CHAPTER – IV

METHODOLOGY

Methodology stands for a particular procedure in any research study that is helpful in finding the solution of the research problem in hand. It is a procedure of gathering and organizing data from primary and secondary sources regarding the problem. It is a systematic plan of using various methods and techniques to understand and explain the cause and effect relationship. Therefore, in this section it is essential to explain precisely, the way in which the selection of data collection strategies relate to an overall theoretical and epistemological stance for the research.

The method and procedure explained in this chapter is based on the assumptions already made in the Introduction (Chapter-I). These include the implicit as well as the explicit assumptions covering the motive of ‘A Critical Study of Growth and Development of Engineering Education in Punjab after Independence’ which were considered valid by the researcher to solve the present research question.

In case of the present study there are more than one approaches which the investigator has proposed to adopt, to reflect an answer from different angles to the present research question. The investigator has tried to relate both methods of data collection and organization back to the objectives established in Chapter-I.
Descriptive method of research has been found to be most promising for the present research work as “It helps to explain educational phenomena in terms of the conditions or relationships that exist, opinions that are held by the students, teachers, parents and experts, processes that are going on, effects that are evident, or trends that are developing. Because of the apparent ease and directness of this method, a researcher can gather information in terms of individual’s opinion about some issue, by a simple questionnaire. At times, descriptive survey is the only means through which opinions, attitudes, suggestions for improvement of educational practices and instruction, and other data can be obtained”. (Kaul 2005 : 433)

To conduct the present research study the investigator has used qualitative as well as quantitative approach in descriptive educational research.

4.1 DESIGN OF THE STUDY

To study the growth and development of engineering education at national and Punjab level, critically, the investigator has adopted different approaches of descriptive research which have resulted in dividing the research work into following four parts:

1. Policy Perspective
2. Analysis of Secondary Sources
3. Study of views and perceptions
4. Case Studies
4.1.1 Policy Perspective

The policy perspective of engineering education has been studied on the basis of reports of various commissions and committees, five year plans, and other related documents. The government policies related to technical and engineering education viz-a-viz educational needs of the country in general and the state in specific have been reviewed. Needless to mention that the policy perspective in growth and development of engineering education in Punjab has been studied in the broad context of the national policy as well.

4.1.2 Analysis of Secondary Sources

The trend analysis has been done to study the pattern of growth and development of engineering education at national level and in Punjab, based on secondary sources of data. For this purpose various documents of Punjab and Central Government and study reports of various institutions and researchers have been analyzed. The secondary data from all these sources has been pooled up to study the trends of growth and development of engineering education at the national and the state level separately in terms of the following:

(a) Expansion in number of institutions

(b) Sanctioned strength

(c) Student intake and outturn

(d) Growth in faculty
(e) Regional and Social Distribution of Engineering Education

(f) Financing of engineering education

(g) Demand and Supply of engineering graduates

4.1.3 Study of Views and Perceptions

The views and perceptions of the respondents about the different issues related to engineering education have been studied by the method of research to be applied as under:

4.1.3.1 Sampling: To study the views and perceptions, the investigator has used non probability (purposive) method of sampling. The representative samples from the different segments of the public have been selected. The administrators, intellectuals, social activists, teachers of various engineering colleges and beneficiaries have constituted the universe of the study. The detailed composition of the sample has been as per given below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Sampling Group</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Administrators</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>Teachers of Engineering Colleges</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>Students</td>
<td>100</td>
</tr>
<tr>
<td>4.</td>
<td>Intellectuals</td>
<td>50</td>
</tr>
<tr>
<td>5.</td>
<td>Parents*</td>
<td>100</td>
</tr>
<tr>
<td>6.</td>
<td>Social Activists</td>
<td>50</td>
</tr>
</tbody>
</table>

*Only those parents have been included in the sample of the study, who were at least matriculates
4.1.3.2 Development of Interview Schedules

In order to study the views and perceptions of the respondents towards the growth and development of engineering education in Punjab, the following interview schedules have been constructed and standardized by the investigator:

i. Interview schedule for administrators
ii. Interview schedule for teachers
iii. Interview schedule for students
iv. Interview schedule for intellectuals
v. Interview schedule for parents
vi. Interview schedule for social activists

