Chapter 3

ENGINEERING AND TECHNICAL EDUCATION IN INDIA WITH SPECIAL REFERENCE TO KARNATAKA
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3.1 Introduction

Will Durant a noted Historian remarked that “Education is a progressive discovery of our ignorance”. Education plays a dynamic role in socio-economic industrial, scientific and technological advancement of the country. It is the backbone of national development welfare and security of any country.¹

Education is considered to be a fundamental need of each and every citizen of a nation. It is essential for the progress of society and civilization. Man is a social animal, primarily superior to the lower animals because of his power to think and learn. He has been blessed with intelligence; he wants to remain agile/nimble, vivacious and innovative. He desires to go ahead. The list of human achievements with advancement, especially in the field of Science and Technology is innumerable. This has all encompassed because of education. It promotes human intelligence, which enable him to be dexterous and progressive.

3.2 Engineering and Technical Education

Engineering is laudable profession, which has contributed significantly to improvements in the quality of life of the Common Man. While non-engineers demand social relevance and accountability from Engineers, it is quite evident that Engineering, Technology and Society have a symbiotic and synergistic relationship. Technical Education is crucial ingredient in a country’s industrial, economic and social development.

Technical Education all over the world is gaining importance day by day because of rapid advancements in Science and Technology and innovations in
various disciplines due to constant and continuous research in each and every field. In developing countries, especially in India, the knowledge of advancement in technology is one of the basic requirements for any development activities.²

The demand for technical qualified personnel is rapidly gaining momentum in various fields of Technology. It is skillful, artful and constructive education that rises to application-minded mankind who are essential for the socio-economic development of any country.

Engineering and Technical education, which is a pre-requisite for sustaining the complex structure of modern civilization is considered a Sine-qua-non for the achievement of socio-economic goals of any nation.

Our times represent a period of transition of an industrial age to a new age. At this point, we may remind ourselves of Einstein’s profound words, “One lesson I have learnt in a long life is that, all our science measured against reality is primitive and childlike, yet it is a most precious thing we have”³.

Therefore, while it is imperative that modern education should have an important place or may be even the central place to Science and Technology, we must remember that in some essential respect, Science and Technology have severe limitations and ignoring these would be fatal to the progress of society and even its survival.

Now a day, more emphasis is given to technical education. This is a very positive development, which should be welcomed because technical education is the foundation for a vibrant modern society committed to industrial development and eradicating poverty. Without this growth in technical education, the targets of our five-year plans could not have been achieved. Schemes for increasing the production of essential commodities, which are very much necessary to meet the needs of the growing population of India, would not have been possible. The
needs of Engineering and Technology education have been felt very much essential for any nation for its overall development and advancement.

The Technical education should not result in slavery of mankind by the tool of Technology; instead, the technology should be the tool of man. The human face of technology should receive unfailing projection.

### 3.2.1 Concept and Definition

The word ‘Engineer’ is derived from the Latin words “Engine” and “Enginious”, meaning ‘to create’. Engineering education is the acquisition of the art of utilization of knowledge. Engineering is the application of science to the needs of humanity. This is accomplished through knowledge, mathematics and practical experience applied to the design of useful objects or processes.

Encyclopedia Britannica defines Engineering as the “professional art of applying science to the optimum conversion of the resources of nature to the uses of humankind”.

McGraw-Hill Encyclopedia of Science and Technology defines Engineering as “art of directing the great resources of power in nature for the use and convenience of human. In its modern form engineering involves, Men, Money, Material, Machine and Energy”.

The Columbia Encyclopedia defines Engineering as “profession devoted to designing, constructing, and operating the structures, machines, and other devices of industry and everyday life”.

Online dictionary defines “originally, the art of managing engines; in its modern and extended sense, the art and science by which the mechanical
properties of matter are made useful to man in structures and machines; the occupation and work of an engineer\(^9\).

All the definitions indicate that engineering is an art, namely, the art of directing, applying or controlling something for the benefit of the human race.

### 3.2.2 Purpose

India is a developing country. The development of a nation does not depend on the available resources but on effective utilization of these resources. We need a technologically equipped human force for the effective utilization of increasing economic prosperity by the application of Science and Technology to information technology, biotechnology, agriculture, transport, communication and other industries, public health and other welfare activities. Unless effective technical education is provided to the youth of the nation, the process of development cannot be accelerated, therefore engineering education has a significant role to play in the development of national productivity, prosperity, and self-sufficiency.

