Literature review in the field of industry-academia-interface is presented with special attention to the identified categories. Literature analysis of research papers under industry academia interface is done in the domains of industrial training, placement, curriculum development, student evaluation, resource sharing, seminars, research and development, adjunct faculty, collaboration and personality development program with a view to represent literature in a condensed and more informative manner and to understand the amount of work done in the present area of research.

2.1 Introduction

Technical education has several stakeholders among whom industry is one of the major stakeholders. Technical institutions are the major source of manpower supplier to an industry. The technical institution and industry have several complimentary strengths as well as requirements. The importance of industry-academia interface has been realized from decades. The purpose of industry academia interface is to bring the two important stakeholders of an education system i.e. the knowledge user and knowledge supplier viz. industry and academia together to make use of each other knowledge and skills to bring qualitative change in the academic quality and to address various industrial issues to make them globally competitive. The interface between two of them is valued as a critical dimension for academic output and for development of industry, society and nation at large. Observation reflects that industry and academia prefer to work in isolation and their interface is still a hot topic. The low interaction between industry and academia not only dampens the quality education but poses hardship to its stake holders and nation at large. Trainer and the user i.e. institute and the industry while working in seclusion is unable to cope up with the fast changing technological needs, how ever contrary to it, the cohesion between industry and institute is viewed as a gateway to success. Fig. 2.1(a) and Fig. 2.1(b) highlight industry-institute as separate identity (un-successful) and industry-institute cohesive relationship through partnership (Gateway to Success) respectively (Jamode A.V. et al, 2002).
2.2 Literature Review on Industry-Academia-Interaction

Literature review is done with a purpose to understand and interpret the previous work being carried out in the field of industry academia interface. To identify the new field of research work, extensive literature is collected in the form of research papers as well as presentations made in the national workshops with a view to understand the present status of industry-academia interface and the pitfalls for low interaction status. The literature review is done under different interaction domains such as industrial training, student placement, curriculum development, student evaluation, resource sharing, seminars, research and development, adjunct faculty, collaboration and personality development programs. It is beyond the scope of the thesis to descriptively report all the references listed under various headings. Therefore an attempt is made to depict the entire literature in a format so that only a few relevant research articles are covered in the domain of each area/sub area as a representative work. It helps in deriving important inferences regarding the trend and potential for further research in the area and it supports the studies carried out in the field of industry academia interface to strengthen these ties to bring qualitative improvement in technical education and to deepen the satisfaction of all its stake holders. The following few sections discuss only major influential articles in various groups, which are important to the studies made in the thesis.
2.2.1 Study on Industrial Training

Industrial training is a part of graduate engineer’s academic program. It exists either in the form of long or short training depending upon university academic structure. Literature on industrial training in this section is reviewed to understand importance of training in engineering academic program.

Deshmukh and Kothari (1999) analyses the importance of industrial training for undergraduate students and its effective implementation. Industry acts as a backbone for developmental activities of an institution and students in turn help the industries to grow and build up the nation’s economy. During industrial training the trainees get exposure to various technical and other functions of industrial organization. Students work on live projects which are of industrial importance and are to be completed with in the given time frame. This helps industry to solve their problems and the trainee gets benefited by gaining hands on experience through live projects. This experience is of immense use to trainees at the time of their interview. The importance of training can be understood from the following remarks that to mould an engineering student to a full fledged engineer, providing industrial training and there by hands on experience is a must.

Joshi (2007) highlights the purpose and benefit of industrial training. The industrial training is necessary to expose students to practical problems and to make them understand about nature of job and related responsibilities in industry, to inculcate event management activities, to understand industrial standards, testing procedures and calibration methods, to develop innovative ideas and to know the real time operations in the industry, verify theoretical aspects practically, practice to follow industrial discipline and organizational behavior, possibility to choose area of interest to work in future.

Nambudiripad (2003) states that there are complaints from everywhere, particularly from engineering industries, that new graduates from engineering colleges know nothing about the jobs they are expected to carry out. Let us accept the criticism of industries that our engineering students are not directly employable. Industries must realize that every prospective employee needs intensive training before he becomes functional in any job. The importance of training can be understood that fresh young students graduating from the finest engineering colleges are like uncut diamonds. They like uncut diamonds look useless like trifles. Give them proper training and they will dazzle forth in all their glory.
Murthy (2002) has emphasized the need of industrial training and has stated that it is an important component of engineering education in which the industry must play a pro-active role. With large number of institutions and shrinking industrial base this may pose some difficulties, but industry may also be benefited if the potential of the students are exploited through training. Progressive industries lure good students with stipend while some are discouraging by demanding a fee for training.

