3.1 Introduction

Technical Education plays a very significant role in producing competent technical manpower needed for economic and societal development. Global competition combined with the Information technology revolution has led to shift in paradigm in engineering education. It demands technical skills, ability to create, lead and work effectively as a member of a team. Engineering decisions have to make with an understanding of socio-economic factors. The emerging engineering graduates have to be prepared having regard to the change in demands both quantitatively and qualitatively.¹

Engineering and 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 constant and continues 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. 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.

As technical manpower is key to the country’s prosperity and high technology jobs are the need of the future, a high skilled workspace is required. The developing market economy of our country makes greater demands for engineering education. It is required that while broadening specialist field of engineering education, basic theories and fundamental
qualities should be emphasized. Institutions of higher learning particularly technical institutions, where knowledge is transmitted and knowledge is created, clearly form the backbone of country’s future.

The wealth and prosperity of a nation depends on the effective utilization of its human and material sources through industrialization. The use of human material for industrialization demands its education in science and technology. Industry opens up possibilities of greater fulfillment for individual. India’s enormous resources of manpower can only became an asset in the modern world, when trained and educated.

With a large network of technical institutions established and developed since independence and the programmes and initiatives launched in India during the successive plan periods, the technical education system has made significant contributions in producing one of the largest reservoirs of technically trained manpower which has been a source of strength for scientific and industrial development.

3.2. Meaning and Definitions of Engineering Education

The word ‘Engineer is derived from the Latin words ‘engine” and “Enginious”, meaning “to create”. Engineering Education is the acquisition of art of utilization of knowledge. ²

Engineering is the application of science to the needs of humanity. This is accomplished through the knowledge, mathematics and practical experience applied to design of useful objects or processes.³
Encyclopedia Britannica defines Engineering as the “professional art of applying science to the optimum conversion of the resources of nature to the uses of mankind”. 4

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 humankind. In its modern form engineering involves, Men, Money, Material, Machine and Energy”. 5

The Columbia Encyclopedia defines Engineering as ‘Profession devoted to designing, constructing, operating the structures, machines and other devices of industry and everyday life”. 6

All the definitions indicate that Engineering as an art, namely the art of directing, applying or controlling of something for the benefit of human race

3.3. Purpose of Engineering Education

The development of a nation does not depending on the available sources but on effective utilization of these resources. We need a technologically equipped human force for the effective utilization of available resources. 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 prosper and self sufficiency.
The following are important purposes and aims of Engineering Education

1. To offer courses of instruction in different branches of engineering at undergraduate and post-graduate study levels with a view to develop the students with technical excellence.

2. To access and update the curriculum content and educational process continuously and revise the programs and schemes based on realistic needs of the country and 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 facilities 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.
3.4. Development of engineering education-An historical perspective

With the invention of steam engine by James Watt in 1769, the industrial revolution was started in the 18th century in England. The Industrial Revolution laid the foundation of a technological civilization and gave rise to a new system of learning process which is known as Technical Education or Engineering Education. The technical education system brought out the concept of establishment of training institutions in order to meet the challenges of fast changing technological environment.

The first technical institution in the world was started by Dr. John Anderson at Glasgow in 1790 to train the craftsmen and artisans. In the year 1794 another technical institution was started in France and later in USA in the year 1823, the Rensselear polytechnic Institution of Troy at New York State was established. In Germany, in order to provide teaching for all grades of men from craftsmen to Researchers Technische Hochschules Technical institute was established in 1879. Later the imperial college of science and Technology was established in London in the year 1907.

3.5 Development of Engineering Education in India

The foundation of engineering education was laid in India almost at the same time as in Europe. In 1794, the English traders established a survey school at Madras to train Indian personnel in modern land survey and to assist British surveyors. In 1842 the Industrial school was established at Guindy, Madras which was attached to the Gun carriage factory in Madras. Another Industrial school was started in Poona in 1954 to train overseers.8
The first engineering college named Thomson civil engineering college, Roorkee was established in 1847 by the provincial Government in order to supply the manpower needed for the PWD and survey departments in India. The need for introduction of Engineering was highlighted in 1854 on the recommendations made by Wood’s Dispatch. On the bases of recommendations made by Wood’s Dispatch 3 Engineering colleges were established, one each in Bengal, Bombay and Madras which developed into Bengal Engineering college, Poona Engineering college and Guindy Engineering college respectively. The establishment of these three Engineering colleges in 1856 as per the Government policy. Another technical institute known as Victoria Jubilee Technical Institute (VJTI) was established in Bombay in 1887 to train the licentiates in electrical, mechanical and textile engineering.