These interview schedules include open ended questions regarding the following issues:

(a) Government’s role in providing engineering education
(b) Fees in private versus public institutions of engineering and technology
(c) Availability of facilities in various public and private institutions.
(d) Seats lying vacant in various institutions of Engineering and Technology.
(e) Capitation fees demanded by various institutions.
(f) Opportunities for weaker sections of society to get engineering education (Equality of opportunity)
(g) Mobilization of financial resources.
(h) Following of the rules and regulations by the institutions which have been prescribed by AICTE

(i) Mushroom growth of engineering Institutions

(j) Effect of profit motive on the quality of Engineering Education

(k) Rural-Urban divide

(l) Language problem faced by the students

(m) Gender participation

(n) Choice of engineering profession by students

(o) Preference to various trades by the students.

(p) Availability of proper placement services

(q) Unemployment of engineering graduates

(r) Mismatch between demand and supply of engineering graduates

(s) Preference given by Engineering Graduates to different types of Jobs

(t) Problem of brain drain

(u) Practical Knowledge of engineering graduates

(v) Need and development of agro-based industry in Punjab

The above said six types of interview schedules, used for the present study have been developed by the investigator in the following manner:
4.1.3.2.1 Development of Interview Schedule for Administrators

To ascertain the views and perceptions of the administrators, a special interview schedule has been prepared. Before the development of the interview schedules, related literature on growth and development of engineering education in Punjab and the related problems, have been consulted. The content of the schedule has been developed in such a way so as to motivate the respondents to provide the required information. Items have been framed in such a way as can bring the necessary information.

Moreover the items for the interview schedule have been framed in such a manner so that maximum information may be elicited from the respondents. Further, attempt has also been made to keep the items in the interview schedules as precise as possible and at the same time unambiguous and clear. Each item has sought information about only one aspect. Double negatives, annoying and embarrassing questions have been avoided in the items.

The items have been arranged in such a manner that information from general to specific can be collected from the administrators working in the engineering education field which include Heads of departments, Principals and Registrars of various engineering colleges as well as Deans of Academic Affairs, Registrars and Vice-Chancellors of the universities. The items so prepared have been shown to the experts in the field of engineering education and
suggestions about those items have been incorporated and the redundant items have been deleted. Thus, in this way the interview schedule for administrators has been prepared. The structure of the interview schedule has been as under:

### Table 4.2
**Number of items in the interview schedule for administrators related to various issues**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Growth and Development</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>Quality</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>Equity</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>Financing</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Placement</td>
<td>6</td>
</tr>
</tbody>
</table>

4.1.3.2.1.1 Preliminary tryout of the Interview Schedule

First draft of the interview schedule has been tried on the Principals of Giani Zail Singh College of Engineering and Technology, Bathinda and Chandigarh Engineering College, Landran. The purpose of this try out has been to get feedback regarding the suitability of items in terms of language, content, clarity and understanding etc.

It has helped the investigator in modification, alteration, addition or deletion of certain items. After this, the final draft of interview schedule has been prepared.
4.1.3.2.1.2 Validity of the Interview Schedule

Validity is essential for the effective use of any data gathering tool. A data collection tool has been said to be valid when it collects the same information what it claims to collect.

The content validity of the interview schedule has been established by showing it to the experts in the field i.e. some faculty members of the following institutions: (i) Department of Education, Punjabi University Regional Centres, Bathinda (ii) Department of Education, Punjabi University, Patiala (iii) Department of Education, Panjab University, Chandigarh (iv) Giani Zail Singh College of Engineering & Technology, Bathinda (v) Chandigarh Engineering College, Landran. The draft of interview schedule has been properly checked and modified as suggested by the experts of aforesaid concerned field.

4.1.3.2.1.3 Reliability of the Interview Schedule

Since data collection tool must be reliable i.e. it must have ability to consistently yield the same results when repeated measurements are taken of the same individuals under the same conditions.