### 3.3 Objectives of Technical and Engineering Education

Following are the objectives of engineering education:

1. To offer courses of instruction in different branches of engineering at undergraduate, postgraduate study levels with a view to develop in the student technical excellence, social responsibility and to assist in their placement in industry.

2. To access and update the curriculum content and educational process continuously and revise the programmes and schemes based on realistic needs of the country and the emerging technical development.
3. To make the instruction, training and programme oriented towards and relevant to meeting the technological, industrial and socio-economic needs of the country.

4. To undertake research, both fundamental and applied, in science and Technology and educational issues to develop production and process and to facilitate commercial utilization of such R and D output.

5. To assist the industry in facing emerging changes and challenges by providing appropriate trained technical personnel, retraining facilities for working professionals, research, development, design, testing, consultancy and extension service, technological updating, transferred and forecasting services etc.,

6. To foster and maintain linkages with industry, R and D laboratories, other institutions and professional bodies with objectives of mutual assistance exchange avoiding duplication of research efforts and to function in mutually supporting and complementary manner.

7. To achieve a vibrant and dynamic academic status, promoting innovation, creativity and experimentation adopting new tools, methods and systems.¹⁰

3.4 Need for Technical Education

In all industrially advanced countries, technical education has received much attention because of its immediate utility in increasing economic prosperity by the application of science and Technology to industry, agriculture, transport and communication, public health and other welfare activities. India got the lowest number of engineering products per millennium population.¹¹
3.5 History and Development of Technical and Engineering Education in India

3.5.1 Before Independence

In India, right from the time of gaining independence in 1947, technical education was recognized one of the most significant component of human resources development, having great potential for adding value to products and services, for contributing to the national economy and for improving the quality of life of people. Government of India and State Governments have been making consistent efforts for quality improvement and quantitative expansion of the technical education system. Consistent rapid changes are taking place in the socio-economic, industrial and technological scenario as we enter the 21st century.

India was noted for its superior talent in science and technology. If we cast a look at our past, we find our own Mahenjodharo, for example, showed good relics of knowledge of town planning, civil engineering and architecture. Much before this time in Vedic period, Rig Veda mentions about canals/dams.

Technical manpower was found inadequate due to the technological and industrial growth during the later part of the 19th century. Now, education in India has gained momentum because of industrial revolution and scientific advancement in western countries, which had an impact on India leading to technical flourishing.

In India, for the first time, East India Company set up Public Works Department. All the senior level officer’s posts were filled with Englishmen in Administrative wing. Only low level and Technician’s posts were reserved for Indians. It was thought to be more practicable to train low persons, as the result of which some training institutions were established in India. The first of such industrial school was started at Guindy (Madras) during the British rule in 1842. This was attached to Gun Carriage Factory located at Madras (Chennai).
Thomson Engineering College was established in Roorkee in 1847 in order to train civil engineers. The name of this college was changed to Bengal Engineering College in 1857\textsuperscript{13}.

In 1854, an Institute for training overseas was established in Poona (Pune). In 1856, three Engineering colleges came into existence in three Presidencies of Bombay, Calcutta and Madras. In 1858, the School of Guindy and Poona were converted into Engineering colleges and were granted university affiliation.

From 1880 onwards, the demand for Mechanical and Electrical Engineers began to be felt and three presidency Colleges started classes in these streams. In 1887, the Victoria Jubilee Technical Institute Bombay started courses in Electrical, Mechanical and Textile Engineering. By the end of 1904, there were 123 industrial schools and colleges in the country\textsuperscript{14}.

During the late 19th century, there was an instant demand for technical education in the country and in almost every annual session, the Indian National Congress stressed the need for providing technical education.

In 1904, an organization known as the Association for Advancement of Scientific and Industrial Education was established in Calcutta. In Bengal, the National Council of Education established the college of Engineering and Technology at Jadavpur University, which formed the nucleus of the present Jadavpur University.

Sir. Jamshedji Tata at Bangalore established the world-renowned and highly reputed institution in the field of engineering and technology, Indian Institute of Science in 1911. Now, it has been ranked 7 among the important, highly reputed scientific institutions in the world.
In 1919, the Mealgan Engineering Colleges started functioning at Lahore and after independence, this college was shifted to Chandigarh as Punjab College of Engineering and Technology.

The credit for starting the first-degree classes in Mechanical and Electrical Engineering courses and establishment of Department of Mining Engineering during 1917 goes to the Banaras Hindu University under the dynamic leadership of Pandith Madan Mohan Malaviya.

In 1921, the Sergeant Report on the post war education development in India gave further fillip to the growth of technical education in India.

