INTRODUCTION

The year 1849 is a watershed in the history of the Punjab, for it marked the termination of the Sikh rule and ushered in a new era of the British rule. Special arrangements were made for the administration of this province and a set of brilliant bureaucrats were engaged for governing this sensitive region. Apart from various measures taken for the security and consolidation of the British rule, introduction of science and technology, developed as a part of the policy envisaged by the British administrators. Whereas some substantial research work has been done on various other aspects of British administration in the Punjab, while works on the history of introduction of science and technology in Punjab abound, perception of science and technology issue has received only scant attention from historians. There are, of course, a number of essays and articles but rarely has it been chosen as a subject for a full-scale study. The study is significant because introduction of science and technology in India, and in Punjab in particular, marked the first step in the course of British imperialism.

A review of a variety of published literature shows that no serious and systematic research work has been carried out on this topic so far. This topic has received only casual and fragmentary treatment at the hands of scholars.

An analytical study on science and technology has been done by Deepak Kumar in his work entitled Science and the Raj, 1857-1905, (1995). Based on primary sources, contemporary tracts, journals and secondary sources, this book seeks to map out the development of science in a colonial situation, its social implications and its economic ramifications. It has revealed the nature and working of the relationship between the techno-scientific imperatives and colonial requirements. The history of India during the last century spectacularly illustrates a close link between science and the Raj and Deepak Kumar has endeavoured to explore the nature, course and significance of this link. It also focuses upon the early British exploratory activities, problems in science, administration, science education, scientific research work, and of course the Indian response in these areas. In his work, more stress is given to Bengal state; there are very few references to Punjab, which is the area of my research work.
The second book on the science and technology has been written by Satpal Sangwan. Its title is *Science, Technology and Colonisation: An Indian Experience, 1757-1857* (1991). His work is based on the contemporary accounts, published and unpublished records of East India Company, contemporary journals, transactions of scientific societies, newspapers and pamphlets. His book makes a brief survey of science and technology in India during pre-colonial times and it also discusses British scientific surveys and explorations in India. It throws light on the various facets of technological development within a colonial framework. It touches upon the response of various Indian social groups towards introduction of science and technology in India. The study discusses the introduction of science and technology in India as a whole. Very few references about Punjab have been made.

Another important book is *Technology and the Raj - Western Technology and Technical Transfers to India 1700-1947*, (1995). Edited by Roy MacLeod and Deepak Kumar, this work focuses on three key relationships in the history of Western technology in British India -- practice, shaping and constraining technology transfer and technological and engineering education, patterns emerging in transportation and communication. This book gives very useful information about principles of British policies which they adopted to utilise new technologies in India. Hardly any reference has been made to the Punjab.

David Arnold’s work *Colonizing the Body: State Medicine and Epidemic, Disease in the 19th Century India*, (1993), mainly deals with the history of epidemic diseases and medical interventions to uncover different forms of Indian responses and explore their resistance, accommodation, participation and appropriation. This book is an account of the interactive relationship between the colonial power and knowledge within society but it rarely touches Punjab.

The other important work is Ian J. Kerr’s book *Building the Railways of the Raj*, (1995). In this work, the writer has dealt with a number of questions such as who conceived the railways of the Raj, who built them and how and under whose directions the builders worked. The purpose of railway construction in India in the last half of 19th century is described and
analysed. But in this study too very few references have been made about the introduction of railways in Punjab and the response of the people.

In his book, *The Science of Empire: The Scientific Knowledge, Civilisation and Colonial Rule in India*, (1998), Zaheer Baber has analyzed the social context of the origins and development of science and technology in India from antiquity through colonialism to the modern period. A key feature is the author's analysis of the role of pre-colonial trading circuits and other institutional factors in transmitting scientific and technological knowledge from India to other civilised countries. A significant portion represents an analysis of the role of modern science and technology in the consolidation of the British Empire in India. Thus, it provides a meaningful background from the all-India angle for my study. However, the region of Punjab is untouched.

The case study made by A.C. Arora in his book *British Policy towards the Punjab State 1858-1905*, (1952), concentrates on how the new imperial policy evolved by British in the post-1857 period, was applied to the Native States and with what effect. In one of his chapters, he throws light on the introduction of railways, post and telegraph in the princely states only. The Punjab province as a whole has not been taken into consideration. I will endeavour to focus my discussion on the unexplored terrain. Response of the people towards these projects would figure prominently.

Another significant work is *Uncharted Terrains: Essays on Science Popularization in Pre-Independence India*, edited by Narender K. Sehgal, Satpal Sangwan and Subodh Mahanti (2000). Herein, the scholars have made a convincing study of popularisation of science in pre-independence India. Their essays constitute an extensive work on the development of science and technology and its popularisation in India as a whole and particularly Bengal, Assam and Punjab. Kamlesh Mohan makes the most important study on the popularisation of science in Punjab in her article ‘Ruchi Ram Sahni and Pursuit of Science in a Colonial Society’. Here in, she has presented a review of Ruchi Ram Sahni’s contribution towards the popularisation of science among the people living in the urban areas of Punjab. Another important article is by H.S. Virk’s ‘Ruchi Ram Sahni - a Great Science Populariser of Punjab’. In his article H.S. Virk analyses Ruchi Ram Sahni’s commitment to the dissemination of science in Punjab. Another
important essay is by Irfan Habib. In his essay, 'Munshi Zakaullah and Vernacularisation of Science in the Nineteenth century India'. He represents the ethos of Delhi Renaissance and the desire of Munshi Zakaullah to re-emphasise the role of science and scientific values for cultural and material advancement of his countrymen.