The test-retest method has been used to carry out reliability of the interview schedule. The final draft of interview schedule meant for administrators has been tried on five principals of different engineering colleges and the responses have been recorded. After a gap of one month the same interview schedule has been again given
to the same principals. The responses given by the respondents in the second administration have been compared with that of the first and it has been found that the responses have been, nearly similar to the first. This has established the reliability of the interview schedule.

(A copy of the final draft of the interview schedule for administrators has been given in Appendix B).

4.1.3.2.2 Development of Interview Schedule for Teachers

To get the views & perception from the teachers, a special interview schedule has been prepared. Before the development of the interview schedule, related literature on growth and development of engineering education in Punjab and the other related problems, have been consulted. The content of the schedule has been developed in such a way so as to motivate the respondents to provide the required information. Items have been framed in such a way as can bring the necessary information.

Moreover the items for the interview schedule have been framed in such a manner so that maximum information may be elicited from the respondents. Further, attempt has also been made to keep the items in the interview schedules as precise as possible and at the same time unambiguous and clear. Each item has sought information about only one aspect. Double negatives, annoying and embarrassing questions have been avoided in the items.
The items have been arranged in such a manner that information from general to specific can be collected from the teachers working in the engineering institutions which include professors, associate professors, lecturers of various engineering colleges & engineering departments of the universities. The items so prepared have been shown to experts in the field of engineering education and suggestions about those items have been incorporated and the redundant items have been deleted. Thus, in this way the interview schedule for teachers has been prepared. The structure of the interview schedule has been as under:

### Table 4.3
**Number of items in the interview schedule for teachers related to various issues**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Growth and Development</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Quality</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Equity</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>Financing</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Placement</td>
<td>5</td>
</tr>
</tbody>
</table>

### 4.1.3.2.2.1 Preliminary tryout of the Interview Schedule

First draft of the interview schedule has been tried on teachers of Giani Zail Singh College of Engineering and Technology, Bathinda, Chandigarh Engineering College, Landran and Guru Teg Bahadur College of Engineering & Technology, Chhapianwali. The purpose of
this try out has been to get feedback regarding suitability of items in terms of language, content, clarity and understanding etc.

It has helped the investigator in modification, alteration, addition or deletion of certain items. After this, the final draft of interview schedule has been prepared.

**4.1.3.2.2 Validity of the Interview Schedule**

Validity is essential for the effective use of any data gathering tool. A data collection tool has been said to be valid when it collects the same information what it claims to collect.

The content validity of the interview schedule has been established by showing it to the experts in the field i.e. some of the faculty members of the following institutions: (i) Department of Education, Punjabi University Regional Centres, Bathinda (ii) Department of Education, Punjabi University, Patiala (iii) Department of Education, Panjab University, Chandigarh (iv) Giani Zail Singh College of Engineering & Technology, Bathinda (v) Chandigarh Engineering College, Landran. The draft of interview schedule has been properly checked and modified as suggested by the experts of aforesaid concerned field.

**4.1.3.2.3 Reliability of the Interview Schedule**

Since, a data collection tool must be reliable i.e. it must have ability to consistently yield the same results when repeated measurements are taken of the same individuals under the same conditions.
The test–retest method has been used to carry out reliability of the interview schedule. The final draft of interview schedule meant for teachers has five teachers of different engineering colleges and the responses have been recorded. After a gap of one month the same interview schedule has been again tried on the same teachers. The responses given by the respondents in the second administration have been compared with that of first and it has been found that the responses have been, nearly similar to the first. This has established the reliability of the interview schedule.

(The final draft of the interview schedule for teachers has been given in Appendix C).

4.1.3.2.3 Development of Interview Schedule for Students

To get the views & perception from the students a special interview schedule has been prepared. Before the development of the interview schedule, related literature on growth and development of engineering education in Punjab and related problems, has been consulted.

The content of the schedule has been developed in such a way so as to motivate the respondents to provide the required information. Items have been framed in such a way as would bring the necessary information.