In the beginning of the twentieth century, with an increased realization of the importance of technical education in India, another Engineering college was established at Jadavpur, Bengal under the auspices of the National council education which started a diploma course in Mechanical engineering in 1908. Sir Jamshedji Tata, an industrialist and a devout nationalist leader established the Indian Institute of science at Bangalore in 1909. In 1917, the Benaras Hindu University started a comprehensive degree course in electrical and mechanical engineering.

In 1936-37, a two member team of British experts advised the Government on a major reform in the education system, based on which a
model institution called Delhi Polytechnic was started in Delhi which was later known as Delhi college of Engineering.

### 3.5.1 Establishment of AICTE-1945

The AICTE was established by a Government Resolution in 1945. The mandate of the AICTE was to advice the Government of India on planned and coordinated development of all aspects of technical educations at the diploma, under-graduate and post-graduate levels including research.

### 3.5.2 Establishment of IITs

The AICTE appointed a committee in 1945 under the chairman of Mr. N.R. Sarkhar, popularly known as Sarkar committee, which recommended establishment of four higher technical institutes, on the pattern of Massachusetts Institute of Technology (MIT), USA, to meet the India’s post war needs for high grade engineers, technologists etc. Accordingly the Government of India Institutes of Technology of India established five Indian Institutes of Technology at Kharagpur in 1950, Bombay in 1958, Kanpur in 1955, Madras in 1960 and in Delhi in 1961. In order to meet the demand of qualitative engineering personnel in the Global market and to maintain regional balance between various states in the country, the Government of India has started many more India Institutes of Technology in the recent past as mentioned below in addition to the above five. They are

1. Indian Institute of Technology, Bhubaneswar
2. Indian Institute of Technology, Gandhi Nagar
3. Indian Institute of Technology, Guwahati
4. Indian Institute of Technology, Hyderabad
5. Indian Institute of Technology, Indore
6. Indian Institute of Technology, Mandi
7. Indian Institute of Technology, Patna
8. Indian Institute of Technology, Rajasthan
9. Indian Institute of Technology, Roorkee
10. Indian Institute of Technology, Ropar
11. Indian Institute of Technology, BHU, Varanasi
12. Indian school of Mines, Dhambad

The Roorkee Engineering College which was established in the year 1848 was elevated as Indian Institute of Technology in the year 2002.

3.5.3 Establishment of Regional Engineering Colleges (presently known as National Institutes of Technology)

On the recommendations of the Engineering personnel committee (1995) which anticipated a shortage of Engineering personnel by 1960-61, 15 Regional Engineering colleges were established in 15 states as joint ventures of the Government of India and the respective state Governments in which the college is located. The first Regional Engineering college was established at warangalin Andhra Pradesh in 1959.

During the year 2002, all the Regional Engineering colleges in the country were renamed as National Institutes of Technology (NIT) by the Government of India. In a bid to promote regional development, the Government established an NIT in each state and Union territory of the country. NIT funding has been increased and is provided exclusively by the central Government. The following is the current list of NITs in India.
1. Dr.B.R.Ambedkar National Institute of Technology, Jalandhar
2. S.V.National Institute of Technology, Surat
3. Malaviya National Institute of Technology, Jaipur
4. Maulana Azad National Institute of Technology, Bhopal
5. Motilal Nehru National Institute of Technology, Allahabad
6. National Institute of Technology, Agartala
7. National Institute of Technology, Calicut
8. National Institute of Technology, Durgapur
9. National Institute of Technology, Hamirpur
10. National Institute of Technology, Jamshedpur
11. National Institute of Technology, Kurushetra
12. National Institute of Technology, Patna
13. National Institute of Technology, Raipur
14. National Institute of Technology, Rourkela
15. National Institute of Technology, Silchar
16. National Institute of Technology, Srinagar
17. National Institute of Technology, Tiruchirapalli
18. National Institute of Technology, Warangal
19. National Institute of Technology, Suratkal
20. Visvesraya National Institute of Technology, Nagpur

3.5.4. Growth and development of Engineering Institutions in India

The graduates growth rate is far exceeding the country’s growth rate. In the last 15 years there has been a veritable explosion in the number of technical colleges operating across the India. Between the period from 1990 to 2003, the number of engineering colleges rose from 337 to 1200 (of which
almost 1000 are in the private sector). At present there are 3393 Engineering colleges in India. This unfettered growth has led to a host of other problems, such as faculty shortages, raising rates of unemployment and a general decline in academic standards.