Ghani (2002) has pointed out that in many countries the technical education systems offer programs integrating the training component as part of education to make the students to fit in to their jobs, but in India, that does not happen.

Lahiri et al (2006) is of the view that in spite of all efforts and the enormous financial investment made, the industry feels that present technical manpower of degree and diploma institutions are lacking in practical skills and they are weak in coping with fast changing needs of the industry. Hence there is a dire need of such technologists who are adaptable to fast changing environment of the world of work and are equipped with necessary practical skills. In future, India will depend more on skills and knowledge of its people and less on its vasta natural resources. The need of the hour is now for highly skilled/ practically oriented trained technical manpower who can address to the issues of productivity, quality, cost and time and are capable of transforming ideas and concepts in to working prototypes.

Verma (2002) is of the view that industrial training is a very popular mode of industry-institute- interaction, but industry hardly takes the trainee students seriously; rather they treat them as hindrance in their day to day work. The trainee must be paid stipend by the industry to bring seriousness and business like approach.

Achintya and Rai (2007) has highlighted the importance of practical training. Engineering or technology is a discipline that is alike ‘swimming’- all theoretical inputs are meaningless until and unless the student enters the water and attempt to swim. Theoretical inputs are pointless until practical, hands on training is included in the curriculum. The basic promise would be that both industry and educational institute should understand that quality in future would depend largely on their mutual cooperation and working together.

2.2.2 Study on Student Placement
Quality of an institution is judged by the number of firms it attracts for campus recruitment and the number of students thus recruited. At the time of independence India had only 38
engineering colleges with an annual intake of 3000 students, producing engineers mainly to meet the needs of basic and traditional industries. With globalization scenario has completely changed. (www.indicareer.com) has mentioned that presently country has 3573 engineering colleges in India. (www.ithappensinindia.com) has stated that AICTE approved seats in the country for which admission was to be made in 2009-10 is 10, 71,896. Through literature survey, study is made to understand the employment status of technical graduates, reasons of low employment and industrial views on employability skills.

Ghani (2002) says that the relationship between technical education and employment is a complex one in which the technical institutions and the world of work traditionally do not match with each other. Technical education has a responsibility to prepare technical manpower for the world of work. Although there is inter-dependence between work and technical education but a wide gap persists between them. The technical institutions operate in isolation from the world of work. The curriculum is almost devoid of content relating to work, isolated from real life situation. In the information era industry look for knowledge employee having human values and demands high level skills which vary from communication and computer skills to positive attitude and ability to effectively work and lead team. The performance of fresh engineers assessed by using employability skills profile indicate that fresh engineers perform only at an average level in the area of knowledge and technology and technical skills. Their performance in behavioral skills is just below average. Their skill in idea generation and imagination, inferring the results, interpreting the graphs and diagrams, analyzing the failure, applying the concept to real situations and evaluating the material or process need to be improved.

Achintya and Prasad (2007) has commented on the performance of students during placement interviews. These days very few students can perform satisfactorily in the placements due to lack of confidence, communication and presentation skills. To day students are equipped with knowledge for merely getting through the examinations and the total quality of a student remains a secondary option.

Wani et al (2003) is of the view that the mushroom growth of engineering colleges in the last two decades in India has resulted in unemployment of engineering graduates. This situation has been aggravated by our educational system itself, which mould student for wage employment rather than for self employment. While India has the world largest stock of
scientists, engineers and technicians, it has not derived full economic advantage from this skill base because of the mismatch of education and training.

2.2.3 Study on Curriculum Development

There is a constant demand of skilled professionals and domain experts to keep up pace with the growing job market in India. The academic institutions are challenged to keep updating their curricula with the latest technologies to equip students with the skills that will propel them into fulfilling careers right from the start. The literature survey study was done to understand how flexible and responsive is the student curriculum to fast changing technological needs and what is the participation level of education stake holders in designing and improving student curricula to make it need oriented:

Nambudiripad (2003) states that courses in engineering science are the heart and soul of engineering education. Any investment made in these courses pay dividends in the form of a strong, solid foundation and clarity of concepts. Engineering curriculum can not afford to neglect emerging areas. Synthesis and creativity are the high pedestals in successful academic programs. It is generally accepted that industries must be consulted in designing a proper curriculum as they are the end users of institutional product. In practice, however, most industries with notable exceptions tend to have myopic vision and do not have the maturity to contribute to the task. Middle level scientists of national laboratories and research organizations who are experienced and academically mature, but administratively not very busy are the right choice as external members of academic committees. Undergraduate programs in engineering should be broad based; specialization in narrow area is not a good idea at undergraduate level.