Moreover the items for the interview schedule have been constructed in such a manner so that maximum information may be elicited from the respondents. Further, attempt has also been made
to keep the items in the interview schedule as precise as possible and at the same time unambiguous and clear. Each item has sought information about only one aspect. Double negatives, annoying and embarrassing questions have been avoided in the items.

The items have been arranged in such a manner that information from general to specific be collected from the students studying in various engineering institutions. The items so prepared have been shown to experts in the field of engineering education and suggestions about those items have been incorporated and the redundant items have been deleted. Thus, in this way the first draft of the interview schedule for the students has been prepared. The structure of the interview schedule has been as under:

Table 4.4
Number of items in the interview schedule for students related to various issues

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Growth and Development</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Quality</td>
<td>9</td>
</tr>
<tr>
<td>3.</td>
<td>Equity</td>
<td>8</td>
</tr>
<tr>
<td>4.</td>
<td>Financing</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Placement</td>
<td>4</td>
</tr>
</tbody>
</table>

4.1.3.2.3.1. Preliminary tryout of the Interview Schedule

First draft of the interview schedule has been tried on the students of Giani Zail Singh College of Engineering and Technology,
Bathinda, Chandigarh Engineering College Landran and Yadavindra College of Engineering, Talwandi Sabo. The purpose of this try out has been to get feedback regarding suitability of items in terms of language, content, clarity and understanding etc.

It has helped the investigator in modification, alteration, addition or deletion of certain items. After this, the final draft of interview schedule has been prepared.

4.1.3.2.3.2 Validity of the Interview Schedule

Validity is essential for the effective use of any data gathering tool. A data collection tool is said to be valid when it collects the same information what it claims to collect.

The content validity of the interview schedule has been established by showing it to the experts in the field i.e. some of the faculty members of the following institutions: (i) Department of Education, Punjabi University Regional Centres, Bathinda (ii) Department of Education, Punjabi University, Patiala (iii) Department of Education, Panjab University, Chandigarh (iv) Giani Zail Singh College of Engineering & Technology, Bathinda (v) Chandigarh Engineering College, Landran. The draft of interview schedule has been properly checked and modified as suggested by the experts of aforesaid concerned field.

4.1.3.2.3.3 Reliability of the Interview Schedule

Since a data collection tool must be reliable i.e. it must have ability to consistently yield the same results when repeated
measurements are taken of the same individuals under the same conditions.

The test–retest method has been used to carry out reliability of the interview schedules. The final draft of interview schedule meant for students has been tried on five students of different engineering colleges and the responses have been recorded. After a gap of one month the same interview schedule has been again tried on the same students. The responses given by the respondents in the second administration have been compared with that of first and it has been found that the responses have been, nearly similar to the first. This has established the reliability of the interview schedule.

(The final draft of the interview schedule for students has been given in Appendix D).

4.1.3.2.4 Development of Interview Schedule for Intellectuals

To get the views & perception from the intellectuals a special interview schedule has been prepared. Before the development of the interview schedule, related literature on growth and development of engineering education in Punjab and the related problems has been consulted. The content of the schedule has been developed in such a way so as to motivate the respondents to provide the required information. Items have been framed in such a way as would bring the necessary information.

Moreover the items for the interview schedule have been framed in such a manner so that maximum information may be
elicited from the respondents. Further, attempt has also been made to keep the items in the interview schedule as precise as possible and at the same time unambiguous and clear. Each item has sought information about only one aspect. Double negatives, annoying and embarrassing questions have been avoided in the items.

The items have been arranged in such a manner that information from general to specific be collected from the intellectuals. The items so prepared have been shown to experts in the field of engineering education and suggestions about those items have been incorporated and the redundant items were deleted. Thus, in this way the interview schedule for intellectuals have been prepared. The structure of the interview schedule has been as under:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Growth and Development</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Quality</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>Equity</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>Financing</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Placement</td>
<td>5</td>
</tr>
</tbody>
</table>

### Table 4.5
Number of items in the interview schedule for intellectuals related to various issues

4.1.3.2.4.1 Preliminary tryout of the Interview Schedule

First draft of the interview schedule has been given to the intellectuals. The purpose of this try out has been to get feedback
regarding the suitability of items in terms of language, content, clarity and understanding etc.

