled under this pressure. George Watt, was asked in 1903 to prepare his famous Dictionary of the Economic Products of India.
- But he was not given a free hand in selecting the products. He was asked to include only those which were of commercial value.
- The result was that instead of a Dictionary of Economic Products, he produced a Manual of Commercial Products.
- Colonial researchers was unable to distinguish between 'basic' research and 'applied' research.
- This was particularly true of the geologist and botanists.
- Some of the specialists received a great deal of attention while others none; for example, large sums were spent on geological explorations & nothing on the examination of agricultural soils.
- According to George Watt the Geology of India requires fourteen European experts, while the Agriculture and the Industries of India must be content with two or three expert investigators.'
- There was relative neglect of medical and zoological sciences & this is in sharp contrast to larger investments in botanical, geological and geographical surveys
- Western medical classes, for instance, were started in 1822, but it took another thirty years to produce its compilation of information on tropical disease in India.
- Charles Morehead brought out in 1856 Clinical Researches on Disease in India in two volumes.
- The research of of tropical diseases was undertaken by individuals who were separated both geographically and professionally and so, naturally, a consistent body of knowledge failed to develop.
- This was true for every branch of knowledge
- There was almost total absence of pure or theoretical research.
- Research activities in science like physics and chemistry which had by then reached 'a professional stage' in Europe, were hardly noticeable in India
- In the Centenary Review of the Asiatic Society (Calcutta, 1886), P.N. Bose apologetically wrote: 'Our chapter of chemistry at the Asiatic Society is near being as brief as the proverbial chapter on Snakes in Ireland.'
- There were chemical analyzers in every province but their job was confined only to medico-legal cases and the inspection of government stores.
- India was found suitable only for field research.
- She was used as a hinterland with exotic varieties of flora, fauna and minerals which were to flood the European laboratories for many years to come.
- The real research was thus to be done in the metropolis.
- India could get only ancillary units.
- In India scientific explorations brought the government, science and economic exploitation into a close relationship.
- But the Indians and India' s interests were left largely in the cold

TECHNOLOGY, EMPIRE & ECONOMY

- Technological changes occur in every society. But the parameters of development are determined by the pace with which technological changes take place in a particular society and its ramifications.
- In pre-British India, the process was definitely slow.
- A European thinker Max Weber marvelled at how the Indians had perfected the 'technology of contemplation', but faulted them on material technology.
- Civilian officials were concerned about traditions and customs and did not wish to unsettle them for fear of a revolt.
- But technical men like engineers were not enamoured by such considerations.
- They were less interested in 'local knowledge and practices'
- Among the new technologies of the Victorian era the steamship, exotic seeds, the telegraph, the railway - made wave in India
- In the industrial sector, to maintain commercial advantage, British legislation largely discouraged technological change in India.
- Failure can be attributed to colonialism, the retention of an archaic culture, the changing nature of the technological push, or to some combination of these factors.
- The disadvantages accruing from the loss of sovereignty are well manifest in their internal workings.
- Technological projects remained enclavists. Technology transfer is a deliberate (perhaps organic) deliverance

- What colonial India saw was a cultural as well as an economic syndrome which contained within itself an intricate interplay of 'colonial' penetration, 'native' resistance and response.
- India's burgeoning commercialisation was not followed by industrialisation.
- Formalised courses were there, but no incentive to innovation.
- A factory system did emerge, but industrial laboratory came only on the eve of independence.
- For India to industrialise, using applied science, there had to be structural incentives to invest and innovate.
- But these could not come from 'within', as the 'within' had lost its sovereignty.
- They faced formidable problems arising from the absence of essential machinery, know- how, and trained personnel.
- The 'token' industrialisation that did take place in certain sectors (textiles and later in steel) had no 'multiplier' effect on the industrialisation.

SCIENCE EDUCATION

- In the educational scheme, science was never given a high priority.
- The character of 1813 called for the introduction and promotion of knowledge of the science among the inhabitants of British India.
- But it remained a pious wish. Moreover, it gave no indication of which system of science, indigenous or European, was to be preferred.
- In 1835, Thomas Babington Macaulay not only succeeded in making a foreign language (English) the medium of instruction, his personal distaste for science led to a curriculum which was purely literary.
- The entry of science was thus delayed.
- A few medical and engineering colleges were opened but they were meant largely to supply assistant surgeons, hospital-assistants, overseers, etc.
- The curriculum, the instruments, and the very organisation of these colleges were geared to meet the requirements of only subordinate services.
- Later in 1870, the Indian universities began to show some inclination towards science education.
- In 1875, the Madras University decided to examine its matriculation candidates in geography and elementary physics in place of British History.
- Bombay was the first to grant degrees in science, Calcutta University divided its B.A. into two branches -' A' course (i.e. literary), 'B' course
- Even this slow growth of science education was beset with many problems.