A more significant work on Punjab about science popularisation is *Memoirs of Ruchi Ram Sahni: Pioneer of Science Popularization of Punjab*, (1994), edited by Narender K. Sehgal and Subodh Mahanti. It is a selection of the relevant portions from his voluminous manuscript entitled Memoirs of an Octogenarian. It has generated positive awareness among science communicators and enthused researchers about the need to unearth other such personalities in other parts of the country. It gives very important information about Ruchi Ram Sahni’s work, which he did to popularise all kinds of scientific knowledge throughout Punjab.

Yet another important work on Punjab is Imran Ali’s book *Punjab under Imperialism 1885-1947*, (1989). It is a notable contribution to our understanding of significant economic growth under colonial rule in the Punjab. It is a study and analysis of some significant trends in agrarian economy of this region, which experienced a number of changes due to the introduction of new technology in the field of irrigation during the British period. It portrays significant aspects of economy and societies in canal colonies of Punjab. It also throws light on the nature of imperialist rule (British rule) and on preparedness of the indigenous population in utilising the limited opportunity for economic transformation that came its way. In this study, technology in agriculture is the major concern. Other aspects have been totally ignored. I have tried to explore these ignored aspects during my research work as well as the perceptions and responses of different social segments.

The purpose of my study is to assess the motives of the British rulers in introducing science and technology in Punjab and to map out the changes in the cultural milieu of society in Punjab. The object of my study is to fill a glaring gap in the socio-cultural study of science and technology of colonial Punjab and to evaluate the perceptions and responses of the people, socio-
religious reformers, intellectuals including scientists, professors, writers and poets towards scientific and technological innovations.

Science and technology in ancient Punjab were in a relatively advanced state down to twelfth century A.D. However, during the subsequent centuries, their prestige, like other parts of India, declined: and the western countries, especially England, where great scientific achievements were made in physical and natural sciences during the seventeenth and eighteenth centuries gained prestige. At the advent of British rule, mathematics, astronomy and medicine were the three major disciplines that had dominated Indian scientific tradition. But here too, they did not record as much advancement as their counterparts did in Europe. They remained contented with the practice of the principles of their ancestors. Indian scholars did not venture to explore the enormous resources of nature. They also failed to establish rapport with the artisans and craftsmen. Technology, therefore, advanced at a slow pace. However, it did not appear at any stage that Indians were incapable of improving their methods and techniques. As for their abilities, they were unsurpassed in manual dexterity, general intelligence, perseverance and frugal habits. Indian mechanics were equally good in manufacturing and using their tools. They were also capable of making inventions and improving their methods. The only impulse required was stimulation, support and encouragement. But the pre-colonial socio-economic configuration and intellectual environment failed to supply these incentives.

The introduction and proliferation of science and technology during the British rule is one of the most important developments in the history of Punjab. Right from the establishment of British power in Punjab, the idea that science and technology could be used to build and maintain their rule in Punjab came to dominate the thinking of the British colonisers. Like in other parts of India, British made a conscious effort to introduce and develop western science and technology. In addition to commercial interests, administrative reasons led to the introduction and extension of western science in Punjab.

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2 In a broader way this hypothesis has been accepted in a number of recent studies being undertaken to explore the development of science under colonial set-up in different parts of the Empire, viz. Australia, Canada, India etc.
The appearance of the surveyor, the plant collector, the mineralogist and the introduction of steam vessel, steam railways, electric telegraph, printing press, telescope and a host of other inventions began to arrest the attention of local populace. Besides, with the reduction in time for travel between Punjab and Bengal, the flow of scientific information from Bengal and other parts of India where the British had already introduced western science and technology, became more rapid. It was followed by unprecedented increase in scientific activities.

Besides, the colonial scientist badly needed support from the local people who could supply the required information at a very low wage. To meet their demands, the British opened various scientific and technical schools mainly to train for subordinate posts like assistant surgeons, and overseers. The main idea was to prepare a class of local subordinates who would assist their European masters in scientific projects. The medical and engineering centres that were opened did not intend to prepare a class of local doctors or engineers but that of apothecaries. Besides, the British provided education only in those branches of science and technology, which were of immediate value to them. Owing to such a restricted agenda, the progress in Punjab was very limited. But Punjabis made a success of whatever little opportunities were given to them. They had to contend with shortage of funds, foreign medium of instructions, and racial prejudices. Later on, the demand for more scientific and technical education reached a new height that it became a major plank of the national movement and the British had to recognise that India must become more self-reliant scientifically and industrially.

The search for their own identity had begun. The limited growth of education, introduction of new technology in new industries, laying of railway lines etc. brought in its wake the new socio-religious reformers who began to adopt themselves to the new conditions. During the last decade of the nineteenth century, the conditions in the Punjab were conducive to the growth of socio-religious organisations. After decades of turmoil and confusion, the people of the Punjab witnessed a spell of peace and settled life under the

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British rule. The people, belonging to different communities living in Punjab, responded differently to the challenges posed by the British rule and founded socio-religious reform movements for purifying their religions which they believe could not stand against Christian missionaries. Their yearning for purification and improvement naturally directed their minds towards the sources of their faith, which were perceived to be lustrous and undefiled.

These movements began to regard science as the crucial instrument for all progress. They also shared faith in scienticism and utilised it as a weapon to counter missionary attacks upon their religions be it Hinduism, Islam or Sikhism.

The spread of scientific and technical education had given rise to an intellectual class, which began to become aware of its role and responsibility, and critical of British rule\(^5\). A section of the Indian intelligentsia had immense appreciation for modern science and technology. The Delhi College (1823), for example, achieved something qualitatively different from the contemporary Calcutta renaissance the students here showed a clear inclination towards scientific rather than literary education\(^6\). Ruchi Ram Sahni (1863-1948) virtually personifies the beginning of what one may call National Science. He established the Punjab Science Institute for popularisation of science in Punjab in 1885\(^7\), and it was a coincidence that the Indian National Congress was born in a same year\(^8\). There were also some intellectuals who opposed western science and technology like Vaid or Hakims (practitioners of ancient system of medicine), they opposed the allopathic system of medicine which had posed a great threat to their professions.

Despite having limited opportunities to rise, various intellectuals succeeded in the popularisation of new western thought in the urban and rural areas. In spite of the denial of basic opportunities and avenues for growth, a section of native intellectuals neither boycotted the colonial masters nor

\(^5\)Ibid., p.106.
rejected the honorific titles conferred on them. Rather they chanelised their frustration and anger into more creative ways like creation of scientific awareness among adults through their writings, scientific researches, and organisational activities for improving the quality of science teaching in schools, opening of Swadeshi chemical industries and scientific workshops and translation of scientific works into vernacular languages. These three forms highlight the common trend of thinking, harnessing training and western scientific knowledge for nation building⁹.

Science and technology left a deep impact on the people of Punjab and their society. It influenced the demographic change taking place in the society, for example -- the migration of people from rural to urban areas, the growth of population, decline of death rate due to better medical facilities, breakdown of joint family system and the weakening of kin groups. The direct fallout of these changes was the rise of the middle and upper class which was responsible for the cropping in of the spirit of status evaluation in the minds of general public. These changes are partly visible.

The people of Punjab responded positively to the changing trends in society owing to the introduction of railways, post, and telegraph network, new education system and introduction of new commodities like electricity, kerosene oil, metalware, crockery, chemicals and wooden furniture, I have discussed how these changes helped them to build a social class which broke the age - old taboos, superstitions and rigidity of the caste system. These changes also brought the spirit of national integration, the ideas of nationalism and freedom for the wider section of society. It worked for the welfare of all human beings irrespective of caste, creed and religion, which culminated in the overthrow of those very political forces, which introduced new science and technology in India.

Turning to perception, it can be described as an immediate apprehension of an object or situation affecting any or all the sense organs by way of sensation, it means our knowledge of objects. It is the experience of

objects and events present in the environment. The process of converting a sense impression into a meaningful situation is called perception. It is an insight, appreciation, awareness, consciousness, observation, sensitivity, discernment, realization, knowledge, opinion, consideration, notice, view, and senses etc. In the words of Silverman, perception is an individual's awareness aspect of behaviour, for it is the way each person processes the raw data he or she receives from the environment, into meaningful patterns. According to Edmund Fantino and G.S. Renolds, 'perception is the organizing process by which we interpret our sensory input'. According to Charles G. Morris, 'All the processes involved in creating meaningful patterns out of a jumble of sensory impressions fall under general category of perception'.

By response we mean action, reaction, riposte, retort, answer, acknowledgement, reply, and spontaneous effect etc. In the words of Andrew W. Colman, response means any physical or psychological reaction of an organism to stimulus. It may include behavioural, muscular, glandular, or metaphysiological reaction caused by stimulation of a sensory receptor. According to Philip Lawrence Harriman, response is an ideational reaction to stimulus.

The present work is an intensive and in-depth study of appreciation, awareness, consciousness, observation, realization, knowledge, opinion, consideration, notice, action, reaction, riposte, reply, retort, answer, acknowledgement, and spontaneous response towards the introduction of science and technology in Punjab during the British rule from 1849 till its end in 1947.

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12 Ibid., p. 152.
13 Ibid.
A comprehensive and critical account of historical background, scientific and technological institutions, new technological projects, responses of socio-religious reformers, responses of intellectuals and perception of common people during the period under study, has been given, in the chapters that follow.