While the number of technical institutions has exploded across the country, it occurred in geographic packets. Almost 60 percent of the Engineering colleges of the country were established in south India. Nationally an average of 350 students per million people enters into technical degree programs.

The rapid growth of Engineering institutions not only has led to surplus numbers of Engineering graduates, but also a dramatic shortage in qualified faculty. At present during the academic year 2010-11 there are 3241 Engineering colleges are available in India with the intake of 1324246 seats. Table: 3.1 describes the year wise increase of new Engineering and other professional colleges in the country.\(^{10}\)
Table 3.1

Year Wise Growth of Engineering and Other Professional Colleges in India from the Academic Year 2005-06 to 2010-11

<table>
<thead>
<tr>
<th>Year</th>
<th>Engineering colleges</th>
<th>MBA colleges</th>
<th>MCA colleges</th>
<th>Pharmacy colleges</th>
<th>Colleges for Architecture</th>
<th>Hotel management institutions</th>
<th>Total</th>
<th>Additionally established colleges</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-06</td>
<td>1475</td>
<td>1888</td>
<td>1576</td>
<td>629</td>
<td>118</td>
<td>70</td>
<td>5756</td>
<td>383</td>
</tr>
<tr>
<td>2006-07</td>
<td>1511</td>
<td>2031</td>
<td>1619</td>
<td>665</td>
<td>116</td>
<td>64</td>
<td>6006</td>
<td>250</td>
</tr>
<tr>
<td>2007-08</td>
<td>1668</td>
<td>2062</td>
<td>1642</td>
<td>854</td>
<td>116</td>
<td>81</td>
<td>6423</td>
<td>417</td>
</tr>
<tr>
<td>2008-09</td>
<td>2388</td>
<td>2734</td>
<td>1768</td>
<td>1021</td>
<td>116</td>
<td>87</td>
<td>8114</td>
<td>1691</td>
</tr>
<tr>
<td>2009-10</td>
<td>2942</td>
<td>3482</td>
<td>1888</td>
<td>1054</td>
<td>106</td>
<td>93</td>
<td>9565</td>
<td>1451</td>
</tr>
<tr>
<td>2010-11</td>
<td>3241</td>
<td>3858</td>
<td>1937</td>
<td>1102</td>
<td>125</td>
<td>101</td>
<td>10364</td>
<td>799</td>
</tr>
</tbody>
</table>

Fig: 3.1

Diagrammatic Representation of year wise growth of Engineering colleges
Table – 3.2
Year Wise Growth of Seats in Engineering and other Professional Colleges in India from the Academic Year 2005-06 to 2010-11

<table>
<thead>
<tr>
<th>Year</th>
<th>Engineering colleges</th>
<th>MBA colleges</th>
<th>MCA colleges</th>
<th>Pharmacy colleges</th>
<th>Colleges for Architecture</th>
<th>Hotel management institutions</th>
<th>Total</th>
<th>Additionally established colleges</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-06</td>
<td>499697</td>
<td>122663</td>
<td>61991</td>
<td>32708</td>
<td>4379</td>
<td>4435</td>
<td>725873</td>
<td>40691</td>
</tr>
<tr>
<td>2006-07</td>
<td>550986</td>
<td>144372</td>
<td>63394</td>
<td>39517</td>
<td>4543</td>
<td>4242</td>
<td>807054</td>
<td>81181</td>
</tr>
<tr>
<td>2007-08</td>
<td>653290</td>
<td>185780</td>
<td>78692</td>
<td>52664</td>
<td>4543</td>
<td>5275</td>
<td>979914</td>
<td>182860</td>
</tr>
<tr>
<td>2008-09</td>
<td>841018</td>
<td>227989</td>
<td>82578</td>
<td>64211</td>
<td>4543</td>
<td>5794</td>
<td>1226133</td>
<td>246219</td>
</tr>
<tr>
<td>2009-10</td>
<td>1071896</td>
<td>273732</td>
<td>121123</td>
<td>72836</td>
<td>4133</td>
<td>6387</td>
<td>1550107</td>
<td>323974</td>
</tr>
<tr>
<td>2010-11</td>
<td>1324246</td>
<td>378907</td>
<td>135173</td>
<td>103867</td>
<td>4933</td>
<td>7061</td>
<td>1954482</td>
<td>404375</td>
</tr>
</tbody>
</table>