It has helped the investigator in modification, alteration, addition or deletion of certain items. After this, the final draft of interview schedule has been prepared.

4.1.3.2.4.2 Validity of the Interview Schedule

Validity is essential for the effective use of any data gathering tool. A data collection tool is said to be valid when it collects the same information what it claims to collect.

The content validity of the interview schedule has been established by showing it to the experts in the field i.e. some of the faculty members of the following institutions: (i) Department of Education, Punjabi University Regional Centres, Bathinda (ii) Department of Education, Punjabi University, Patiala (iii) Department of Education, Panjab University, Chandigarh (iv) Giani Zail Singh College of Engineering & Technology, Bathinda (v) Chandigarh Engineering College, Landran. The draft of interview schedule has been properly checked and modified as suggested by the experts of aforesaid concerned field.

4.1.3.2.4.3 Reliability of the Interview Schedule

Since, a data collection tool must be reliable i.e. it must have ability to consistently yield the same results when repeated measurements are taken of the same individuals under the same conditions.
The test-retest method has been used to carry out reliability of
the interview schedule. The final draft of interview schedule meant
for intellectuals has been given to five intellectuals and the
responses have been recorded. After a gap of one month the same
interview schedule has been again given to the same persons. The
responses given by the respondents in the second administration
have been compared with that of first and it has been found that the
responses have been, nearly similar to the first. This established the
reliability of the interview schedule.

(The final draft of the interview schedule for intellectuals has
been given in Appendix E).

4.1.3.2.5 Development of Interview Schedule for Parents

To get the views & perceptions from the parents, a special
interview schedule has been prepared. Before the development of the
interview schedule, related literature on growth and development of
engineering education in Punjab and the other related problems, has
been consulted. The content of the schedule has been developed in
such a way so as to motivate the respondents to provide the required
information. Items have been framed in such a way as would bring
the necessary information.

Moreover the items for the interview schedule have been
constructed in such a manner so that maximum information may be
elicited from the respondents. Further, attempt has also been made
to keep the items in the interview schedules as precise as possible
and at the same time unambiguous and clear. Each item has sought information about only one aspect. Double negatives, annoying and embarrassing questions have been avoided in the items.

The items have been arranged in such a manner that information from general to specific be collected from the parents. The items so prepared have been shown to the experts in the field of engineering education and suggestions about those items were incorporated and the redundant items have been deleted. Thus, in this way the interview schedule for parents has been prepared. The structure of the interview schedule has been as under:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Growth and Development</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Quality</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Equity</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Financing</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Placement</td>
<td>3</td>
</tr>
</tbody>
</table>

4.1.3.2.5.1 Preliminary tryout of the Interview Schedule

First draft of the interview schedule has been tried on five parents. The purpose of this try out has been to get feedback regarding the suitability of items in terms of language, content, clarity and understanding etc.
It has helped the investigator in modification, alteration, addition or deletion of certain items. After this, the final draft of interview schedule was prepared.

4.1.3.2.5.2 Validity of the Interview Schedule

Validity is essential for the effective use of any data gathering tool. A data collection tool is said to be valid when it collects the same information what it claims to collect.

The content validity of the interview schedule has been established by showing it to the experts in the field i.e. some faculty members of the following institutions: (i) Department of Education, Punjabi University Regional Centres, Bathinda (ii) Department of Education, Punjabi University, Patiala (iii) Department of Education, Panjab University, Chandigarh (iv) Giani Zail Singh College of Engineering & Technology, Bathinda (v) Chandigarh Engineering College, Landran. The draft of interview schedule has been properly checked and has been modified as suggested by the experts of aforesaid concerned field.

4.1.3.2.5.3 Reliability of the Interview Schedule

Since, a data collection tool must be reliable i.e. it must have ability to consistently yield the same results when repeated measurements are taken of the same individuals under the same conditions.

The test-retest method has been used to carry out reliability of the interview schedule. The final draft of the interview schedule
meant for parents has been tried on five parents and the responses have been recorded. After a gap of one month the same interview schedule has been again tried on the same parents. The responses given by the respondents in the second administration have been compared with that of first and it has been found that the responses have been, nearly similar to the first. This has established the reliability of the interview schedule.