Ahuja and Nanda (2003) is of the view that rare attempts have been made to ascertain the needs of the society and most of the educational programs in the country are designed, developed and implemented very unsystematically. Some of the programs are not need based. There has been very little interaction between the industry and the technical institutions and consequently curriculum development programs in the technical institutions have failed to envision the requirements of the industry.

Sirohi and Sinha (2003) the course curriculum is an important subject to attract attention as far as quality assurance is concerned. No form of technical education can assure quality if it does not pay attention to the maintenance of high standards in its assessment of programs and
faculty, and in constant updating of curriculum. Course structure must be such that it builds the basic foundation in sciences. Content should reflect the changing demands, and technology upgradation. Periodic review of the curriculum is essential to bring in the new technologies, design procedures etc.

Naskar (2007) points out that survival of industries in the technological competitive environment is only possible if they are adequately manned by competent and technical sound personnel produced by the technical institutions. In today’s world technology is changing very rapidly. Technical institutions lack in industrial orientations. Since industries are the major stakeholders of technical education systems of a country, the industrial requirements must be emphasized in designing new curricula or revising the existing one. It is worth mentioning that industrial requirements and industrial contributions are taken into considerations in technical education systems, but to the greatest extent it is not yet uniformly practiced throughout the country like ours.

Jain and Rai (2007) are of the view that phrase; course curriculum outdated, has been much talked about and has been prevailing for a very long time. It has been the case in the past and will continue to remain in future also. In order to have the curriculum for the engineering courses in line with the scientific and technological need of the hour, it is necessary that the curriculum should fulfill the need of the industries, there should be some flexibility in curriculum so that students acquire latest skills in their interest rather than learning by rote and curriculum must be revised frequently to keep it relevant to the technological developments.

Shetty (2009) has commented that effective planning of engineering curriculum requires careful identification of the national goals of engineering education. It is a well known fact that the present curricula are rigid and the syllabi are unresponsive to the fast changing scientific and technological situations as well as their relevance to the development. A lot of flexibility and freedom should be built in to the curriculum, with focus on training the student to learn how to relate knowledge to the practical environment in which they live.

Sinha (2004) has emphasized the need to update the curriculum regularly as the technology is continuously changing and the technical education tends to be obsolete very soon. Continuously updating of curriculum is essential. While leading institutions have in-built mechanism for curriculum update but large number of other institutions tend to follow
outdated syllabi. Often the faculty may be reluctant to changes. Needless to say a dynamic curriculum development mechanism should form a crucial component of development policy.

Achintya and Rai (2007) have given a feedback that development of transferable skills is one of the most important skill which industry look in students. The curriculum for various courses of the technical institutions has been developed purely by teachers of the subject concerned. It is recommended that industries and other research organizations have to be involved in the curriculum development in view of changing scenario.

2.2.4 Study on Student Evaluation

Success of any program can be judged through its quality tools. Evaluation is one of an important parameter of quality assurance. Through literature, study is made to understand the reforms in evaluation system and involvement of major educational stake holder in student evaluation in enhancing student learning affectivity.

Naskar (2007) has stressed the need of industrial participation in student academic programs. The industry personnel need to be totally involved in curriculum review, development, implementation, preparation of question paper and student assessment to keep the technical education tuned to the industrial need and changing scenario.

National Training Policy for the Power Sector (2002) as per policy report in many institutes, the training programs is not evaluated in a scientific manner. The content, form and duration of number of programs are being continued without taking cognizance of the changes taking place. Rare attempt is made to measure the effectiveness of training through performance feedback.

Lahiri, Karaulia and Tegar (2006) are of the view that the conventional method of examination system may not work well. The terminal examination is to be replaced with continuous assessment system. Industry experts associated with all academic activities should jointly assess and evaluate performance of the learner on problem solving skills. This will enhance the credibility and utility of the program.