Fig: 3.2
Diagrammatic Representation of year wise growth of Engineering seats
It is very interesting to note from the Table:3.1 and Table:3.2 that among the 3241 Engineering colleges available in India, 726 are situated in Andhra Pradesh. Among the 1324246 seats available in Engineering colleges in the country, 304080 seats are available in Andhra Pradesh. Among the 726 colleges only 18 Engineering colleges are owned by state Government Universities with the annual intake of 4595 seats. In entire state of Andhra Pradesh the private managements are playing the dominant role in running the Engineering and other professional colleges.

The National Knowledge Commission was set up by Government of India in 2005. The commission will advise the Prime Minister on how India can promote excellence in the education system to meet the knowledge challenges of the 21st century. The Commission submitted its report in the year 2008 and made the following recommendations on Engineering Education.11

3.5.5 Growth of Engineering Education in Andhra Pradesh

Andhra Pradesh consisting of 3 Regions namely 1.Coastal Andhra, 2.Telangana, 3.Rayalaseema. In the pre-Independence days of India there were only 3 Engineering colleges in Andhra Pradesh, Osmania University College of Engineering was established in the year 1929 at Hyderabad. It is first Engineering College in Andhra Pradesh. School of Planning and Architecture was started in Hyderabad in the year 1940. Later in 1946 two Engineering colleges were started namely Government Engineering College, Kakinada and Government Engineering College, Anantapur. Andhra University College of Engineering was started at Visakhapatnam in the year
1959. Osmania college of Technology was started at Hyderabad in 1969. The Regional Engineering College (presently known as National Institute of Technology) was established at Warangal in the year 1959.\textsuperscript{12}

In order to supervise engineering education in Andhra Pradesh, a separate technological University was established in the year 1972 namely Jawaharlal Nehru Technological University. Its headquarter at Hyderabad. In 1976 Kakatiya Engineering college was established at Kothagudem.

The number of Engineering colleges in Andhra Pradesh at the end of year 1976 is only 10. At the end of the year 1985 the number of Engineering colleges available in Andhra Pradesh is 25. Later the Government of Andhra Pradesh accorded permission to start Engineering colleges under private managements on self finance bases. At the end of year 1995, the number of Engineering colleges reached to 35 in Andhra Pradesh.

In the last 16 years, there has been a veritable explosion in the number of Engineering colleges in the state of Andhra Pradesh. There were 35 Engineering colleges in the year 1995 in Andhra Pradesh. Between 1995 to 2011 the number of engineering colleges rose from 35 to 726. While the number of technical institutions exploded across the country, it has occurred in geographical pockets. The four southern states and Maharashtra combined are home to almost 60 percent of the country’s engineering institutions. The following table shows the abnormal growth of engineering colleges in Andhra Pradesh.
Table: 3.3

Growth of Engineering colleges in Andhra Pradesh during 1996-2011

<table>
<thead>
<tr>
<th>Year of establishment</th>
<th>Number of Engineering colleges in Andhra Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>upto 1995</td>
<td>35</td>
</tr>
<tr>
<td>1996</td>
<td>38</td>
</tr>
<tr>
<td>1997</td>
<td>47</td>
</tr>
<tr>
<td>1998</td>
<td>64</td>
</tr>
<tr>
<td>1999</td>
<td>93</td>
</tr>
<tr>
<td>2000</td>
<td>106</td>
</tr>
<tr>
<td>2001</td>
<td>114</td>
</tr>
<tr>
<td>2002</td>
<td>186</td>
</tr>
<tr>
<td>2003</td>
<td>219</td>
</tr>
<tr>
<td>2004</td>
<td>238</td>
</tr>
<tr>
<td>2005</td>
<td>262</td>
</tr>
<tr>
<td>2006</td>
<td>282</td>
</tr>
<tr>
<td>2007</td>
<td>337</td>
</tr>
<tr>
<td>2008</td>
<td>535</td>
</tr>
<tr>
<td>2009</td>
<td>656</td>
</tr>
<tr>
<td>2010</td>
<td>685</td>
</tr>
<tr>
<td>2011</td>
<td>726</td>
</tr>
</tbody>
</table>

A serious situation has arisen in recent years because of the mushrooming of a large number of private Engineering colleges. Barring some exceptions, there is scent regard for maintenance of standards.