(A copy of the final draft of the interview schedule for parents has been given in Appendix F).

4.1.3.2.6 Development of Interview Schedule for Social Activists

To get the views & perception from the social activists special interview schedule has been prepared. Before the development of the interview schedule, related literature on growth and development of engineering education in Punjab and the other related problems, has been consulted. The content of the schedule has been developed in such a way so as to motivate the respondents to provide the required information. Items have been framed in such a way as would bring the necessary information.

Moreover the items for the interview schedule have been framed in such a manner so that maximum information may be elicited from the respondents. Further, attempt has also been made to keep the items in the interview schedules as precise as possible and at the same time unambiguous and clear. Each item has sought
information about only one aspect. Double negatives, annoying and embarrassing questions have been avoided in the items.

The items have been arranged in such a manner that information from general to specific be collected from the social activists in the state. The items so prepared have been shown to experts in the field of engineering education and suggestions about those items have been incorporated and the redundant items have been deleted. Thus, in this way the first draft of the interview schedule for social activists has been prepared. The structure of the interview schedule has been as under:

**Table 4.7**

*Number of items in the interview schedule for social activists related to various issues*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Growth and Development</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Quality</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Equity</td>
<td>7</td>
</tr>
<tr>
<td>4.</td>
<td>Financing</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Placement</td>
<td>4</td>
</tr>
</tbody>
</table>

**4.1.3.2.6.1 Preliminary tryout of the Interview Schedule**

First draft of the interview schedule has been given to the various social activists. The purpose of this try out has been to get feedback regarding the suitability of items in terms of language, content, clarity and understanding etc.
It has helped the investigator in modification, alteration, addition or deletion of certain items. After this, the final draft of interview schedule has been prepared.

4.1.3.2.6.2 Validity of the Interview Schedule

Validity is essential for the effective use of any data gathering tool. A data collection tool is said to be valid when it collects the same information what it claims to collect.

The content validity of the interview schedule has been established by showing it to the experts in the field i.e. some faculty members of the following institutions: (i) Department of Education, Punjabi University Regional Centres, Bathinda (ii) Department of Education, Punjabi University, Patiala (iii) Department of Education, Panjab University, Chandigarh (iv) Giani Zail Singh College of Engineering & Technology, Bathinda (v) Chandigarh Engineering College, Landran. The draft of interview schedule has been properly checked and modified as suggested by the experts of aforesaid concerned field.

4.1.3.2.6.3 Reliability of the Interview Schedule

Since, a data collection tool must be reliable i.e. it must have ability to consistently yield the same results when repeated measurements are taken of the same individuals under the same conditions.

The test-retest method has been used to carry out reliability of the interview schedule. The final draft of interview schedule meant for social activists has been tried on five social activists and the
responses have been recorded. After a gap of one month the same interview schedule has been again tried on the same social activists. The responses given by the respondents in the second administration have been compared with that of first and it was found that the responses were, nearly similar to the first. This has established the reliability of the interview schedule.

(A copy of the final draft of the interview schedule for social activists has been given in Appendix G).

4.1.4 Case Studies

Case studies of eight engineering colleges of Punjab state being run under the different types of managements have been conducted. The following six types of colleges of engineering have been covered under this study:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of the college</th>
<th>No. of Colleges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Central Government Managed Colleges</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Punjab Government Managed Colleges</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>University Managed Colleges</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Privately Managed but Punjab Govt. aided Colleges</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Self Financed Private Colleges</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Deemed Universities</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>
These case studies have been conducted with the help of a self constructed Institutional Inventory to seek information about the following aspects of the institutions:

a. Recognition and Accreditation of the institutions
b. Admission procedure
c. Courses available and intake
d. Social distribution of seats
e. Infrastructure
f. Faculty
g. Fee structure
h. Placement
i. Research and development
j. Feedback from the faculty and students

Moreover feedback from the students and teachers about the institution in general and about the above aspect of the institution in particular has also been taken.