Bhattacharya (2003) has commented that evaluation system is the new pedagogy of transfer of learning and it calls for extensive examination reforms which have to be oriented towards measuring application of knowledge and problem solving skills.
2.2.5 Study on Resource Sharing

With economy going global, quality has taken a front seat and profits have come down. Industry and academia is passing through financial instability and at the same time resources are underutilized. The literature is examined on sharing of resources so that optimum utilization of the resources may occur and purchase of duplication and obsolete items may be avoided.

Ahuja and Nanda (2003) have pointed out that higher technical education institutes in the country are facing staggering problems arising out of faculty shortages, obsolescence of laboratory equipment, necessity of up gradation of skills of technical personnel and resource crunch. The infrastructural facilities available in majority of institutions are extremely inadequate. The situation gets worsened due to isolation of the institutes from industries, and research and development institutions. The non resource sharing between these institutions has led to underutilization of resources and has put additional burden to create and continuously upgrade the expensive and state of the art infrastructural facilities.

Sirohi and Sinha (2003) are of the view that to ensure quality teaching there should be proper linkages between the resource institutions, technological institutes of higher learning and other participating technical institutions. Such linkages will ensure the growth and attainment of excellence by the participating institutions by addressing the specific academic issues involving faculty development and faculty collaboration, strengthening of research programs, curriculum development and distance learning, student exchange programs, library and networking etc.

Naskar (2007) has emphasized the need to generate resources through industrial staff development programs. The facilities available at the technical institutions at all levels may be conveniently utilized to offer need based training programs for the on line industrial personnel. This way the institutions as well as industries would be mutually benefited.

National Training Policy for the Power Sector (2002) the national policy stresses the need of sharing resources for better utilization. The networking amongst various organizations and other reputed institutes for optimizing training modules and to change the present attitude of my-resources to our-resource-our people is essential, so that redundancy/duplication of hi-tech infrastructure facilities is avoided and optimal utilization of existing training infrastructure and facilities and expertise through networking is made possible.
2.2.6 Study on Seminars

Seminar is the most common source of interaction between industry and academia. The interaction through seminars in updating student, faculty and industrial staff and its impact in building effective industry-academia relations is studied through literature survey.

Murthy (2002) suggests that faculty expertise may be utilized to organize state of art lectures on relevant topics in industry for in house staff. These lectures can also be in the form of short term courses to upgrade industrial staff skills. Senior industry personnel as well as members of professional societies may be called to deliver lectures in institutes on latest industrial trends and practices. These seminars can be made part of academic curriculum.

Achintya and (2007) are of the view that experts from industries should be called to deliver and discuss the relevance of their technology and managerial process among the students. Engineers from industries and faculties from technical institutions must be freely exchanged for short period for sharing the expertise.

Jamode et al (2002) have stated that seminars are must to expose students to latest technology used in industry.

2.2.7 Study on Research and Development

Research is considered as a backbone of any developmental activities and the nation’s economy is directly linked to it. Through literature survey status of research and developmental activities is studied to understand present status of quality education in promoting industrial growth.

Murthy (2002) states that most of the externally funded / sponsored projects carried out in institutes are from government departments with negligible industry involvement. The interaction between industry and technical education is so crucial and grave that the relevant quality and cost effectiveness gets affected under the increasing pressure of global competitions.

Raviprakasha, et.al, (2003) have commented that the progress of a country is decided by the research activities and their outcomes. There is a need for further improvement of performance of our higher education and research. High priority should be given to the basic research. The scientific and technological achievements are crucial for our survival as a self reliant nation.
Ahuja and Nanda (2003) have highlighted the interest of Indian industries in promoting research and development activities in comparison to other countries. It is said that the growth of research and development activity in industry remains unimpressive and research and development expenditure by industry, as a percentage of total research and development expenditure, is only 21% in India, compared to 61% in U.K., 63% in Japan and 72% in U.S.A. The Indian industries have always preferred for achieving short term goals in a profit oriented environment by sacrificing research and development investments for acquisition of plant, machinery and infrastructural facilities. The low investments in research and development activity in an industry affect the development of relevant technologies for socio-economic growth in the country. Consequently the technical institutes are deprived of the latest developments in science and technology.

Naskar (2007) has pointed out that by and large research activities and problems for student project assignment carried out in institute do not reflect the actual need of the industries.

Sinha (2004) states that institute have to evolve a clear cut policy on research and development in order to sustain faculty interest. Research and development considerably enhances the teaching level of the institute. Leading technical institutions with post graduate and PhD programs have fairly well laid out plan to encourage research and development through project activity and individual research and consultancy.