3.5.6 Growth of Engineering Education in Rayalaseema

The first engineering college was started in 1946 in Anantapur in Rayalaseema area. This was called as Government Engineering College, Anantapur. Later in the year 1958, Sri Venkateswara University College of Engineering was started at Tirupati. No engineering college was established
in Rayalaseema area during the period from 1959 to 1979. Later the Government of Andhra Pradesh accorded permission to start the engineering colleges under private management. As a result of this decision KSRM Engineering at Kadapa during year 1980, G.Pulla Reddy Engineering College, Kurnool in year 1985, Sri Vidyaniketan Engineering college , Rangampeta in 1996 and Sri Kalahashteeswara Institute of Technology , Sri Kalahasti during the year 1997 were established under private management

The following table will show the growth of Engineering colleges in Rayalaseema area during 1998 to 2009.

Table:3.4

<table>
<thead>
<tr>
<th>Year of Establishment of Engineering Colleges in Rayalaseema area</th>
<th>No. of Engineering Colleges added</th>
<th>Total No. of Engineering Colleges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 1997</td>
<td>-</td>
<td>07</td>
</tr>
<tr>
<td>1998</td>
<td>06</td>
<td>13</td>
</tr>
<tr>
<td>1999</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2001</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>2002</td>
<td>02</td>
<td>25</td>
</tr>
<tr>
<td>2003</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2004</td>
<td>01</td>
<td>26</td>
</tr>
<tr>
<td>2005</td>
<td>01</td>
<td>27</td>
</tr>
<tr>
<td>2006</td>
<td>04</td>
<td>31</td>
</tr>
<tr>
<td>2007</td>
<td>10</td>
<td>41</td>
</tr>
<tr>
<td>2008</td>
<td>34</td>
<td>75</td>
</tr>
<tr>
<td>2009</td>
<td>12</td>
<td>88</td>
</tr>
</tbody>
</table>
It is observed that 65% of engineering colleges were started during the period from 2006 to 2009 in Rayalaseema area. This is tremendous growth of engineering education in Rayalaseema area.13

3.6 Committees appointed by Government of India to offer suggestions for growth and development of Engineering Education in India

India has potential to be a global technology leader. The Indian economy has been growing at the rate of 9% per annum. The Indian industry has also become globally competitive in several sectors and can increase its global market share. A critical in this will be the success of the technical education system in India. The following are the major committees appointed to offer suggestions for the growth and development of the Engineering education in India.14

Table:3.5
Committees appointed by Government of India on Engineering Education

<table>
<thead>
<tr>
<th>Name of the Committee</th>
<th>Title</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarkar Committee</td>
<td>Higher Education institutions for the post-war industrial development</td>
<td>1945</td>
</tr>
<tr>
<td>Thacker committee</td>
<td>Post graduate Engineering Education and research</td>
<td>1959-61</td>
</tr>
<tr>
<td>Nayudamma committee</td>
<td>Postgraduate education in Engineering and Technology</td>
<td>1959-1961</td>
</tr>
<tr>
<td>Dr. Jayakrishna Committee</td>
<td>Review of Regional Engineering Colleges</td>
<td>1974</td>
</tr>
<tr>
<td>Nayudamma committee</td>
<td>IIT’s Review</td>
<td>1985</td>
</tr>
<tr>
<td>P. Rama Rao Committee</td>
<td>Reshaping postgraduate in Engineering and Technology</td>
<td>1995</td>
</tr>
<tr>
<td>R.A. Mashelkar Committee</td>
<td>Strategic road map for Academic excellence of future RECs</td>
<td>1998</td>
</tr>
<tr>
<td>U.R. Rao Committee</td>
<td>Revitalising the Technical Education</td>
<td>2003</td>
</tr>
<tr>
<td>P. Rama Rao Committee</td>
<td>IIT Review</td>
<td>2004</td>
</tr>
<tr>
<td>Sam Pitroda Committee</td>
<td>National Knowledge Commission on Higher and Technical Education</td>
<td>2005-2008</td>
</tr>
</tbody>
</table>
Among the above committees U.R. Rao Committee and P. Rama Rao Committee have enlisted the following challenges encountering by the Engineering Education in India.