First, a rough draft of the institutional inventory has been constructed after reviewing the related literature on the subject. Then opinions of the experts about the inventory have been sought after discussing the objectives of the research study with them. After this a preliminary tryout of this inventory has been carried out in two engineering colleges to get feedback regarding the suitability of items in terms of various components, language and content.
The preliminary try-out has helped the investigator to revise, modify and alter the items. All the irrelevant, impractical and ambiguous items have been modified or deleted and new adequate items have been added. Thus the final draft of the inventory along with the questionnaire for feedback has been prepared which has been used to conduct the case studies of the following institutions (the final draft of the institutional inventory and feedback questionnaire has been appended with the thesis in the form of Appendix I):

i. National Institute of Technology, Jalandhar

ii. Giani Zail Singh College of Engineering & Technology, Bathinda

iii. University College of Engineering, Patiala

iv. Yadvindra College of Engineering, Talwandi Sabo

v. Guru Nanak Dev College of Engineering & Technology, Ludhiana

vi. Chandigarh Engineering College, Landran

vii. Guru Gobind Singh College of Engineering & Technology, Talwandi Sabo

viii. Thapar Institute of Engineering & Technology, Patiala

A sample of 25 students and 10 teachers has been taken from each of the institutions to get feedback about the institution.
4.2 CONDUCT OF THE STUDY

1. To study the policy perspective of engineering education, the reports of various education commissions and committees, five year plans and other policy documents have been collected from various libraries, internet and other sources and have been reviewed.

2. To study the trend analysis, the document analysis of the following has been made:

   a) Economic surveys
   b) Statistical Abstracts of Punjab
   c) Reports of Planning Commission of Government of India
   e) I.S.T.E. (Indian Society of Technical Education)’s reports
   f) I.I.E. (Indian Institute of Engineers) Reports
   g) All India Educational Surveys
   h) Annual reports of Government of India
   i) National Science Foundation Reports
   j) Journals, Magazines and Newspapers
   k) Policy documents and reports of various Education Commissions.
   l) AICTE Annual Reports
   m) CABE Committee Report
   n) Reports of Directorate of Technical Education, Punjab
   o) Five year plan documents of Government of India
   p) Various research journals
   q) Research reports of various researchers
r) Other reports and data available on the internet.

3. To get the views & perceptions the investigator has personally interviewed the various groups of subjects as stated in the sampling.

4. To conduct the case studies of eight colleges of engineering the self constructed ‘Institutional Inventory’ was used. The investigator personally visited these institutions to seek the detailed information regarding these institutions

4.3 ANALYSIS OF DATA

1. Various documents and reports on technical and engineering education have been scrutinized to cull out the theoretical and empirical observations with regard to policy perspective and implementation mechanism.

2. The quantitative data regarding increase in number of institutions, faculty strength, students intake and outturn, financing pattern and demand and supply which have been available in various secondary sources have been analysed with the help of statistical tables and drawing of line graphs, bar charts and pie charts, etc.

3. The technique of ‘content analysis’ has been used to study the views and perceptions of different groups of people namely administrators, intellectuals, social activists, teachers of engineering colleges and beneficiaries regarding the various issues related to engineering education in the context of specific socio-economic conditions of the state in particular and the country in general. Further, ‘percentage analysis’ of the views &
perceptions given by the respondents has been done and presented in the form of statistical tables and the results have been discussed.

4. The case studies of eight engineering colleges have been done with the help of data collected through self constructed Institutional Inventory. Since the case study is a way of organizing social data for the purpose of viewing social reality. It examines social unit as a whole. The unit may be a person, family, a social group, a social institution or a community. The purpose is to understand the life cycle or an important part of the life cycle of the unit. The case study probes deeply and analyses interactions between the factors that explain present status or the influence, change or growth’ (Best and Kahan 2003:249). Therefore the information collected through the Institutional Inventory has been organized in the light of one of the objectives of the present research study regarding the study of procedure for admission, recognition and accreditation of the institutions, intake, infrastructure, courses available, reservation of seats, faculty, fee structure, placement & research & development, etc.