Krishnamurthy, et. al, (2001) are of the view that research and development activities and their outcome are the key factors which speak about the nation progress. Research and development environment stimulates the student learning and expose them to their personal and professional development. One is able to keep pace with the rapid development in the different technological areas besides fulfilling the demands and needs of industries.

Gopalan (2003) has stressed the need for joint research and emphasized that research and development organizations and professional bodies in the country should contribute their mite for technical education quality improvement by associating themselves with All India Council of Technical education, which in turn should invite research and development institutions to sign memorandum of understanding with All India Council of Technical education for joint research work.

Shetty (2008) is of the view that industry institute research has multiple attractions. It can meet the industrial needs for research while acquainting faculty and students more deeply
with the ground realities of the industry. The activities of the engineering faculty in teaching and research are interrelated and should be properly coordinated to serve the needs of the industry. Educational institutions in India are primarily concerned with teaching and have very little research activity. With technology driven entrepreneurship coming up in the industry in a big way, the academia is bound to become more amenable to a closer interaction with industry. Compulsions of a global market are bound to force industries in general to look afresh at their research and development efforts.

Achintya and Rai (2007) have highlighted importance of industry academia interface in research and development activity and according to them the interaction between industry and technical education is so crucial and grave that the relevant quality and cost effectiveness get affected under the increasing pressure of global competition. To day we are surrounded with the fast emerging technological innovations and therefore without industry-academia interaction research and development activities would be quite irrelevant. The industrial sectors must be encouraged to enhance and pour their investments on researches undertaken by the high level technical institutes in addition to their own research and development divisions which take care of their day to day quality control. In developed countries, the government and industry are increasingly aware of their key human resources and propel to boost up their technical expertise.

Wani et al (2003) have commented that the competition grows more knowledge based and it become imperative for industries to effectively develop and deploy their knowledge generating assets. The research should not remain on paper rather it should percolate for the real use of the society. Technology must be transferred from laboratory to industry, as successfully as is the case with agricultural universities and dairy research institutes which have resulted in green and white revolution in India.

Chatterjee (2003) is of the view that strategic relationships with research universities have provided industry with success on both human and knowledge capital in USA and there has been phenomenal growth in industry funded research and development in educational institutes, so much so that private sector’s contribution is now greater than that of the government in universities. Unfortunately this has not happened in India.
2.2.8 Study on Adjunct Faculty

Faculty is of vital importance in pursuit of academic excellence. One should recognize that in addition to high quality teaching all academic activities like research and development, consultancy, innovations, reengineering and academic reforms are faculty driven. Through literature a study is made to understand the quality of available faculty in technical institutions, necessity of adjunct/exchange faculty and importance of continuing education.

Murthy (2002) highlights importance of adjunct faculty and industrial exposure to faculty and recommends that deputation of faculty to industry during vacations is an important scheme to be implemented by all institutes to expose faculty to industrial environment. It was further suggested that faculty may also be sent for a semester or a year in an industry and a specific project may be given to them in an industry. Continuing education and deputing industrial staff for higher studies to institutes must be an ongoing activity of any progressive industry to remain in the forefront and to cope up with the new technologies. Scheme of adjunct faculty from industry is very beneficial for institutions who are suffering dearth of good teachers. Competent persons from industry can be asked to teach a course or part of it. This practice is widely prevalent in developed countries. Their teaching schedule must be as per their convenience and our country should give major thrust in employing expert industrial teachers.

Ahuja and Nanda (2003) have commented on the availability and quality of faculty. Unfortunately technical institutes in India are not able to attract, retain and motivate high caliber young entrants for the faculty positions due to deteriorating research aptitude of graduates and inadequate remuneration incentives available in technical education system. There is an acute shortage of faculty with about 25-40% positions being unfilled. Moreover there have been inadequate initiatives on the part of technical institutes to train the faculty through quality improvement programs.

Nambudiripad (2003) has highlighted the need of faculty development. None of the lofty considerations can be put in to practice unless the faculty is academically prepared for it. In recent years, hundred of engineering colleges have come up and it has become impossible to find even moderately qualified faculty for these colleges. The situation with regard to poor faculty that has been haunting us has now been aggravated. The vast majority of our faculty needs considerable training and author has suggested that industrial experience should be
made mandatory qualification in faculty recruitment and any existing faculty without such exposure may be sent to industries for such an experience as persons who have first hand knowledge of the real situation will be able to do justice to the teaching.  