3.7. Challenges facing by Engineering Education

Today there are more than 3300 engineering institutions in the country turning out more than 6,00,000 engineers every year. Indian Engineering Education presents one of largest educational systems in the world. The challenges posed by this rapidly growing system in our country are extremely complex. An Engineering education is the relevant to the graduate if it meets the needs of the industry. A core set of such needs must be identified. It should include skills related to manufacturing, computer technology, interpersonal relations, analytical and experimental techniques.

The engineering graduates of the advanced countries possess a high level of confidence in handling unknown problems. The gap has to be bridged through setting up appropriate educational system.

The challenges currently facing Indian Engineering education have been documented in a number of recent studies and expanded upon in a host of columns, opinion pieces and feature pieces in the Indian and International media. The following is the summary of the main challenges facing by the Engineering education and an overview of some of the recommendations made by education committees, lawmakers, academic observers. 15
a) Too many institutions due to unregulated growth, especially in the private sector.

b) Institutions are proliferating in geographical packets, leading to oversupply in some markets and shortages in others.

c) Not enough qualified faculty, and not nearly enough doctorates coming through the system.

d) Weak quality assurance structures, especially accreditation procedures.

e) Lack of cooperation and interaction between industry and the classroom.

f) High levels of unemployment and underemployment among engineering graduates.\(^9\)

To address the above challenges the Government of India appointed National Knowledge Commission to offer suggestions on higher and Engineering Education under the chairmanship of Sam Pitroda. The committee opined that a glaring regional imbalance has emerged in the availability of engineering education. Two-thirds of the engineering institutions are located in four southern states, plus Maharashtra, even though they account for less than one-third of the population.

3.8. Initiatives for effective functioning of Engineering education system

Based on the inputs from the working group and consultation with other stakeholders, National Knowledge Commission (NKC) proposes the following set of initiatives for the effective functioning of Engineering Education system in India.\(^{16}\)

1. **Reforming and Regulatory framework**: An Independent Regulatory Authority for Higher education with a standing committee on Engineering education should be established in order to exercise due diligence at the
point it approves entry for an institution to grant degree/diplomas. The committee will determine the criteria and process of accreditation and license multiple agencies of the same. AICTE would focus on important issues of curriculum development, pedagogy, faculty development etc.

2. **Improving Governance of Institutions**: Progressive dismantling of the affiliating system, grant of full autonomy where feasible, mandatory disclosure on website by all institutions of their infrastructure, faculty, intake and performance of students, recognition status and placement record.

3. **Attracting and Retaining faculty**: Creation of adjunct positions for professionals from industry and research institutions, incentives for attracting and retaining, relaxing Ph.D requirement for teaching undergraduates, Use of Information Technology and open educational sources from the best universities across the world to overcome faculty shortage.

4. **Curriculum Reform**: Greater flexibility, interdisciplinary perspective and choice of electives, development of integrating skills such as problem solving and logical reasoning, process orientation, learning ability and communication skills, industry participation to discuss all real life case studies, revamping of laboratory courses, co-curricular activities.

5. **Integrating science and Engineering education**: Reduction of perceived gap between science and Engineering, starting 4 year undergraduate program in science initially in institutions of excellence. Allowing graduates to pursue doctoral program in science and technology with a master degree.
6. **Industry-Academia interaction**: Frequent dialogue with Government and Industry through seminars and workshops to achieve greater alignment of engineering education with employment opportunities, summer internship to be made an integral part of the curriculum, use of apprenticeship training for honing the skills of engineering graduates in multiple skills to encourage innovation and competitiveness in the global economy.

7. **Monitoring**: Elite Institutions to adopt a few engineering institutions of their choice and helping them raise standards, making available educational resources in the public domain for use of all students at the post graduate level and working professionals; existing IITs to mentor new IITs, NITs to mentor selected engineering institutions in their region, creating an atmosphere where institutions of distinction feel a sense of calling for the interest of national good.

The National Knowledge Commission Report has analysed the current scene of Engineering Education and made recommendations for its improvement such as all types of approvals for the establishment of new institutions and any additions or changes on the old institutions should be automatic, subject to certification of minimum by designated certifying bodies drawn from professional institutions, councils and academics. Such information should be available as an “Open Access” document on a suitable website or a repository.

Roles of UGC and AICTE or another hybridized new organization need to be redefined and confined to development of curricula, pedagogy, faculty and entrepreneurship. These institutions should be empowered in their respective domains to ensure compliance with the rules and regulations.
References:


