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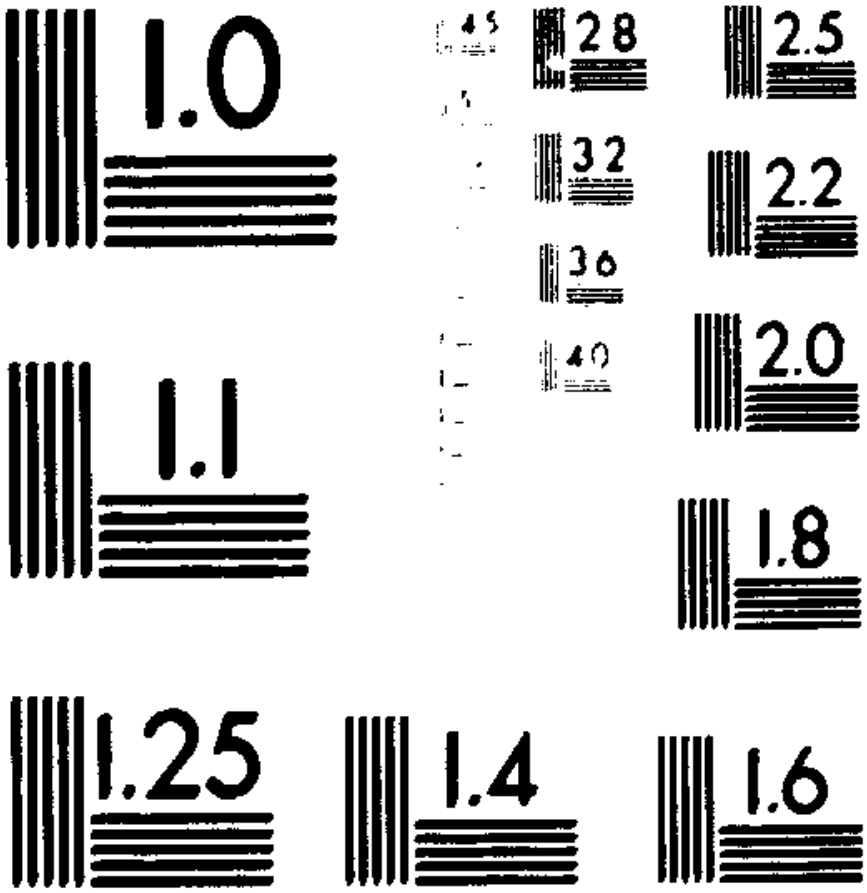

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23. February 1985.
English

Development of Plastic's Testing and Training Facility
at the Extension Centre of CIPET in Ahmedabad.
DP/IND/82/044/11-03/32.1.H

India.

Technical report: Mould Design and Fabrication

Prepared for the Government of India
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme.

Based on the work of Mogens Jensen,
expert in Mould design and fabrication

United Nations Industrial Development Organization
Vienna

3408

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He is most grateful to Dr. Mathur and Dr. Rammamurthy for their welcome and courtesy in Ahmedabad and Madras, respectively.

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Last but certainly not least, I would like to express my gratitude to Dr. Gumen, Back-stopping officer at the Chemical Industries Branch in UNIDO, Vienna.

SUMMARY

The consultant was contracted by the United Nations Industrial Development Organization (UNIDO) to serve in India as a specialist in Mould Design and Fabrication under the "Plastics Materials and Product Testing Programme in India". The assignment was scheduled for three months (Oct. - Dec.) 1984 (Appendix 1).

The purpose of the project, as defined by UNIDO, is to strengthen the existing plastic testing and training facility at Madras and to establish a testing and training facility at the Extension Centre in Ahmedabad.

According to the original terms of reference the consultant's duties were concerned with the Extension Centre alone, however, a decision was taken at a tripartite meeting in July that the service should be divided between Madras and Ahmedabad. This information, unfortunately, was not communicated to all parties involved. A work plan and program for Madras and Ahmedabad, respectively, was drawn up and coordinated, and 8 counterparts, 5 in Madras and 3 in Ahmedabad, were assigned to the consultant. (Appendix 2)

Although the terms of reference were quite similar for the two duty stations, it should be born in mind that the Institute in Madras is well-established whereas the Extension Centre in Ahmedabad is still in its initial implementation.

The actual service provided by the consultant was quite broad under the general heading of engineering for part design and tool making.*)

It is the considered opinion of the consultant that the service provided could have been of still more use if the scope of work had been narrower, e.g. by working together with only one or two counterparts at each duty station. At the very least, it should have been decided well in advance of arrival how the time should be divided between the two centres.

Again, the consultant is of the considered opinion that it is simply not possible to do a fair justice to the very good counterparts at the centres when too many subjects are covered.

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*) In this report "tools" is used as a broad expression. "Mould" explicit for injection moulds.

During the mission a number of short courses and seminars were arranged in Madras as well as in Ahmedabad. The consultant also delivered a number of lectures for staff and students.

Lecture notes, amounting to over 200 pages were prepared for the above seminars, together with approximately 85 OH-transparencies. Also, a collection of trade literature was left. Some other material has been forwarded after termination of the mission.

A number of tools and moulds, mainly for test samples, were reviewed and some changes in design were suggested.

The consultant also participated in consultative work for outside clients. Some cases have been followed up after the mission.

The consultant is quite prepared to continue to provide additional information within his speciality if it is so desired.

The consultant has gained the definite impression that there is a high demand for quality tooling in India, because the demand for components and end products of plastics of high precision and good finish increases, also relative to product output.

The concept, therefore, of plastics engineering and tool centres, like CIPET, which combine commercial production of tools for the market with training of tool makers and rendering of Tool Advisory Services to industry is considered a good concept.

CIPET's active role in disseminating technical knowlege as well as its policy in maintaining its relatively high technological level makes it necessary to continually up-date machinery and equipment. Some suggestions for this purpose have been included in the present report.

The time period for the mission included a number of National holidays. Activities were further interrupted three times (Indira Gandhi's assassination, cyclonic weather, and parliamentary elections). Additionally, some days (mainly holidays) were spent on travel. These facts, together with the quite heavy teaching load on seminars (Appendix 3) necessitated that only some of the missions' findings could be handed over before departure.

The report, therefore, contains information which could have been communicated during the mission if time had permitted. In effect, some sections are more descriptive than analytical. It is hoped, however, that the report will be taken as an exchange of ideas or as a dialogue between the consultant and CIPET.

A number of suggestions or recommendations have been made. It should be emphasized that the views and opinions are entirely those of the consultant.

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ANNEXURES

PECOMMENDATIONS

The recommendation stem directly from the following sections and are, therefore, stated briefly.

Short-term courses:

- it is recommended that CIPET appoint one person responsible for the planning and administration of short-term course activities.

- it is recommended that UNIDO make provision for the use of video at CIPET for demonstration of new technologies.

- it is recommended that UNIDO make provision for the purchase of demonstration items which are not readily available in India.

- it is strongly recommended that CIPET initiate courses on mechanical properties of plastics for improved design.

Production of tools

- it is recommended that CIPET establish a Tool Engineering Consultancy Service Cell with the responsibility of securing and following-up of orders from Industry.

- it is recommended that CIPET take up applied research on the subject of prototype and short-run moulds.

Maintenance

- it is recommended that CIPET employ an instrument technician for maintenance and calibration of instruments and equipment.

- it is recommended that CIPET encourage the foremen to keep up the plastics processing machinery and moulds to a higher maintenance standard.

Upgrading of injection moulding machines

- it is recommended that CIPET purchase equipment for the instrumentation of injection moulding machines.

Use of computers

- it is recommended that CIPET introduce the use of computers as a background for future CAD/CAM activities.

Cooperation with industry

- it is recommended that CIPET establish a procedure for outside clients when approaching CIPET for consultations.

Cooperation between UNIDO and CIPET

- it is recommended that UNIDO conduct an international work-shop on the use of CAD/CAM techniques in the plastics and tool making industries.

FINDINGS AND REPORT OF MISSION

The plastics industry in India

The plastics industry in India has attained a reasonable status with an overall growth rate during the past two decades. The country now has manufacturing facilities for all the commodity plastics and a few speciality and engineering plastics. The stress for a whole decade, however, was on the completion of the on-going petro-chemical projects at Baroda and Bongargaon rather than on starting new projects. Recently, the government has approved an investment of RS 2600 crores*), half of this sum will be spent on a gas cracker complex near Bombay. Sanctioned schemes to be completed in the seventh Five-year Plan also include a major expansion of the state-owned Indian Petro-chemical Corporation's Baroda complex, at a cost of RS 500 crores and a number of downstream units at other locations. Besides, synthetic rubber plants, polyester plants, nylon plants and acrylic fibres plants will be set up.

Plastics consumption in India is still among the lowest in the world, with an annual consumption per capita of just 0.5 kg. This is in sharp contrast to West Germany's consumption of 95 kg, the U.S.'s 92 kg, Sweden's 87 kg and even Latin America's 6 kg and Africa's 1.4 kg.

There is little doubt, however, that the plastics industry lies on the threshold of change. The inital thrust in application was towards replacement of existing materials, with the benefit of lower weight, lower cost, ease of manufacture, and consistency accruing. Substitution of traditional materials continues to be the major area of application, but an increase in consumption is anticipated in new applications within, e.g., plasticulture, car production, electronics and telecommunications.

Today the industry caters mostly to the requirements of the consumer goods industry, and it is therefore necessary to strengthen its capability to meet emerging trends, not only in quantity, but even more importantly in quality.

The industry will require constant input of resources both in terms of investment and manpower to meet the replacement as well as expansion needs. It has been assumed that the replacement needs will be approximately 10%, in terms of fixed

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*) 1 crore = 10^7 ; 1 lakh = 10^5

assets and 5% in terms of manpower. A gradual increase in the utilization processing capacity in terms of virgin raw material consumption has been assumed so as to reach a level of 50% utilization from the present level of 33%.