Sirohi and Sinha (2003) have emphasized the necessity of quality faculty. It is becoming increasingly difficult to attract and retain good faculty. Meeting faculty shortages, improving their quality and retaining quality faculty are critical to improving the standards of technological education in the country.  

Sinha (2004) has commented on faculty quality. While we often get outstanding students in engineering for most of the colleges, the same may not be true for teachers. Even leading institutions are finding difficulty in attracting good teachers in several engineering disciplines in view of very attractive remunerations available in other competing professions. A bad teacher is a liability to an institution that can ruin several generations of students without inspiring or imparting any worthwhile knowledge. Since teachers are the crucial element who can effect development in technical education, realistic national policy for their selection and to create an environment for them to work for their professional growth is highly desirable.  

Krishnamurthy, et. al, (2001) have pointed out that to cope up with the changing demand of industry and society, working professionals have no choice but to constantly update and renew their knowledge through continuing education with a view to remain abreast with modern developments and to ensure job growth. The mission of continuing education is not only the economic development of the country but also to bring improvement in quality through technological research, innovation, training and consultancy.  

National Training Policy for the Power Sector (2002) specify that every employee has a right to receive need based training at regular intervals to enable him to develop his potential to the maximum and contribute his best to the organization. Money spent on training should be treated as an investment instead of expenditure.  

Bhattacharya (2003) has stated the importance of training in generating better human resource. The industry world over is facing cut throat competition with better technology and business sense. To survive in the competitive world many companies are shedding off their fat by reducing manpower and overhead expenses. Many are trying to convert fat in muscles by training and redeploying its surplus manpower.
2.2.9 Study on Collaboration

Collaborations based on mutual trust and a belief can open platform for developmental activities. Some people call it as a gateway to success. Through literature survey collaboration for productive relationship between industry and academia is studied for greater satisfaction of its stake holders.

Natarajan (2001) has highlighted the rational for collaboration through Henry Ford’s statement that coming together is a beginning; keeping together is success. We need multidisciplinary approaches, integrated and holistic thinking and collaboration between partners with complementary interests, assets and needs. With collaboration, information, ideas, resources can be pooled and duplicate and harmful competition can be avoided. It expands the capacity of the participants to accomplish objectives that can not be accomplished as well, alone. Useful information can be obtained on needs, assessment, evaluation and curriculum development.

Wanehoo (2007) has put forward views on benefits of collaboration. The collaboration expands opportunities for mutually beneficial relations between industry personnel and academia. It helps in financing the research programs at the institute level and increases degree of mutual trust. It facilitates rapid commercialization of institute research in a highly competitive economic environment. It contributes in the economic development of the local region, the state, the nation and the world.

Raviprakasha, et.al, (2003) have put forward their views on previous memorandum of understandings. Professional training linking institutions with industry and other user sectors will foster the quality of research and manpower training. The memorandum of understanding signed with industries has not paid much return and have remained on paper alone.

Gopalan (2003) has stressed the need of memorandum of understanding to be signed between All India Council of Technical Education and Confederation of Indian Industries regarding the manner in which real life projects belonging to industries could be offered to engineering institutions who, in turn, offer these projects to under graduate and postgraduate students as part of their project work. Such a procedure would ensure active participation of the industries in student academic program and promote quality education in technical institutes.
Wani et al (2003) have commented that the Indian industry has so far preferred international collaborations rather than academic or domestic research and development organizations in search of technology. It is essential for the industrial sector to develop indigenous technological capabilities in collaboration with the academic institutions. Collaboration provide access to globally renowned curriculum, enhances job opportunities and visibility for the university on a global scale. It contributes on continuing basis in the faculty development programs and in quality education. To develop and transfer technology for small and medium enterprises in India, effective interaction of academic institutions with industrial sector will be the first step in this direction.

Chopra, K.L. (2006) has pointed that collaboration between two or more partners requires a driving force derived from shared values, challenges or threats, and tangible benefits.

The benefits of collaborations are highlighted through Fig. 2.2

![Collaboration Benefits Diagram](image_url)

Fig. 2.2: Collaboration Benefits
2.2.10 Study on Personality Development

With global competition, soft skills are getting new dimensions. Students with better technical skills but low on soft skills are finding hard to make strong footing in professional career. The literature study was carried out to understand the importance of personality development programs in generating better employment opportunities and building people for professional growth.