The technical education remained static for a long time. There was no coordination between the various institutions in the country and an integrated approach at all India basis didn’t exist. As a result of which the All India Council of Technical Education (AICTE) was established in November 1945.

The central Government appointed a “High Powered Committee” in 1945 to probe into the problems of technical education in India. Another development prior to independence was the establishment of the council of Scientific and Industrial Research (CSIR). These two organizations worked under the joint chairmanship of Late Sri. N.R.Sarkar and made several recommendations. On the recommendation of the first committee, the five Indian Institute of Technology came in to existence in Kharagpur, Bombay (Mumbai), Madras (Chennai), Kanpur and Delhi.

The second committee was responsible for the setting up of a network of Regional Engineering College, National Laboratories and Industrial Research Institutes. Subsequently, the Engineering Personnel Committee (1956) and the Post-Graduate Engineering Education Committee (1962) and the Scientific Manpower Committee helped the Government to have proper assessment of the
problems of Technical education and to accept the concept of integrated planning in technical education.

3.5.2 After Independence

At the dawn of the independence in 1947, India realized the need for the technical education for its people. The main objectives were to oust illiteracy, poverty and provide the education for all. As a result, soon after independence, a series of commissions and committees were constituted to provide advice to the government for the reorganization and development of education.

The establishment of All India Council for Technical Education (AICTE) in 1945 and Scientific Manpower Committee in 1947 paved the way for effective systematization of technical education. In 1947, when India attained independence, there were 38 technical institutions in the country with total intake capacity of 1850 students per year for the degree courses.

All India Council for Technical Education (AICTE) is the most important statutory body advising the central and state government in the matters relating to the organization and development of technical education in the country. Act of Parliament set up AICTE as a statutory body in 1987, with a view to proper planning and coordinated development of technical education in the country. Thus the AICTE has to take all such steps, which it may think necessary for ensuring coordinated and integrated development of technical education and maintenance of norms and standards in the field of technical education in the country.

On the recommendation of AICTE, practically every state has now set up a separate Directorate of Technical Education (DTE). This Technical Board functions under the preview of concerned State Government Authority.
In 1945, the Government of India set up a committee for the establishment of Higher Technical Institute, and this committee strongly recommended the establishment of Indian Institutes of Technology in the (IIT) pattern of MIT (Massachusetts Institute of Technology) in United States. As a result, Indian Institutes of Technology at Bombay (Mumbai), Delhi, Kanpur, Kharagpur Madras (Chennai) and Guwahati are functioning at present, which are the most reputed, advanced scientific institutions of India.

All the Indian Institutes of Technology were started with an undergraduate teaching leading to Bachelor of Technology. Being reputed technical institutions of the country, they have good facilities in terms of equipment, faculty, and library and per capital expenditure.

Table-3.1: List of six Indian Institutes of Technology (IIT)

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<thead>
<tr>
<th>Sl.No.</th>
<th>Place</th>
<th>Year of establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kharagpur</td>
<td>1950</td>
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<tr>
<td>2</td>
<td>Mumbai</td>
<td>1958</td>
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<td>3</td>
<td>Chennai</td>
<td>1959</td>
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<tr>
<td>4</td>
<td>Kanpur</td>
<td>1960</td>
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<tr>
<td>5</td>
<td>Delhi</td>
<td>1961</td>
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<tr>
<td>6</td>
<td>Guwahati</td>
<td>1981</td>
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</tbody>
</table>

The technical education pattern in India is in the five levels, viz, ITI’s, Polytechnics, Degree courses, Regional Engineering colleges and India Institute of Technology. ITI’s award Certificate courses; Polytechnics offer courses in Diploma; and Degree Courses leading to B.E./ B.Tech, M.E./ M.Tech degrees.

There are 17 Regional Engineering Colleges (REC) offering technical education18. Now REC’s are renamed as National Institute of Technology (NIT). Their Board of Governors manages all the NIT’s, which are Deemed Universities.
All the National Institute of Technology and State Engineering colleges award under-graduate (BE), Post-Graduate (ME/ M.Tech) and Doctoral degree (PhD), where as B.Tech., M.Tech and research degree leading to PhD, are awarded by the IIT's.

During the year 2006-2007, the country has nearly 1478 Engineering institutions at the degree level enrolling annually around 5 lakhs 8 thousand students each year. These Colleges are affiliated to 248 universities around the country including 17 National Institutes of Technology. In addition, 1244 Polytechnic Colleges with over 2.65 lakhs intake of students in various diploma courses of which nearly 70% are in the private self financing sector. Even though, the growth in the number of Engineering colleges was initially in the four States of Karnataka, Tamilnadu, Maharastra and Andhra Pradesh in the late Nineties other States also followed the policy of establishing more engineering colleges, mostly under the management of private Sector 19-20.