Krishnamurthy et al, (2001) have stressed the need of communication skills. Most of the university programs do not adequately equip students with technical communications. Many engineering graduates are deficient in communication skills and this has been the subject of complaint by industrialists. The colleges and universities are remiss in not instilling the one basic skill, the ability to communicate, which is required if an engineer is to prosper and advance in today’s industrial environment. It has no room for the engineer who does not have the skill to be a participating team member. Engineers must express themselves, write and speak, read their audiences, get their message across in clear, concise terms and interact with their peers in a team work environment.

Nambudiripad (2003) has highlighted the importance of personality. Personality development is inculcation of integrity and ethical values; compassion and sympathy for the underprivileged; social commitment; the ability to laugh at one self, see the humorous side in every situation and smile in life. This has taken on new significance in recent years when all our efforts revolve around one theme, viz. make money.

Natarajan (2004) has drawn attention to importance of humanities and social sciences for engineers. The engineers and technologists can not function effectively in society without being educated in the humanities and social sciences. Courses in professional ethics, human values, CSR (corporate social responsibility) technology are important to appreciate the impact of their engineering and technological decisions and designs. However, in most of our technical institutions, humanities and social sciences faculty are engaged in teaching only language and management courses, and are essentially considered to play a supplementary role.

National Training Policy for the Power Sector (2002) the national training policy lays stress on the right type of attitude. The attitude of an individual person plays an extremely important role in his/her performance. In spite of the availability of the best of knowledge
and skill, the ability to provide the desired services may still be found wanting in individuals, if they are not imbued with appropriate attitudes. Presently training is concentrated mainly in the area of acquisition of knowledge and upgradation of skills and very little emphasis is given on attitudinal changes/behavioral sciences. It is high time to introduce these aspects of training in the curriculum as with such training the employees develop better sense of belongingness for an organization and depict improved appreciation of interests of stakeholders. Bringing attitudinal changes is an imperative need in changing scenario.

Lahiri, Karaulia and Tegar (2006) are of the view that apart from testing knowledge transfer, some indicators may be generated to determine the development of positive attitudes in the students.

Ghani (2002) states the importance of soft skills in today's scenario. In the past employees were usually located at one place, but with globalization they have to travel to the rest of the world and is to communicate with people from diverse cultures. Besides expected job skills, cerebral skills are now in greater demand than manual skills. The employee is expected to possess critical thinking, problem solving skills and rapid communication skills to respond quickly to changes. The confederation of industries asserts that employers place more and more emphasis on personal qualities which can not be taken for granted even in applicants with every good academic qualification. The ability to communicate, high motivation, prospective leadership qualities, positive attitude is the present expected requirements from fresh engineers. A survey of employers needs indicates that qualities such as reliability, trustworthiness, willingness to learn, ability to work in a team were rated more important than formal qualifications. Another study reveals that employers want an employee to be competent in basic skills for entry level jobs and work related social skills such as presentable, responsible, co-operative, enthusiastic, communicative, disciplined, flexible and positive in work attitudes. Communication skills, analytical reasoning, critical thinking, practical orientation, interpersonal sensitivity, motivation, planning, decision making, leadership and emotional stability are the core competencies that major employers like to see in their employees.

Bhattacharya (2003) has pointed out that acquisition of both hard and soft skills in an integrated manner is the requirement for employability. These skills are essentially characterized by an interdisciplinary approach to knowledge. They have to be developed in
an integrated manner over the years as they can neither be developed separately nor as a one shot affair. The importance of value education is emphasized through the precautionary note that achievement of higher quality education might empower the pass outs for efficient performance of techno-economic functions, however, if proper understanding of social and human context of professional work is not made, these skilled professionals might easily become tools for exploitation and private gains at the cost of common good.

Achintya and Prasad (2007) are of the view that many organizations are reluctant to absorb engineers having problems of communication, technical skills and job knowledge. Only few student reach to satisfactory level due to lack of communication, confidence and presentation skills.

Wani et al (2003) have emphasized the importance of soft skills and is of the opinion that engineering success today require more than up to the minute technical capability i.e. to communicate; to work as a team; to think creatively; to learn quickly; to value diversity.

Shivappa and Jayadeva (2003) have reported the findings of Satish and Munsung (1999) on using co-operative learning in classroom environment and it reveals that a section of students taught with teamwork and empowerment approach performed better than the section of students taught with traditional method.