Apart from these Engineering colleges and Indian Institute of Technology (IIT's). We also have specialized institutions like National Institute for Training in Industrial Engineering (NITIE). National Institute for Foundry and Forge Technology (NIFFT), the Indian School of Mines (ISM), the school of Planning and Architecture (S.P.A), National Institute of Industrial Design (N.I.I.D), etc 21. As a result of this, there is a spectacular development of technical education. We have been able to achieve the enviable record of being the third largest country of skilled manpower in the whole world.

Technical Training Institute of India (TTII) and Indian Society for Technical Education (ISTE) were set up in 1968 for technical and technician education in the country. It provides financial support for organizing short-term programmes like Workshops and Conferences to Engineering Colleges/ Polytechnics for the improvement of quality of technical education.
3.6 Growth of Technical Education in Karnataka: A Statistical Profile

Karnataka State stands out prominently on the map of technical education in India to the large number of institutions imparting technical education. It stands presently at 3rd place, next to Maharashtra and Tamil Nadu in terms of total number of technical institutions within the state. A list of engineering colleges functioning in Karnataka State during the year 2006-2007 is given in the Annexure-1 (Sources: Annual Technical Manpower Review: Karnataka 2007: Engineering NTMIS Nodel Centre for Karnataka, Surathkal).

3.6.1 Before Re-Organisation

Karnataka, rightly be considered as one of the most progressive states in India, and especially, a pioneer in the field of technical education because of the foresightedness of then Dewan of Mysore Sir M.Visveshwaraiah. He was an engineer, educationist, a statesman, administrator and visionary.

Imparting technical education as a part of curriculum made its beginning only in the later half of the 19th century. First technical institute, the school of Engineering was established in Bangalore in 1862. The institution available thereafter for several years for training men for lower service of public works department was the school that had been established by Rao Bahadur Arcot Narayana Swamy Mudialiar (RBANM) established a Technical School in 1873.
Industrial School was established at Hassan in 1889 and in Mysore in 1892. P.N. Krishnamurthy, a representative of Assembly, stressed the encouragement in industrial education and Government sanctioned a scheme of technical education in 1903.

In 1913, the Government sanctioned establishment of Mechanical School at Bangalore, which was imparting instruction in Electrical and Mechanical Engineering. In order to, streamline the method of imparting industrial education on a systematic pattern. The Dewan of Mysore, Sir M. Visveswaraiah, a renowned engineer of Government of Karnataka formulated a Committee and it made the following recommendations.

1) to start the college of Technology in Bangalore to give higher instruction in Technical, Industrial and Commercial matters.
2) to start three more Industrial schools.
3) to award more scholarships to encourage the study of technical subjects in foreign countries.

The pattern of levels of technical education in Karnataka is not different from the other parts of the country. In Karnataka, the technical education was imparting during this period had through the following type of institutions:

1. Industrial Schools.
2. Sri Krishnarajendra Silver Jubilee Technology Institute.
3. Sri Jayachamarajendra Silver Jubilee Technology Institute and
4. The School of Engineering.

There were 14 industrial schools in old Mysore at the time of integration. Some of them were converted into Industrial Training Institutes and others were closed. In the period of 1915-21, an attempt was made to unify industrial education in the State by providing four-year course in the Industrial School at
taluka and district levels and advanced training in the Chamarajendra Technical Institute at Mysore.

Sri. Jayachamarajendra Occupational Institute (Presently Sri. Jayachamarajendra polytechnic) was started at Bangalore in 1943 as a result of the donation of Rs. Two lakhs by Sir M. Visveshwaraiah. The Institute, initially started with 12 courses, now offers as many as 15 courses.

In Bombay-Karnataka area, the earliest technical Institution was Industrial School, Dharwad (1873), and Started by Mr. Robertson, the Collector of Dharwad. In 1946, BVB College of Engineering was started in Gadag and later it was shifted to Hubli.

In 1947, the Mysore Government started an Engineering College at Bangalore, and for a long time till 1946, this was the only college for the whole state. After 1946 three more engineering colleges were started, one of which was by Government and two were by private management. At the time of unification, there were four engineering colleges in Mysore region and one college at Hubli in Bombay Karnataka region. They are: Visveswaraiah college of engineering, Bangalore (Government), B.M.S. College of engineering in Bangalore, the National Institute of Engineering, Mysore, and BVB college of Engineering at Hubli by private management, and BDT college of Engineering Davangere by Government (Now BDT college is renamed as UBDT).

Before the reorganization, the number of Engineering Colleges, Polytechnics and Schools in the state were, 46 and 24 respectively.

3.6.2 After –Re-Organisation

During the decade between 1956-57 and 1968-69, ten more Engineering Colleges were started, of which nine were started by private organizations and one
by government. Government of India and Government of Karnataka started the Karnataka Regional Engineering College at Surathkal jointly in 1960.

Government of Karnataka established separate Technological University in Karnataka on 1st April 1998 as per VTU act 1994. Government of Karnataka started specialized university in the technical field, with a vision to become an outstanding university at the cutting edge of the knowledge that produces world-class research and leaders for innovative technology and industry. There are 127 Engineering colleges (2006-07) (Annexure-1), including 6 government, 12 aided and 109 private colleges offering Bachelors Degree in 25 branches, and M.Tech course in 54 branch with intake inclusive of Post Graduate around 42,105 students per year.


<table>
<thead>
<tr>
<th>Table-3.3: Category wise distribution of technical educational institutions in Karnataka</th>
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<tbody>
<tr>
<td>Level of institution</td>
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<td></td>
</tr>
<tr>
<td>Engineering Colleges</td>
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<tr>
<td>Faculty Strength in Engineering Colleges</td>
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<tr>
<td>Total students Intake</td>
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</tbody>
</table>

3.7 Role of Libraries in Engineering Colleges

The Scientific and Technological revolution in the last few decades has made tremendous and consistent impact on the way, in which information is
processed, stored, retrieved and disseminated. The way of communicating the available information from the various sources to the end users is the major challenge for the Information Scientists.

The developments of multidisciplinary and interdisciplinary subjects have led to information explosion. Today, information is the most powerful tool and valuable resource, which are playing a critical and dynamic role in building human civilization. Information is playing a vital role in socio-economic, political, scientific and technological development of the nation. The library acts as social institution for the conservation, communication and extension of knowledge.

The library is key to the knowledge of the world. Acquisition of knowledge should help for the enlightenment of personality of the individual at the vital, spiritual and mental levels and should inculcate social virtues and faster intellectual development to make him a worthy citizen.

Libraries play a vital role in the development of higher education. They are now universally recognized as important centers for utilization of social, cultural and scientific information where recorded knowledge is acquired, stored, organized and disseminated to all type of clients. It would not be an exaggeration if it were said that a library is an essential prerequisite for successful implementation of higher education programme.

In the words of Dr. S. R. Ranganathan "Libraries are not mere store houses, they are rich springs from which knowledge flow sought to irrigate the wide field of education and culture."25.

According to Dr. Shera, library of future should be the true information center. The library of tomorrow must be the functional rather than monumental. He further advocates the importance and use, if library as knowledge is the lifeblood of our civilization and the library of future may be regarded as the
instrument by which is continuing circulation of knowledge is maintained. This makes library an indispensable and integral part of educational programme.

A College library has a prominent role to play in achieving the objectives of higher education. It supplements the classroom teaching imparted by the teachers and forms an integral part of the teaching process in the college. The primary objective of the college library “is to make its faculties contributive instructional and research programme of the college”.

The Radhakrishna Commission Report aptly describes the place of the library in higher education, as “the library is heart of all the university or college work, directly for its research work and indirectly for its educational work. For humanistic and scientific research a first class library is essential in university or college”.

Similarly, Kothari Commission (1964-66) in its report has emphasized that no university or college or department should be setup without taking into account its library needs in terms of staff, books, journals, space, etc. Nothing could be more damaging to a growing department than to neglect its library or give it a low priority. On the contrary, the library should be an important center of attraction on the university or college campus.

There are number of Commissions and Committees like Radhakrishna, Kothari, Mudaliyar and Ranganathan which have expressed the importance of the library in the field of education. All this makes library an indispensable and integral part of educational programme. And also, library is one of the major agencies where in there is a maximum social utilization of knowledge stored. Therefore, the library is considered as heart of the educational institutions.

In the beginning of the 21st Century. The achievement and growth in the field of Science and Technology are unimaginable and innumerable.
Research and investigations are taking place in each and every field, especially in Science and Technology, which has resulted in the enormous growth of literature.

Engineering & technology are primarily aimed at developing the things, which are already invented by scientists. Such developmental activities need new and nascent information. A technical library as an essential part of its parent body serves this need. This means that discoveries are actually made in the library and subsequently tested out in the laboratory. It is the responsibility of the library staff of engineering and technical libraries to provide right information at right time to right users to save the time of the users.
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