The machinery manufacturing sector is presently well equipped to meet the afore task and it is estimated that imported components, if any, would be well below 5% of the investment envisioned in the processing sector.

A bottleneck might well be the timely availability of proper and reliable tools and dies, which, even at present, is proving to be an extreme constraint. Greater emphasis has to be paid to the aspect of manpower development for tool-makers, as well as for experienced tool designers.

Plastics manufacturing is spread over more than 7.500 units, of which over 90 per cent are in the small-scale sector. The aggregate fixed assets in these units are in the order of 175 crores employing directly approximately 110.000 people. Thus, the total plastics industry generates a turnover of around RS 675 crores. Exports of plastics products at the end of 1983-84 stood at around RS 55 crores.

A transition has taken place in some companies from that of their being a producer of consumer articles to that of their being a sub-contractor supplying components to other industries. What is actually deterring more companies from taking up the manufacture of high technology products, apart from the large investments necessary, is the fear that the engineering industry may not provide it with a steady and assured market for its products. There has also been some constraints in the availability of raw materials, especially in the engineering plastics. The major outlet for engineering plastics has been in only a few specific areas, viz. industrial products, components for space research, atomic energy, and electronics. Present consumption is estimated to be 4300 MT. In India penetration by plastics in the automotive industry has been quite negligible. Still, however, the role of specialized subcontracting will become increasingly important. To survive, this sector must continously keep pace with the development of the user industries, as they move toward higher value-added technologies. This sector must, also, exert greater effort in order to improve product quality and productivity. It must not only acquire the knowledge of the application of new improved materials, but it must have the ability to use labour and materials more effectively, through improvements in management and operational systems and increased mechanization. It must also be expected that companies who have up to now purchased plastic components from sub-contractors will begin to establish their own plastics products manufacturing capabilities.

It is evident, therefore, that the future target groups for The Central Institute of Plastics Engineering and Tools (CIPET)'s cooperation with Industry comprise not only plastics manufacturing units but also engineering companies with a demand for high quality plastics components. Indeed, CIPET may play a role in bridging the gap between them and, thereby, develop the market. CIPET as an autonomous Institute, under the control of the Ministry of Energy and in the Department of Petroleum, with its facilities for development work and testing, as well as its consultancy services, is well geared for this task. As a matter of fact, it is the only Institute of its kind in South East Asia, excluding Japan. It is a rapidly expanding organization with extension centres planned in Ahmedabad, Andra Pradesh, Uttar Pradesh, Orissa and Madhya Pradesh.

The Institute in Madras was established by the Government of India in 1968 with the assistance of UNDP and ILO to give specialized training in the field of Mould Design, Mould Making and Plastics Processing. In order to strengthen the activities of the Institute, a Product Testing Centre (PTC) was established in 1977 with the assistance of UNDP.

The construction of the new buildings for the Centre in Ahmedabad started at the end of September 1984. It is situated in the Industrial Estate of Vatva on a 10 acre site. The estimated completion date of the 12,600 square meter building is March 1986. The Centre has already started several activities in a rented shed of 457 square meters, with a staff of 21 full-time officials and 4 casual workers.

The Ahmedabad extension centre in the Western region was originally planned by the Government, keeping in mind that 45% af the processing capacity of plastics is located in that region. There is, therefore, a large demand for services similar to CIPET's for training and testing. Now CIPET is implementing this project with the collaboration of the Government of Gujarat to meet these requirements.

A tool room, a processing shop and design facilities are being set-up at Ahmedabad. The training programme for the Ahmedabad Branch of CIPET is planned in such a way that it will mainly function to supplement the training programmes existing in Madras which is oriented towards training of staff at technical level. Retaining its identity with CIPET, through the running of certain long term courses, the Ahmedabad Centre will also run the type of courses that cannot be catered to in the main stream of activities, which is short term courses to facilitate the needs of the growing processing industries. The new short term courses to be introduced in plastics processing are: Two to four weeks training programmes in injection

moulding, extrusion of pipes, film blowing, and blow-moulding. A total of a minimum of two training courses will be introduced initially per year, which will be further expanded upon depending upon the requirements.

COMMENTS ON LONG-TERM TRAINING

Ahmedabad

Plastics Mould-Making Course

The syllabus for this 2-year (Madras 3 year) course was reviewed.

Entry requirements for this course is the Industrial Training Institute (ITI) certificate. At present 10 students in the first batch have completed three semesters. The second batch of 12 students is in its first semester. It is believed that most of the students will find jobs as supervisors in medium and large-scale industries after completing the course.

Currricula were discussed with counterparts mainly in Madras, however, no in-depth assessment was made. The curricula appears to be well balanced, and the general training of students seems to be at a reasonable level of performance.

Two points were often raised in the discussions, the question of whether students should be trained as generalist or as specialist, and th ion of whether students should terminate their studies by making a test ly in the form of a tool or a mould.

As far as the first question is concerned, it is the opinion of the consultant that emphasis should be placed on the vocational skills of the students, that is that generalization should take place over specialization, but the students should be conversant with the in-depth use of the general purpose machines like lathes, milling machines and grinding machines. A good handwork requires a practical feeling for the work-piece based on the training of motory skills. Specialization can then be achieved later.

Students at CIPET have, compared with students, e.g. at the three Indo-Danish Tool Rooms, a higher proportion of their training given in theory classes (40/60 theory/practicals vs 20/80). This is despite the fact that the course of training in Ahmedabad is only two years as compared to four-years apprenticeship training at the Indo-Danish Tool Rooms.

It is the opinion of the consultant, therefore, that the present level of practical, well-rounded training is an absolute minimum for a tool-maker.

The consultant shares the opinion that it is a good motivation for the students to terminate their studies by making a work-piece, however, this work-piece does not have to be a complete mould.

A suggestion could be to make, within a prescribed period, (e.g. 40 hours) an implement (e.g. a thread-cutter) which the student may keep and use in his future work. Drawings for such implements can be forwarded from the consultant if they are so desired.

Whenever possible the students should undertake more production work for customers instead of exercises. Such work could include maintenance of moulds for training in bench-fitting.

The limitations inherent in the purchasing procedures based on quotations, is one of the factors that at Ahmedabad stands in the way of a more flexible approach for students making different work-pieces, either as a final-year project or for industry. In tool making there is always a need for a special steel of various dimensions in small quantities. The present procedures also stands in the way of fulfilling customer demands for short-term delivery time.

Plastics Processing Training Programme

This 12 (or 10) week course is a general course without specialization. It has no entry requirements, although a defined entry level may be introduced in the future. It is aimed mainly at people working in industry, however, some participants come directly from engineering colleges.

Up until now two courses have been conducted in Ahmedabad. The first batch had 8 students and the second batch had 12 students.

Students received 40% theoretical training and 60% practical. From the syllabus detailed programmes are prepared for every two-week period, which is a sensible approach given the present circumstances.

No aptitude test is carried out after completing the course, but the students responses are evaluated from a questionaire.

The course is conducted in English, which is a problem in some cases as not all students are familiar with English.

It is a general impression from reading the questionaires that students highly appreciate the practicals. They even suggest that the content of practicals should be increased.

The consultant feels that the present proportion between theory and practice of 40/60 per cent should be maintained in general. The efficiency of learning could be improved by producing better AV-raids, and by a better planning of the practicals, e.g. by heating-up the machines beforehand so that they are ready when the students start.

These suggestions are obviously off-course, as management and instructors are well aware of the situation. It is simply so that optimum conditions for learning can only be achieved by gradual refinement developments towards well-defined goals.

Mould Design Course

Entry requirements to this 6 month (1 year) course are B. Eng. or Diploma in Eng.

The course has been offered only once in Ahmedabad, however, the response from qualified candidates was poor, even though enough draughtsmen had applied for the course.

The course will be offered again in the spring of 1985 after the foreman instructor has taken up his position in Ahmedabad.

The syllabus for the course was reviewed by the consultant and its curricula is considered to be appropriate and of a good standard.

It is the opinion of the consultant, however, that the assumptions for the course should be reconsidered. It is suggested that the 6 month course failed because Industry, and especially small-scale industry, was not prepared to sponsor candidates for such a relatively extended period of suppliamentary study, as well, the course of study is too limited and therefore of comparatively little interest to non-sponsored (and generally non-employed) candidates, because, it would not materially improve their employment prospects.

In order to profit from the existing expertise at CIPET, an introduction of evening classes should be considered for draughtsmen or young people, who have completed a tool makers' training. Such a course could also consolidate and complement practical experience for people working in industry.

Refresher Training Courses and Seminars

These courses of one or two weeks duration are complimentary to the longer-term training. Even before the present activities were initiated some courses were conducted by personnel on deputation from Madras.

The response for the planned, but post-poned, two-week course on injection moulding was rather good (\ppendix 3). Courses on extrusion, including blow-moulding are planned, which seems to be a good initiative after considering that the plastics industry in the Western Region is concerned mainly with extrusion (pipe, film, wire coating etc.).

It is suggested that the number of courses be increased. This would also serve to establish closer contacts with industry.

Practical training seminars on turning, milling, grinding, tool sharpening, etc. could also be introduced. Such courses should have a dominant vocational element, although the number of participants is limited by the available machines. Even though the instructors are adequately experienced in their specific skills, they should also be encouraged to broaden their experience, by introducing new techniques within their speciality, as well.

COMMENTS ON SHORT-TERM COURSES

Short-term courses are a recognized means of transferring knowledge. A substantial number of well managed courses are conducted every year at CIPET. The following comments are merely presented in order to present CIPET's fine reputation and to reinforce their standards for excellence in this field.

The number of short courses can and should be expanded. In this context it will be necessary for CIPET to identify a number of industry groups as primary targets for such activities. It will also be necessary to review the educational aspects of the courses.

Traditionally, instruction were perceived as "subject centered", whereas the current movement of most continuing educational and training programs are toward a "problem-centered" orientation, reflecting the notion that adults seek additional learning in order to solve a problem. This was quite evident also in the courses conducted during the mission, where most participants brought forward very relevant problems for discussion - and probably hoped to have the problems solved during the course.

Therefore, teaching adults on a short-term course is distinctly different from teaching young students.

The problem-centered orientation, which usually must deal with a more complex group of learners and other variables, requires that very careful attention be paid to the problem(s) being adressed in order that the learning experience is fully maximized and that the program reaches its peak of effectiveness. This is not to imply that personal-interest programs and activities representing "learning for the sake of learning" should cease to exist. Such programs have been an important activity at CIPET for a very long time and, hopefully, will continue to be so.

Briefly, what should be emphasized here is that all course activities offered should be designed to meet the educational needs of the intended audience; have clear cut goals and learning outcomes; they should employ relevant contents, methods, and delivery systems; they should have effective learning assessment procedures; and have an appropriate administrative organization to guide and be responsible for the short-term operation in carrying out its purpose and mission in a responsible manner.

At present, each Course Director carries the complete responsibility for initiation, promotion and administration of short-term courses. This may well be the most effective organization for a limited number of courses, e.g. at the present level of activity in Ahmedabad, but in Madras the number of courses will, perhaps, be substantially increased in the future. It is, therefore, recommended that one person be appointed to be responsible for the systematic planning of short-term course activities, such as administration, production of lecture notes, preparation of teaching materials, as for example slides and demonstration models, advertisements, mailing of programs, updating of mailing lists, etc. It is assumed, that this will lead to an administrative rationalization, thereby leaving more time for the professionals to work on their true vocations.

It is also the opinion of the consultant, that modern teaching methods are not used as extensively as they should be. The audio-visual means of imparting knowledge and developing skills has been recognized as one of the most effective methods and yet there is comparatively little utilization of this technique. As for example, the black-board is used extensively for making drawings, which could better be prepared beforehand on a poster or flip-over sheet.

A plastic resource kit, showing a display of various plastics design and uses, is very effective in communicating basic principles. Engineering aspects are shown by exhibiting examples like ribbing of plastic parts, snap-fit assemblies and application of sandwich structures, clearly labelled with the material selection and other salient features.

The effect of varying testing conditions is best demonstrated by showing actual samples.

Besides, normal products also failed products are needed to show the students the problems encountered in actual practice. Products can be obtained from raw material suppliers or from processors. It is very instructive to show students these products and to confront them with the costs and difficulties involved in making working prototypes. These aids can be used also for small group discussions and, when the need arise, for in-company training. Also, they are not dependent upon electricity and, therefore, not susceptible to electricity power-cuts.

In the same context, efforts should also be undertaken toward developing practical case settings which would enable participants to analyze and examine technical problems in a critical manner with a final view to solving them. Such analytical skills will be extremely useful in daily work.

A somewhat more advanced concept is the use of video, which is certainly an accepted effective means of transfering knowledge. Therefore, it is recommended that UNIDO make provisions for this so that this facility can be used to its full advantage by CIPET.

For example, new technologies are very often demonstrated using video in more industrialized countries. The purchase of video cassettes, therefore, may exclude the purchase of equipment which would otherwise be purchased merely for demonstration purposes. Also, consultants could demonstrate new techniques like CAD/CAM without the necessity of access to the actual equipment.

It is also recommended to UNIDO that provisions should be made for the purchase of demonstration items, e.g. hot-runner mould components, which are not readily available in India.

New subjects for short-term courses should be introduced only after careful market research. However, it is strongly recommended by the consultant that courses be initiated on the quantitative aspects of the mechanical properties of plastics. As an example, the prediction of the reliability of design by carrying-out calculations on plastic products and especially the ribbing of plastic parts as well as the fastening and joining of plastics should be taken up in the curricula.

COMMENTS ON THE FEASIBILITY OF PRODUCTION OF TOOLS IN THE TOOL-MAKING SHOP

The feasibility of producing tools for outside clients was raised several times during discussions in Madras and was raised again, though to a lesser extent, in Ahmedabad.

Basically, the overall concept is to combine the commercial production of tools for the market with the training of tool makers and the rendering of tool fabrication advisory services to small-scale industry.

The arguments for this concept are obvious. Firstly, the idea of spreading technical know-how through the production of good tools is very much in accordance with the objectives of CIPET. Secondly, the experience gained in producing such tools would give the instructors an up-to-date understanding of the requirements from industry and, thereby, enhance the training of tool makers. Thirdly, but certainly not the least, such activities would generate an income for CIPET, thereby contributing to the depreciation of investments, and would probably allow some economical latitude, as well as give an understanding of the market mechanism of tool manufacturing.

The arguments against commercial production are that; firstly, production for outside clients must always have second priority to the training af students; secondly, the students do not possess the necessary skills before they have had some training; and thirdly, that there are already bottlenecks around some machines.

The question of manpower was also raised. In Madras, there are at present 4 tool makers and 8 operators for 60 students. The total number of machines is around 60. Up to now between 30 and 40 moulds and machine tools have been made for CIPET and its Extension Centres. Although there are occasionally orders from Industry in die-sinking, spark erosion, etc., no complete mould has yet been delivered to Industry. The fact that CIPET has not been able to present acceptable delivery times has, in some cases, deterred Industry from placing an order.

The consultant is of the opinion that the concept of a financially self-supporting tool manufacturing facility, combined with the training of tool makers and tool designers is a sound idea.

However, if the full potential hope of the Institute is to serve Industry - with a special emphasis on small-scale industry, then there will have to be a fundamental change in the way cooperation with Industry is organized in order to make the concept work and achieve that objective.

The consultant felt, for example, that communication between the design office and the workshop should be improved, in order to ensure the designer's familiarities with workshop practices and possibilities, and, thereby, offer competitive designs.

It is, therefore, recommended that a Tool Engineering Consultancy Service Cell be begun for Industry with the capacity or capability of establishing the necessary contacts with customers and to secure an appropriate order mix. The Consultancy Cell should be composed of staff from both the design office and the workshop. They should be allowed to spend one day each week visiting customers in the area to canvass for orders.

It is extremely important that customer's requirements, wishes and expectations are recorded when an order is received. Standard forms for this purpose exist or can be established easily. The Consultancy Service Cell, mentioned above, should have the responsibility for ensuring that deliveries quoted and accepted from customers are realistic and closely adhered to, as well as maintaining the right attitude in regard to the quality of work which is created.

From what could be seen of drawings in the design office, the available know-how should be sufficient enough to solve nearly all the ordinary tasks in design. When unusual solutions are required, or the designers feel uncertain, there exists a good library, design examples, and reference books.

It is important not to design over-sophisticated (and therefore too expensive) tools which are not appropriate to the requirements of especially small-scale customers. An effort should be made toward simplifying not only the design but also the manufacture of tools required by small-scale industries.

The workshop presently runs only one shift, while a second and part of a third shift would normally be standard for private tool rooms. However, by observing the students and machine operators - primarily in Ahmedabad - it was found that the setting of speed, feed, reading of drawings, finding of cutting tools and other equipment, setting-up, checking measurements and so on was done less satisfactorily. The floor to floor time may easily be reduced by some 30 to 50 per cent. On

the other hand some machines, like the spark erosion machines and the jig borer, were operating with reasonable utilization and efficiency.

The consultant does not share the view that NC or CNC machines are a prerequisite for increased productivity. Such machines, however, should be introduced when there is a need for upgrading existing equipment, however, it is quite plausible that production of moulds for outside clients will require extra staff.

Another production which could be taken up by CIPET is the development of a system of Standard Mould Components which are available in most industrialized countries. Sush a system is, so far, not available in India. It is felt, therefore, that a Standard Mould Set and the other parts of such a system will meet a long felt need by the mould making industry.

The consultant was very often approached by people asking for information about zero, pre-production, prototype, and short-run moulds. This is a subject of great interest to mould-makers all over the world. However, the requirements very often differ because, e.g. in industrialized countries prototypes are required at an early stage of the product development cycle, whereas short-run moulds are of the most interest to countries with a low market potentiality.

The consultant recommends CIPET take up applied research on the subject of prototype and short-run moulds, based on the requirements from the Indian Plastics Industry.

COMMENTS ON MAINTENANCE OF PLASTICS PROCESSING MACHINERY

An evaluation of the workshops showed that the plastics processing equipment was in working order and the staff to be familiar with it.

The consultant, however, cannot refrain from commenting that the upkeep of plant, machinery and moulds, as well as the housekeeping, is far from satisfactory in Madras, and to a lesser extent in Ahmedabad.

It is the little things that get overlooked, like the cleaning of machines, fouling of cooling channels, calibration of regulating instruments, protecting of mould surfaces, etc. Two factors, especially, should cause concern. Firstly, safety regulations should be strictly observed during all demonstrations, e.g. no injection moulding machine should be operated with broken safe-guards. Secondly, demonstration of injection moulding should not take place without proper cooling of the moulds. when demonstrating the effects on product rate and quality. It is simply not possible to teach realistic industrial injection moulding, with its emphasis on reducing cycle time, without cooling of the mould.

Likewise, it is impossible to reach a satisfactory quality without proper cooling.

There is an awareness of these problems, especially in Ahmedabad. It was also observed that tool machines were better maintained in Madras and Ahmedabad.

Since the plastics processing machines are not run with a heavy load in the same way as production machines, preventive maintenance of machines beyond lubrication and regular cleaning, is not justified. Repair services may, in some cases be available from the supplier, however, with its facilities, CIPET should be able to rely on its own resources for most of the required tasks.

If the plan for taking-up research with instrumented injection moulding machines should materialize, there will be need for a person with skills in the maintenance and calibration of instruments and equipment. Such a person could share his activities with the Product Testing Centre, as well as with the planned Extension Centres.

It is recommended, therefore, to employ a technician, whose qualifications should include some knowledge on electronics combined with the practical experience in experimental set-up.

To improve maintenance, it is recommended that the foremen should be encouraged to keep up the plastics processing machinery and moulds to a higher standard, so as to improve safety precautions and to raise the level of industrially relevant instructions.

COMMENTS ON THE UPGRADING OF INJECTION MOULDING MACHINES

CIPET has a policy of maintaining an up-to-date machine park. It has, therefore, been suggested to phase out some of the present injection moulding machines and replace them by machines of a later design. Tenders for such machines have been sent to six of the major European suppliers. In the begining, a 6 ounce machine will be replaced, later perhaps the 12 and 24 ounce machines.

It is envisaged that one of the new machines will be utilized only for experimental work and demonstrations.

Extensive experiments in such work has shown that measurements of the actual melt temperature, the cavity wall temperature, and the cavity pressure profile at various locations provide a wealth of additional information that can assist in a better understanding of the process and at the same time demonstrate important parameters of the process. (See Appendix 5).

A number of sensors are available for measuring pressure and temperature in melt and mould. Also, mobile set-up units are available that consist of suitable control and monitoring devices for set-up. The cost for this equipment, which is sufficient for a number of machines, is presently between $ 2500 and $10000.

It is recommended, therefore, that the following equipment be purchased and installed on one machine in Madras as well as in Ahmedabad.

PRESSURE MEASUREMENTS

Hydraulic Pressure

Pressure in the hydraulic cylinder should be measured and recorded. There are a number of fairly inexpensive transducers available, also indigenous. There are rarely any temperature effects in the measurement. Hydraulic pressure transducers are usually cheaper and more reliable than devices wich come in contact with the melted plastic.

(The pressure in front of the screw tip shows qualitatively the same tendencies as the hydraulic pressure, although not during the holding pressure stage. This pressure, however, is more difficult to measure, but a conversion of the hydraulic

pressure by means of the ratio between hydraulic piston and screw area is usually sufficiently exact.)

Cavity Pressure

The Dynisco range of pressure transducers are available for installation directly in the cavity, or in the mould behind an ejector pin. Dynisco transducers are based on the strain-gauge principle. Mounting the Type PT 449 directly in the cavity eliminates the need for knock-out or dummy pins, which may bend or freeze and degrade the performance of the pressure measurement. That will also eliminate the shock problems associated with transducers mounted behind the pin in the ejector plate.

The sensing area measures 6 mm diameter, allowing it to be installed in applications where space is limited. The sensing element is made of stainless steel. Maximum mould temperature is 200°C and the pressure range is up to 1500 bar.

The FT 444, 445 and 446 units are designed for installation outside the cavity. The FT 444 OH slides into a slot machined in the ejector plate so that the sensing button rests behind an ejector or dummy pin. Standard maximum pressure is 1500 bar, with maximum temperature of 230°C. Type FT 445 H and FT 446 H are smaller versions, for use when there is insufficient room to cut a slot for the FT 444, and are fitted into a hole in the ejector plate, again with the button resting behind a pin. Maximum temperature and pressure are the same as for the FT 444.

Kistler transducers perform basically the same tasks. They are based on the quartz principle, making them especially suitable for recording of pressure transients. Documentation for these transducers have been left in Madras and Ahmedabad.

Most suppliers of pressure transducers also supply the necessary amlifying equipment.

CAUTION

Pressure transducers are high precision instruments. They need the utmost care in handling, fitting and operation.

Position and velocity measurements

Position and velocity of the screw can be measured using a linear transducer, where the output signal is processed by a simple electronic circuit to produce a pure velocity signal. Extra-sensitive linear transducers are used to measure the acceleration of the screw during the injection stroke.

Temperature measurements

Melt temperature can be measured in the nozzle with sensors based on the thermocouple principle. There are a number of robust sensors on the market. They can, however, also be made in-house, provided the necessary soldering techniques are mastered.

In-mould temperature sensors require less skill for own manufacture. On the market are probes, e.g. from Engelmann and Buckham, in a number of configurations for permanent installations with a bajonet connector for the signal lead; removable with a threaded cap and a coiled lead; with magnetic dics for attachment to small moulds; for passing through water channels; for side sensing of shallow parts; and versions shielded to resist temperatures.

Hydraulic oil temperature measurements are very often a prerequisite of monitoring machine performance.

Calibration and recording

Reliable measurements depend on a careful calibration of sensors and recording equipment. It is self-evident, therefore, that all equipment should be correctly calibrated. Means for calibration should be considered whenever equipment is purchased.

As an example, calibration of pressure transducers can be made using a simple hydraulic pump together with a precision manometer.

Accurate temperature measurements will require a zero-point reference, e.g. an electronic junction reference or an ice flash bottle, provided that ice is readily available.

Monitoring and recording can be done using a variety of equipment. A combination of a two-channel oscilloscope (e.g. the BPL-oscilloscope) and a fast responding plotter has proved useful in much experimental work.

Auxiliary equipment

A small hand-held electronic thermometer with probes for submerged and contact measurements is very useful for many purposes, e.g. for measuring the temperature of melt ejected into a cup, or for measuring mould surface temperatures.

Standard flow controllers for mould cooling are rarely calibrated. For the measurement of the heat balance of moulds and machines, precision flow controllers should be used together with manometers for pressure control.

It is very essential for the processing of engineering plastics that mould tempering units (e.g. a leak-stopper from Regloplas) be purchased. Ideally two units are required for each machine, e.g. for maintaining different temperatures on the core and the cavity.

Processing of engineering plastics requires in most cases a pre-drying of the pellets. It is suggested, therefore, that the purchase of a hopper dryer should be considered.

COMMENTS ON CAD/CAM AND ITS RELEVANCE TO CIPET

Computer Aided Design (CAD)/Computer Aided Manufacturing (CAM) is slowly making its impact on the plastics and tool-making industries in industrialized countries.

The key element in CAD/CAM is the common data base, created at the product design stage, and from which all software programs can radiate and interfere with each other.

A part will first be drawn using a Computer Aided Draughting System, which creates the data base for the part. The part can then be examined by the stress analysis package. The flow of the plastic can then be analysed, weld lines placed, residual stresses minimized, and so on. The same data is used for both stress and flow analyses. In addition, costs can be based on predicted cycle time, shot weight, clamp force required, etc. Next is mould design. The same data base is used to design the mechanics of the mould and to determine cooling need. Then come NC machining. Using the same information, production can be scheduled and machine monitoring can be used as part of the production control.

No CAD package fulfills all the requirements for use as the core program of an integrated centralized data base software package.

Whether it is wise from a technical and economical viewpoint to employ CAD/CAM techniques in a company depends not only on the particular needs of the company but also on the technical and organizational parameters of the facility. The cost-benefit ratio must be evaluated in each case.

CIPET, with its aim at being in the front of technological developments in plastics product design and fabrication, must establish, as its long term objective, an environment for research and development in the use of computers in the plastics industries.

Even so, it would be unwise for CIPET to enter directly into buying sophisticated hardware and software packages before a further knowledge of computing has been established.

Computer technology and costs are changing so rapidly that expensive installations could become obsolete within a few years.

The hardware comprising a Webster SS 23 Central Processing Unit (CPU) and Fujitsu SP 830 printer plus a visual graphics terminal, Calcomp 81 plotter and Houston Hi-pad digitizer costs a total of around $30.000. (All quoted prices are estimated European prices).

Software, e.g., non-graphics finite difference programs from Moldflow cost around $12.000, and the additional graphics programs, for analyzing a part by a finite element method and displaying the filling pattern graphically, costs around $16.000.

A graphics work station (hardware and software) costs around $58.000.

It should be stressed that these are budget prices and that a work station can be formulated to the requirements of a particular user, incorporating his own preferences for peripheral equipment and existing hardware.

The cheapest home computer system, however, is a powerful machine. For example, the Commodore 64 can cost as little as $700. It will familiarize anyone with little or no computer experience in the basic mechanics of computers.

Having become familiar with computer operations, a simple control program/micro-computer based machine, or an up-grading, will enable a variety of simple but functional programs to run. For example, a total system (hardware plus software) running programs to calculate pressure drops over runners, cooling time, and to design water cooling requirements would cost $5.000 - $7.000. These are usually 8 bit machines. The memory and speed is limited, so that the major software, such as finite element stress analysis and flow analysis cannot be run.

The next step will be a larger system, either an extended memory 16 bit machine or a full 32 bit machine. The hardware costs start at $11.000 plus the cost of software. The real power of these machines is that they can run CAD systems effectly, but these have been developed for special purpose applications, and are too sophisticated, which is not good, because it increases the learning time.

Buying a simple piece of draughting software, which can be as cheap as $7.500, and runs on a general purpose computer system, may be more rational. Such a system, to be effective, must have a common data base which can interface with all other software, such as stress and flow analysis, NC - machining, etc.

Before a decision is made to buy computers for CAD/CAM applications the following questions should be scrutinized.

- Will computers be introduced in other areas of CIPET's activities, e.g., NC - programming, data acquisition from testing instruments and injection moulding machines, etc. A high degree of compatibility is desirable.

- Imported or indigeneous machines, e.g., the micro 32 machine from Electronics Corporation of India Limited is designed around the Motorola 68 000 series of micro-processors, which is the heart of the MacIntosh and Lisa computers from Apple.

- Low or high level software tools? The principles of structured programing is best apprehended by a high level language like Pascal, however, Basic, a low level language is used for teaching even at college level. Most available programs are written in Fortran-77. Ada has been introduced on MacIntosh, Lisa, and IBM-Pc. These machines have facilities for 2 D draughting only.

- Which operating systems should be selected?

- Are funds available for import, maintenance and up-dating of software packages, and for service and back-up facilities?

- What sort of income from outside clients can be generated from future computer activities?

The answer to the above questions will require some familiarisation with computer operations, as well as some coordination with CIPET's long-range planning. It is clear, however, that investment in new technology is necessary if the Centre wants to maintain its relative technological level.

It is recommended that computers at CIPET to introduced with a fairly low level of sophistication, e.g. by the purchase of a Commodore 64 or a similar inexpensive computer.

The level of sophistication should gradually be increased over a period of maybe 5 years in order to come up to the present-day computer draughting systems and with software that can be interfaced with standard software packages, e.g. for stress and flow calculations and post-processors for NC-machining of tools.

COMMENTS ON COOPERATION WITH INDUSTRY

CIPET's objective of serving Industry has met with good response and several clients approach CIPET every day for advise, especially in the Product Testing Centre, whereas there were few orders on hand in design during the mission.

Some of the contacts are established quite informally, others through a formal inquiry e.g. in the form of a letter. During my mission I was involved in consultancy work in Madras. Some of these contacts have been followed-up after my return from the mission.

It is the opinion of the consultant, however, that there still exists a scope for establishing a more intimate link between CIPET and industry, as there is little promotion of CIPET's activities. Also, there is no formal procedure for clients when approaching CIPET with a problem, and no records are kept of the number of cases under processing by the professional staff.

A procedure for the outside clients is especially important because plastic products by their nature with properties depending on many interrelating parameters require solutions cutting across the dividing lines between different departments.

Certainly, if the stage of self supporting level is a desirable goal, one has to aim at multiple objectives which are feasible within the various limitations of machines, manpower, financial resources and market potentialities. Precise operational programs can only evolve in the course of time, as many factors including intangibles are not readily available now.

In the promotion of CIPET's activities untraditional means should also be tried, e.g. video, press contacts, advertizing in newspapers and spreading sales promotional literature to various existing and potential customers.

Provided coherent strategies and policies are developed and the required inputs are provided for, it should be possible to reach a higher level of activity and a reasonably acceptable level of utilization.

At present, there is no overall planning and monitoring system covering the whole range of activities from the design stage, manufacture and supply of tools to the customer.

If CIPET takes up production of tools for outside clients it is important to establish as the highest priority the concept of "management by objective", where the objective is to manufacture a tool of the specified quality and to deliver it at the promised time.

It might be a consideration to have the Tool Engineering Consultancy Service Cell be responsible for the overall planning. It must ensure that the Design and Tool Room can perform as promised to the customer and to follow-up and ensure the delivery.

The lack of formal administrative procedures has, in the opinion of the consultant, two consequences. Firstly, it is difficult to assure that a client gets a satisfactory follow-up to his inquiry. Secondly, when no records are kept it is difficult to assess the day-to-day workload, and also to charge an appropriate consultation fee, if so is desired.

The above facts are mentioned only in passing because the potential for solving problems is so high at CIPET and because the necessary infrastructure for doing so also exist.

As an example, tool makers always have a need for having the moulds tested and proved before delivery, especially when exporting moulds. Such an activity could easily be offered by CIPET with its machine park, covering typical production machinery.

The optimization of moulds or the correction of existing moulds for improved performance could also be offered as an activity. In most plastics processing companies the daily work load is prohibitive for such work.

Impartial advice on the effectiveness of processing machinery could be offered, as well.

CIPET also has a very well kept and up to date library. However, it should be a long term objective to establish a proper information service with a data bank for disseminating information on raw materials, processing machinery, etc. through periodicals and technical abstracts etc.

A readily identifiable central Plastics Information Bureau could easily be set-up, which could impartially serve the information needs, not only of the plastics

industry but also of companies outside and give general advice on specifying, designing with and the use of plastics.

Based on the aforementioned it is recommended that a procedure be stablished, for outside clients approaching CIPET, with the long-term view of establishing income generating activities in the plastics design and processing sections as well as in the tool shop.

Finally, CIPET should keep as its overall policy the development of a high reputation for quality and professional excellence.

COMMENTS ON FURTHER COOPERATION BETWEEN UNIDO AND CIPET

The plastics processing and the tool-making industries have experinced great changes in this decade due to the increased use of computers, both in the general purpose information processing systems, or as a micro component in specific products and systems applications.

Some of the new computer based techniques, like CAD/CAM, require expensive hardware and some require basic training in fundamentals of computers before a decision can be made to introduce the new technology.

It would seem appropriate, therefore, that an international work-shop be conducted where the use of CAD/CAM techniques in the plastics and tool making industries could be demonstrated.

The consultant is quite prepared, if it is so desired, to propose a curricula for such a work-shop to be conducted at a place where the necessary installations are readily available, and as well to suggest suitable locations where such facilities can be found.

OUTLOOK FOR A SECOND MISSION

The prospect of a second mission was raised in discussions with counterparts. Such a mission, if desired, should have defined objectives, which are established well in advance in order to make the necessary preparations.

Some topics which were not treated in detail but were considered to be of interest to CIPET are

- Instrumentation of and experiments with injection moulding machines.
- Short-term seminars on hot runner moulds.
- Initiation of activities for the use of computers in the design of plastics components and moulds.

MISSION SCHEDULE AND MAIN DAILY ACTIVITIES

OCTOBER

October 2	Tuesday	Briefing in Vienna
October 3	Wednesday	Departure for New Delhi via Frankfurt on PA 066
October 4	Thursday	Holiday: Dussehra Arrival in New Delhi at 2 a.m.
October 5	Friday	Briefing at UNDP - Office, New Delhi Visit to Tool Room and Training Centre, Delhi
October 6	Saturday	Holiday: Muharram Departure for Ahmedabad on IC 451. Visit to CIPET - Office, Ambawadi. Visit to CIPET - Institute, Vatva.
October 8	Monday	Departure for Madras via Bombay on IC 114. Visit to UNDP - Office for clearance of unaccompanied luggage.
October 9	Tuesday	In Madras, introduction to CIPET. Discussion of work plan, familiarization with various activities at the Centre.
October 10	Wednesday	Seminar "Tooling for Plastics". Lecture on "Latest Trends in Design and Fabrication". Finalization of work plan and meeting with counterparts.
October 11	Thursday	Departure for Ahmedabad on IC 172 via Bombay, Flight aborted after 1 hour. Return to Madras for delayed departure. Overnight stay in Bombay.
October 12	Friday	Visit to UNDP - Office, customs clearing agent and Swiss Air for clearance of unaccompanied luggage. Departure for Ahmedabad on IC 103
October 15	Monday	Meeting with Deputy Director and counterparts Visit to site for new institute.
October 16	Tuesday	Preparation of training courses.

October 17	Wednesday	Revision of syllabus for Plastics Processing courses. Discussions with counterparts on mould design and revision of design of bowl mould. Meeting with Deputy Director and counterpart for comments on work plan suggested from Madras.
October 18	Thursday	Lecture for MMC - students and staff from CIPET.
October 19	Friday	Lecture for MMC - students and staff from CIPET.
October 20	Saturday	Meeting with Deputy Director for acceptance of work plan and letter to UNIDO.
October 22	Monday	Holiday
October 23	Tuesday	Holiday
October 24	Wednesday	Holiday: Diwali
October 25	Thursday	Holiday: New Years day
October 26	Friday	Holiday: Bhai Bij Preparation of lecture notes in hotel.
October 29	Monday	Lecture for MCC - students and staff at CIPET.
October 30	Tuesday	Departure for Madras via Bombay on IC 114.
October 31	Wednesday	Start of short course "Introduction to Product Design". Lecture on Product Design. Activities at the Centre stopped 2:30 p.m. after the assassination of Indira Gandhi.

NOVEMBER

November 1	Thursday	Day of national mourning Preparation of lecture notes.
November 2	Friday	Review of library and books on injection moulding, mould design and fabrication. Discussion of acquisition with librarian
November 5	Monday	Discussion with counterparts on mould design (moulds for double threaded parts, etc.)

November	6	Tuesday	Review of injection moulding machines and suggestions for improvements. Preparation of lecture notes.
November	7	Wednesday	Preparation of lecture notes.
November	8	Thursday	Review of CAD/CAM activities and its relevance to CIPET.
November	9	Friday	Preparation of specifications and tenders to major injection moulding machine suppliers Lecture on "Quality Control and Product Liability". Departure for Ahmedabad via Bombay on IC 174 to collect luggage following a change in original work plan suggested by CIPET - Ahmedabad.
November	10	Saturday	Overnight stay in Ahmedabad.
November	11	Sunday	Arrival in Madras.
November	12	Monday	Activities interrupted at 10:30 a.m. after power cut due to cyclonic weather.
November	13	Tuesday	Institute closed due to cyclonic weather.
November	14	Wednesday	Preparation of lecture notes in CIPET's Hostel.
November	15	Thursday	
November	16	Friday	
November	18	Sunday	Preparation of seminar.
November	19	Monday	Seminar "Recent Developments in Injection Moulding".
November	20	Tuesday	Consultations with participants in seminar.
November	21	Wednesday	Further consultations. Discussions with counterparts on mould fabrication techniques (photo etching, etc.). Visit to Govel Plastics, Guindy.
November	22	Thursday	Meeting with Deputy Director, CIPET, Madras. Continuation of course "Introduction to Product Design". Discussions with counterparts on mould fabrication techniques. Preparation of list for follow-up activites
November	23	Friday	Further lectures on "Introduction to Product Design".

November 24	Saturday	Finalization of program at Madras. Departure for Ahmedabad via Bombay on IC 174. Overnight stay in Bombay.
November 25	Sunday	Arrival in Ahmedabad.
November 26	Monday	Start of short course "Introduction to Product Design".
November 27	Tuesday	Further lectures on "Introduction to Product Design".
November 28	Wednesday	Further lectures on "Introduction to Product Design".
November 29	Thursday	Preparation of short courses.
November 30	Friday	Preparation of short courses.

DECEMBER

December 3	Monday	Start of short course "Quality Control and Testing of Plastics Products".
December 4	Tuesday	Further lectures on "Quality Control and Testing of Plastics Products".
December 5	Wednesday	Evaluation of activities at CIPET, Ahmedabad.
December 6	Thursday	Holiday: Idd - E - Milad. Preparation of lecture notes in hotel.
December 7	Friday	Preparation of short courses.
December 8	Saturday	Preparation of short courses.
December 10	Monday	Start of short course "Recent Developments in Injection Moulds and Moulding".
December 11	Tuesday	Further lectures on "Recent Developments in Injection Moulds and Moulding".
December 12	Wednesday	Visit to IPCL, Baroda.
December 13	Thurdsay	Visit to SLM - Manekral. Discussion with counterparts on corrections of various moulds for test specimens.
December 14	Friday	Reports and letters for various consultancies for outside clients of CIPET.

December 17	Monday	Translation from German to English of Instruction Manual. Further discussions and corrections of moulds for test specimens.
December 18	Tuesday	Arrival of counterpart from Madras for follow-up of activities and for design study of hot-runner mould. Further consultancies for outside clients. Preparation of 2 - Week course on injection moulding.
December 19	Wednesday	Follow-up visit to IPCL, Baroda. Visit to Gujarat State Fertilizer Company Limited, Baroda.
December 20	Thursday	Design study on hot-runner mould with counterpart from Madras. Design of mould for compression moulding of test specimens.
December 21	Friday	Review of activities.
December 22	Saturday	Departure for New Delhi on IC 462.
December 24	Monday	Holiday: Lok Sabha elections. Preparation of final report.
December 25	Tuesday	Holiday: Christmas
December 26	Wednesday	Debriefing - New Delhi. Preparation of final report.
December 27	Thursday	Departure for Vienna on LH 665. Debriefing in Vienna.
December 28	Friday	Debriefing in Vienna.

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VISITS

NEW DELHI

October 5 Tool Room and Training Centre
Wazirpur Industrial Area, Delhi

MADRAS

November 21 Govel Plastics Private Ltd.

23 Development Plot, Industrial Estate Guindy

AHMEDABAD AND VADODARA (BARODA)

December 12 Indian Petrochemicals Corporation Ltd
P.O. Petrochemicals Dist. Vadodara

December 13 SLM MANEKRAL INDUSTRIES LTD
Vatva, Ahmedabad

December 19 Indian Petrochemicals Corporation Ltd
P.O. Petrochemicals Dist. Vadodara

Gujarat State Fertilizers Company Limited
P.O Fertilizernagar Dist. Vadodara

Appendix 2.

CIPET, GUINDY, MADRAS - 600 032

UNDP PROJECT NO.DP/IND/82/044

"Plastic Materials & Product Testing Programme in India"

11.03-Expert in "Mould Design and Fabrication"

MR. M.JENSEN

Ahmedabad/Madras - 3 m/m - Oct., Nov., & Dec. 1984

Counter-parts at Ahmedabad:- (i) Mr.G.Lalchandani (Processing);
(ii) Mr. Patel (Tool Room);
(iii) Mr. A.L.Vaidya (Design).

Programme at Ahmedabad:

06.10.84 - Arrival at Ahmedabad from Vienna
- Briefing and introduction

12.10.84		26.11.84
to	&	to
26.10.84		24.12.84

- Familiarisation of various activities of the centre;
- Review assessment and drafting of syllabus for the long-term/ short-term Mould Design/Tooling/Processing Courses;
- Training of counter-parts in the various aspects of Tool & Design;
- Participation in the activities of Mould Making course. Suggest further training programme in the speciality;
- Deliver lectures on subjects related to speciality;
- Provide information on advances in the production of moulds and tooling for plastics processing with particulars emphasis on design of articles, design and production of moulds, maintanance materials and machinery used.

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- Testing of moulds and optimisation;
- Conducting a short-course on "Introduction to Product Design" (Tentative dates 17th & 18th Dec. 1984);
- Preparation of course materials for the proposed courses;
- Lecture programme on "Recent developments in Injection Moulds" (for M/s. Gujarat Plastics Manufacturers Assn.);
- Simple quality control methods for Injection Mouldings;
- Recommendation of reference books; periodicals & education aids;
- Visit to IPCL & Addressing to PRI;
- Visits to industries/institutes in and around Ahmedabad & Bombay for strengthening/establishing contacts.

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CIPET, GUINDY, MADRAS - 600 032

UNDP PROJECT No.DP/IND/82/044

"Plastic Materials & Product Testing Programme in India"

11.03-Expert in "Mould Design & Fabrication"

MR. M.JENSEN

Ahmedabad/Madras - 3 m/m - Oct., Nov., & Dec. 1984

Counter Parts at Madras:- M/s.Kuppuswamy (Processing);
A.R.Subramanian (Tool Room);
Mohd. Nainar (Design).

Mr. S.Swaminathan
Mr. M.K.Rammohan
} CAD/CAM - DATA PROCESSING

Programme at Madras:

09.10.84 to 10.10.84 - Introduction & Briefing;
- Familiarisation with various CIPET facilities and activities;
- Work Programme finalisation;
- Participation in the short-programme on "Tooling for Plastics";

Lecture on "Recent developments in the Design & Fabricatic of Moulds";

28.10.84 to 24.11.84 - Assistance and participation in the short-programme on "Introduction to Product Design"(31.10.84 to 02.11.84);
- Conducting a one day seminar on "Recent developments in Injection Moulds (Including CAD/CAM)

(Tentative date: November 19th)

- Providing information on advances in the production of moulds and tooling for plastics processing;
- Testing of moulds-optimisation;
- Imparting knowledge and providing enough guidelines for developing moulds for the following:-

(a) Hot runner moulds; (b) Sandwich moulding; (c) Two colc moulding; (d) Precision moulding (tolerances etc.); (e) Internal undercuts; (f) Insert Moulding (g) Outsert Moulding (h) Automatic unscrewing.

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- Introducing the techniques of CAD/CAM, commenting on its relevance to CIPET's activities;
- Briefing on setting up of an information Centre/Data collection;
- Processing:- Review of machinery available and improvements suggested;

  Strengthening extrusion capabilities.
- Review of Syllabus:-
  - Review CIPET's approach on Mould Design & production;

    How the time factor can be controlled and improved up on.

    Typical case study.
- Assistance related to:-
  (a) Assembly methods (Ultrosonic, Snap-fit etc.);
  (b) Designing, Tooling & Processing of filled Engineering Plastics;
  (c) Developments in Surface Study; Machining
  (d) Toy moulds - Designs;
  (e) Electroforming;
  (f) Guidance in the design and development of test equipments; microscopy
  (g) Any other specific problems in Tools & Design;
  (h) Discussion with various section-heads for better inter departmental activities;
  (i) Recommendation of reference books, periodicals & educational aids;
  (j) Addressing PRI Members;
  (k) Visits to industries & institutes in Madras & Bangalore (GTTC, EID Parry, NTTF) for strengthening contacts.

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LIST OF TRAINING COURSES

DATE	TIME	COURSE/LECTURE	LECTURE NOTES	PARTICIPANTS
MADRAS				
10 October	11:00 - 12:30	Tooling for Plastics - Latest trends in design and fabrication.		Die-makers and supervisors in Tool Rooms. Staff from CIPET (approximately 20 participants)
AHMEDABAD				
18 October	9:45 - 12:30	Mould Making course - Checking of mould drawings.		Students and staff from CIPET (20 participants)
19 October	9:30 - 12:30	- The injection moulding process.		Students and staff from CIPET (20 participants)
29 October	10:30 - 12:00	- Polishing of injection moulds.		Students and staff from CIPET (20 participants)
MADRAS				
31 October		Introduction to Product Design		
	10:45 - 12:00	- Designing with plastics		(9 parts + 1 CIPET/AMD 11 registered)
9 November	14:00 - 15:30	Quality Control and Product Liability	8 pages	Staff from CIPET + invited guests (24 participants)

Appendix 3.

DATE	TIME	COURSE/LECTURE	LECTURE NOTES	PARTICIPANTS
19 November		Recent Developments in Injection Moulding	Booklet with 105 pages.	Entrepreneurs, mgrs., engrs., foremen and supervisors engaged in mould design, mould fabrication, mould processing and quality control.
	10:30 - 11:00	- Introduction to the seminar.		
	12:00 - 13:00	- Process control.		
	14:30 - 15:30	- Developments in injection moulds.		
	15:45 - 16:30	- CAD/CAM in injection moulding.		(44 parts. + 11 guests and staff from CIPET)
22 November		Introduction to Product Design Con't.		See 31 October.
	10:45 - 12:00	- Designing with plastics.		
23 November	9:30 - 10:30	- Effects of processing conditions.		
	12:15 - 13:30	- Shrinkage dimensions and tolerances of injection moulded articles.		
	14:30 - 15:30	- Case study (with Mr. Kuppuswamy)		
AHMEDABAD				
26 November		Introduction to Product Design		Designers, supervisors, group leaders, senior technicians, training personnel and entrepreneurs.
	10:30 - 11:30	Introduction to fundamentals of product design.	5 pages	(5 parts., 6 registered + staff from CIPET).

DATE	TIME	COURSE/LECTURE	LECTURE NOTES	PARTICIPANTS
27 November	10:45 - 12:30	- Moulding methods vs product design.		
	13:30 - 15:30	- Process limitations on product design.		
28 November	9:30 - 11:00	- Design for stiffness		
	13:30 - 15:00	- Advances in product design.		
3 December		Quality Control & Testing of Plastics Products.		Supervisors and entrepreneurs in plastics industry. Degree in Science Engineering, some experience in plastics/application of plastics.
	9:45 - 10:30	- Introduction to quality control.	5 + 4 pages	(5 part./7 registered)
	12:00 - 12:30	- Measurement of dimensions of plastics products.	7 pages	
4 December	9:30 - 10:30	- Methods of quality control for plastics products.	11 pages	
	11:15 - 11:45	- The systematic approach to failure analysis.	5 pages	
	13:30 - 14:30	- The application of statistics to failure problems.	7 pages	

DATE	TIME	COURSE/LECTURE	LECTURE NOTES	PARTICIPANTS
10 December		Recent Developments in Injection Moulds and Moulding.		Engineers, supervisors, and senior technicians in the field of plastics.
	14:00 - 14:45	- Mould finishing.	13 pages	(12 parts., 16 registered)
	15:00 - 15:30	- Multi-purpose moulds.	5 pages	
11 December	9:30 - 10:45	- Introduction to recent developments in injection moulds and moulding.	5 + 5 + 10 pages	
	11:00 - 12:00	- The influence of processing parameters on part properties.	5 + 5 + 4 pages	
	13:30 - 14:30	- Microprocessor controlled injection moulding machines.	7 pages	
	15:30 - 16:15	- Optimization of the moulding process.	5 pages	
17 December	2 weeks	Injection Moulding.		
28 December		(The 2 week course was postponed until 7 January - 18 January, 1985 due to Parliamentary elections)		(13 participants have registered)
		Total.....	221 pages	

- - -oOo- - -

SPONSOR CERTIFICATE

We sponsor the following candidates

Seal and Signature of
Sponsoring Authority

Address for Communication :

THE COURSE CO-ORDINATOR
"TOOLING FOR PLASTICS"
CENTRAL INSTITUTE OF PLASTICS ENGINEERING & TOOLS
Guindy, Madras-600 032

CIPET

The Central Institute of Plastics Engineering and Tools was established at Madras by the Government of India under the UNDP with ILO as the executing agency, during the year 1968, for training Mould Designers, Mould Makers and other Technicians required for the Plastics Industry. CIPET has recently established an extension centre at Ahmedabad to serve the Western Region with the assistance of Government of India and Govt. of Gujarat.

The Institute of offers highly specialised and practical-oriented training machine international standards in the fields of Plastics Engineering / Technology. The Institute also conducts Short Term non-residential programmes to enable the Industry to sponsor their existing employees. It is expected that such programmes, dealing with specific aspects of Plastic Engineering/Technology shall be utilised by the industry to meet tomorrows challenges of development and expansion. The following Short Term programmes are scheduled for the period ending [redacted] 1984.

Introduction to Product Design :
October 31st to November 2, 1984

Extrusion and Blow Mould Design :
November 23 and 24, 1984

Introduction to Plastics Processing Techniques :
December 11 to 14, 1984

Quality Assessment of Plastics Films :
December 19 to 21, 1984

For brochure, Nomination Form and Registration, please write to :

The Director
CIPET
Guindy, Madras-600 032

CIPET

Offers

Short Term Programme on "TOOLING FOR PLASTICS"

Course Director

Mr. M. ABDUL RAZACK
SENIOR TOOL ENGINEER

Course Co-ordinator

Mr. M. K. RAMMOHAN
TOOL ENGINEER

Appendix 4.

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS
Guindy, Madras-600 032
Grams : CIPET Tel : 432371

Title :

"TOOLING FOR PLASTICS"

Venue :

CIPET
Industrial Estate
Guindy. Madras-600 032

Duration :

From 10th October to
12th October 1984
Between 10-00 and 16-00 Hours

Last Date for Nomination :

1st October 1984

For whom :

For Die makers, Chargehands, Supervisors, Technicians and Entrepreneurs in this field. Preference will be given to sponsored candidates.

Course Content :

1. Types of Moulds
2. Mould Steel Selection
3. Preparation of cores, cavities using special machines
4. Plastic Materials
5. Trouble shooting during moulding
6. N. C. Machines

Methodology :

Lecture classes, in-plant practice, case study and discussions.

Objectives :

The course is intended for Tool rooms which are manufacturing Press tools, Jigs, Fixutres, etc., and yet no Plastics Moulds for want of technology and design aspects. The course is very suitable for Die Makers and Supervisors in Tool Room.

Intake Capacity :

SIXTEEN

Mode of Selection :

First come first served

Course Fee :

Rs. 450/- per participant
(Non Residential)
(include course materials, lunch and tea)

Cheque/Draft should be drawn in favour of:

DIRECTOR
CIPET
Madras-600 032

APPLICATION FORM

Short Term Programme
on
"TOOLINGS FOR PLASTICS"
10-10-1984 to 12-10-1984
CIPET
MADRAS-600 032

Name.....

Age.....

Qualifications.....

Designation.....

Experience.....

.....

Mailing Address.....

.....

.....

Cheque/Draft No.....

Date.....

For Rs..... (.....)

On Bank.....
enclosed.

Telephone No.....

Date :

Signature of Applicant

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS

GUINDY, MADRAS - 600 032

SHORT TERM PROGRAMME

ON

INTRODUCTION TO PRODUCT DESIGN

(31.10.84 to 2.11.84)

PROGRAMME

1.11.84 - THURSDAY

09.30 - 10.30 - Plastics Processing Methods - Mr. S Md Nainar.

10.30 - 10.45 - T E A

10.45 - 12.00 - Designing with Plastics. - Dr. Jensen.

12.00 - 13.30 - Identification of Plastics. - Mr. P Poomalai.

13.30 - 14.30 - L U N C H

14.30 - 15.30 - CAD/CAM for Plastics Tooling - Mr. M K Rammohan

15.30 - 16.30 - Plastics Processing Practicals.

2.11.84 - FRIDAY

09.30 - 10.30 - Effect of Processing conditions. - Dr. Jensen.

10.30 - 10.45 - T E A

10.45 - 12.15 - Testing of Plastics. - Dr. K Ramamurthy

12.15 - 13.30 - Shrinkage, Dimensions and Tolerances of Injedtion Mould articles. - Dr. Jensen.

13.30 - 14.30 - L U N C H

14.30 - 15.30 - Case Study. - Dr. Jensen & Mr. A Kuppuswamy, Mr. S. Md Nainar

15.30 - 16.30 - Colcluding session.

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS
GUINDY, MADRAS - 600 032

SHORT TERM PROGRAMME
ON
INTRODUCTION TO PRODUCT DESIGN
(31.10.84 & 22nd, 23rd Nov '84)

PROGRAMME

22.11.84 - THURSDAY

09.30 - 10.30	- Plastics Processing Methods	- Mr. S Md Nainar
10.30 - 10.45	- T E A	
10.45 - 12.00	- Designing with plastics	- Dr. Jensen
12.00 - 13.30	- Identification of Plastics	- Mr. P Poomalai
13.30 - 14.30	- L U N C H	
14.30 - 15.30	- CAD/CAM for Plastics Tooling	- Mr. M K Rammohan
15.30 - 16.30	- Plastics Processing Practicals.	

23.11.84 - FRIDAY

09.30 - 10.30	- Effect of Processing - conditions.	- Dr. Jensen
10.30 - 10.45	- T E A	
10.45 - 12.15	- Testing of Plastics	- Dr. K Ramamurthy
12.15 - 13.30	- Shrinkage, Dimensions and Tolerances of Injection Mould articles.	- Dr. Jensen
13.30 - 14.30	- L U N C H	
14.30 - 15.30	- Case Study	- Dr. Jensen, Mr. A Kuppuswamy &Mr. S Md Nainar
15.30 - 16.30	- Cplcluding session.	

Programme Schedule :

VENUE 19th November 1984

HOTEL TAJ COROMANDEL,
NUNGAMBAKKAM,
MADRAS.

Timings :

09-30 hours to 16-30 hours

Objectives :

To share the experience of Dr. Mogens Jensen, (UNDP, Expert) on Injection Moulding-Design, Mould fabrication and Processing.

Fees :

The Participation fee for this Programme is Rs. 200/- per participant includes Seminar Materials as well as lunch and refreshments.

Registration :

A registration form is attached. We request you to kindly inform us of your company's nominations at the earliest. The programme fee may be sent by cheque/demand draft drawn in favour of DIRECTOR CIPET, MADRAS-600 032. Kindly inform us of your nominations as soon as possible.

ONE DAY SEMINAR ON

RECENT DEVELOPMENTS IN INJECTION MOULDING—

By
Dr. M. JENSEN
UNDP expert in
Mould Design and Fabrication

Organised by
CENTRAL INSTITUTE OF PLASTICS
ENGINEERING AND TOOLS
INDUSTRIAL ESTATE
GUINDY, MADRAS-600 032

Tel : 432371 Grams : CIPET, Madras

About CIPET

CIPET, an autonomous Institute in the Ministry of Energy, Department of Petroleum, Government of India, has with UNDP assistance, set up a unit for training, development, testing an' consultancy services for the Plastics Industry. The unit's design section, toolroom, processing shop and product testing centre are equipped with sophisticated machinery capable of carrying out most operations connected with plastics. Training is imparted in the fields of tool designing, plastics processing, quality control, mould/tool/die making, mould polishing, etc. The unit also offers advisory services in plastics mould designing, mould making, mould polishing and plastics processing; documentation and abstracts of literature on plastics mould design and manufacture; information on the manufacture of plastics materials and processing equipment; etc. It undertakes the inspection and sampling of moulds; mouldability testing and optimising processing conditions; physical, chemical, mechanical, electrical and optical testing of plastics materials and products; and standardisation of mould components and plastic products.

Dr. Mogens Jensen :—

The leader of the seminar is an internationally recognised UNDP expert in the fields of Mould Design and Fabrication. He is the member of the Danish Society of Polymer Technology, Plastics Institutes of Great Britain, British Institute of Rheology.

Now he is the manager, Process Development, LEGO AG, Research & Development Department, Switzerland (A leading toy manufacturer). He has the sound experience over two decades in the field of Plastics Engineering and Technology.

He has professional experience in industrialised as well as less Industrialised Countries. He has submitted two advisory reports to DANIDA on the Chilean Plastics Industry and DANISH National Report in 1978 on furture technological services to the plastics sector in Denmark.

He has published many articles conference papers and research reports on Plastics Processing, properties and performance of Injection Moulded articles, quality control and consultancy.

This Seminar gives an opportunity to be with Dr. Mogens Jensen in sharing his wide experience on Injection Moulding Persons planning to attend the seminar are requested to provide details of the specific problems in advance so that they can be discussed in problem solving sessions.

Programme Schedule
And Registration Formalities
Specified Overleaf
Please turn over

FOR ENTREPRENEURS, MANAGERS, ENGINEERS, FOREMAN AND SUPERVISORS ENGAGED IN MOULD DESIGN, MOULD FABRICATION MOULD PROCESSING AND QUALITY CONTROL

TOPICS TO BE COVERED

- ☐ ENGINEERING PLASTICS
- ☐ DESIGNING WITH PLASTICS
- ☐ PROCESSING INFLUENCE ON PRODUCT PROPERTIES
- ☐ ADVANCES IN PRODUCTION OF MOULDS AND TOOLING FOR PLASTICS PROCESSING (CAD/CAM)
- ☐ CASE STUDY.

FACILITIES AVAILABLE :

Plastics Processing Equipments :

Hand injection Moulding Machines of 1/2 oz, 1 oz, & 2 ozs shot capacity, Automatic Injection Moulding Machine (PI – 130 of H. M. T.) of 130 tonnes clamping pressure, Automatic Injection Moulding Machine (IS-80 A of S L.M. Maneklal) of 80 tonnes clamping pressure.

Hand Blow Moulding Machine (2 ozs), Automatic Blow Moulding machine (1 Litre capacity) of Windsor

Vacuum Forming Machine (Packart Make) Moulds with different mechanisms of working.

Plastics Testing Equipments :

Contour Cutter, Density Column Apparatus, Instron Universal Tester, Impactometer, Burst Strength Tester, Slip & Friction Tester, Gas Permeability Apparatus, Water Vapour Permeability Apparatus, Brabender Plasticorder, Melt Flow Indexer, Heat Distortion/Softening point Apparatus, Oxygen Index Flammability Tester, Haze, Clarity & Gloss meter, Polarising Microscope, Megometer, Tear Tester, Polar,-o-Scope.

Tool Room Machinery :

Power Hacksaw, Shaping Machine, Radial Drilling Machine, Bench Drilling, Vertical & Universal Milling Machines, Cylindrical Grinding Machine, Tool and Cutter Grinder, Surface Grinder, Deckel Jig boring Machine, Lathes, Pantograph with Single Lip Cutter Grinder.

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS AHMEDABAD.

Offers

Short Term Programme

ON

Introduction to Product Design

26th Nov. '84 to 28th Nov. 1984

Course Director

Mr. HEMANT MEHTA

Course Co-ordinator

Dr. MOGENS JENSEN
(UNDP. Expert)

Address :

A/2, 349, Phase II, Vatva Industrial Estate
Vatva, AHMEDABAD-382 445.
Phone : 876528

Head Office :

CIPET, Guindy, Madras-600 032.

CIPET :

An Extension Centre of Central Institute of Plastics Engineering and Tools (CIPET) Madras has been establised at Ahmedabad to serve the Western Region with the assistance of Government of India, Government of Gujarat and U. N. D. P.

The institute offers highly specialised practical oriented training courses of short and long duration, matching the international standards in the field of Plastics Engineering/ Technology. Testing Laboratories have also been setup at this centre with the assistance of U. N. D. P. for extending the test facilities and quality control in the area of plastics.

Title :

Introduction to Product Design

Venue :

CIPET Extension Centre,
A/2, 349. Phase II,
Vatva Industrial Estate,
Vatva, Ahmedabad-382 445.

Duration :

From 26th Nov. '84 to 28th Nov. 1984
(Three Days) (9-30 AM — 5 P.M)

Objectives :

- To indroduce the Product Design Principles for Plastics Products.
- To generate design awareness.
- To induct quality consciousness in relation to product design.

Course Content :

1. Principles of Product Design.
2. Plastics Materials-Structure & Properties.
3. Plastics Processing Methods.
4 Processing limitations on Product Design.
5. Design for stiffness.
6. Identification of Plastics.
7 Testing of Plastics for quality control.

Methodology :

Lecture classes, Inplant practice, Case Study and Discussion.

Eligibility :

Designers, Supervisors, Group Leaders, Senior Technicians Training Personnel and entrepreneurs.

Intake Capacity :

Fifteen

Course Fee :

Rs. 250/-
Non Residential (Including course material, lunch and tea)

Bank Draft should be drawn in favour of :

CIPET Extension Centre,
Ahmedabad.

CENTRAL INSTITUTE OF
PLASTICS ENGINEERING AND
TOOLS AHMEDABAD.

Offers

Training Programme

ON

Quality Control & Testing of Plastic products

3rd and 4th December 1984 (2 days)

Course Director

Dr. A. B. MATHUR
Assistant Engineer

&

Dr. MOGENS JENSEN
Undp. Expert

Address :

A/2, 349, Phase II, Vatva Industrial Estate,
Vatva, AHMEDABAD-382 445.
Phone : 876528

Head Office :

CIPET, Guindy, Madras-600 032.

CIPET :

EXTENSION CENTRE Ahmedabad.

The Central Institute of Plastics Engineering and Tools (CIPET) was established by Government of India with the assistance of UNDP and ILO at Madras during the year 1968, for training in Mould Making, Mould Design and Plastics Processing so as to develop the manpower required for the plastic industries. An extension centre of this institute has been established at Ahmedabad to serve the western Region with the assistance of Government of India, Government of Gujarat and UNDP for extending the training facilities in this Region comprising states of Maharashtra, Gujarat, Rajasthan and Madhya Pradesh.

The institute offers highly specialized practical oriented training courses of short and long duration matching the international standards in the field of Plastics Technology/Engineering.

A well equipped testing laboratory has now been set up at this centre with the assistance of UNDP for extending the test facilities to the plastic industries and with these available facilities, practical oriented specialized training programme on quality control and testing have been planned to ensure exposure of candidates to the practical problems involved in the relevent areas of study.

Title :

"Quality Control and Testing of Plastic Products"

Venue :

CIPET Extension Centre.
A/2, 349, Phase - II
Vatva Industrial Estate.
Vatva, Ahmedabad 382 445.

Duration :

03-12-84 to 04-12-84 (2 days)
From 0930 hrs. to 1700 hrs.

Objectives :

- To impart training on the quality control testing and evaluation of Plastics.
- For the awareness of the factors that affect the quality of products.
- To induct Quality Control conciousness and importance of Testing.

Tentative Scope :

- Introduction to Quality Control.
- Methods of Quality Control for Plastic Products.
- Standardization.
- Identification analysis and characterisation of Plastics.
- Main characteristics of plastic materials
- Tests and Testing equipments.
- Product Testing.

Methodology :

Lectures Demonstrations and Practicals.

Eligibility :

Supervisors and Entrepreneurs in plastics industry. Degree in science & Enginee.ing/ Technology. Some experience in Plastics/ Application of Plastics.

Preference will be given to sponsored candidates.

Co se Fee :

Rs. 200/-
(non residential, includes course meterials, lunch & tea)

Intake Capacity :

TWELVE

Closing Date for Registration :

23rd November 1984

Bank Draft should be drawn in favour of :

CIPET Extension Centre.
Ahmedabad.

FACILITIES AVAILABLE :

Plastics Processing Equipments :

Hand Injection Moulding Machines of 1/2 oz, 1 oz. & 2 ozs shot capacity, Automatic Injection Moulding Machine (PI – 130 of H. M. T.) of 130 tonnes clamping pressure, Automatic Injection Moulding Machine (IS-80 A of S L.M. Maneklal) of 80 tonnes clamping pressure.

Hand Blow Moulding Machine (2 ozs), Automatic Blow Moulding machine (1 Litre capacity) of Windsor.

Vacuum Forming Machine (Packart Make) Moulds with different mechanisms of working.

Plastics Testing Equipments :

Contour Cutter, Density Column Apparatus, Instron Universal Tester, Impactometer, Burst Strength Tester, Slip & Friction Tester, Gas Permeability Apparatus, Water Vapour Permeability Apparatus, Brabender Plasticorder, Melt Flow Indexer, Heat Distortion/Softening point Apparatus, Oxygen Index Flammability Tester, Haze, Clarity & Gloss meter, Polarising Microscope, Megometer, Tear Tester, Polar,-o-Scope.

Tool Room Machinery :

Power Hacksaw, Shaping Machine, Radial Drilling Machine, Bench Drilling, Vertical & Universal Milling Machines, Cylindrical Grinding Machine, Tool and Cutter Grinder, Surface Grinder, Deckel Jig boring Machine, Lathes, Pantograph with Single Lip Cutter Grinder.

Offers

Short Term Programme

ON

Recent Developments in Injection Mould & Moulding

10th Dec. 1984 to 11th Dec. 1984

Course Director

Shri G. K. LALCHANDANI

Course Co-ordinator

1. **Dr. A. B. MATHUR**
2. **Dr. MOGENS JENSEN**
   (UNDP. Expert)

Address :

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS

A/2,-349, Phase II, Vatva Industrial Estate,
Vatva, AHMEDABAD-382 445.
Phone : 876528

Head Office :

CIPET, Guindy, Madras-600 032.

CIPET :

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The institute offers highly specialised practical oriented training courses of short and long duration, matching the international standards in the field of Plastics Engineering/ Technology. Testing Laboratories have also been setup at this centre with the assistance of U. N. D. P. for extending the test facilities and quality control in the area of plastics.

Title :

"Recent Development in Injection Moulds and Moulding"

Venue :

CIPET Extension Centre,
A/2, 349. Phase II,
Vatva Industrial Estate,
Vatva, Ahmedabad-382 445.

Duration :

10th December '84 to 11th December 1984
(Two Days)
From 09-30 Hours to 17-00 Hours.

Course Content :

1. Latest Deviopments in Mould Design
2. Machining & Mould Finishing
3. Injection Moulding Machines
4. Multi-Purpose Moulds & Mould Materials
5. Micro Injection Moulding
6. Plastic Raw Materials & Quality Control
7. Trouble Shooting

Objectives :

To update the knowledge with the latest moulding methods, practical developments, machining methods, mould polishing and standardisation of mould parts.

Methodology :

Lectures, Inplant Training, Film Programme etc.

Intake Capacity :

FIFTEEN

For Whom :

Engineers, Supervisors and Senior Technicians in the field of plastics. Candidates sponsored by industries will be given Preference.

Course Fee :

Rs. 200/-per participant (includes course materials, tea and lunch). Participants have to make their own arrangement for stay and transport.

Bank Draft should be drawn in favour of :

CIPET Extension Centre,
Ahmedabad.

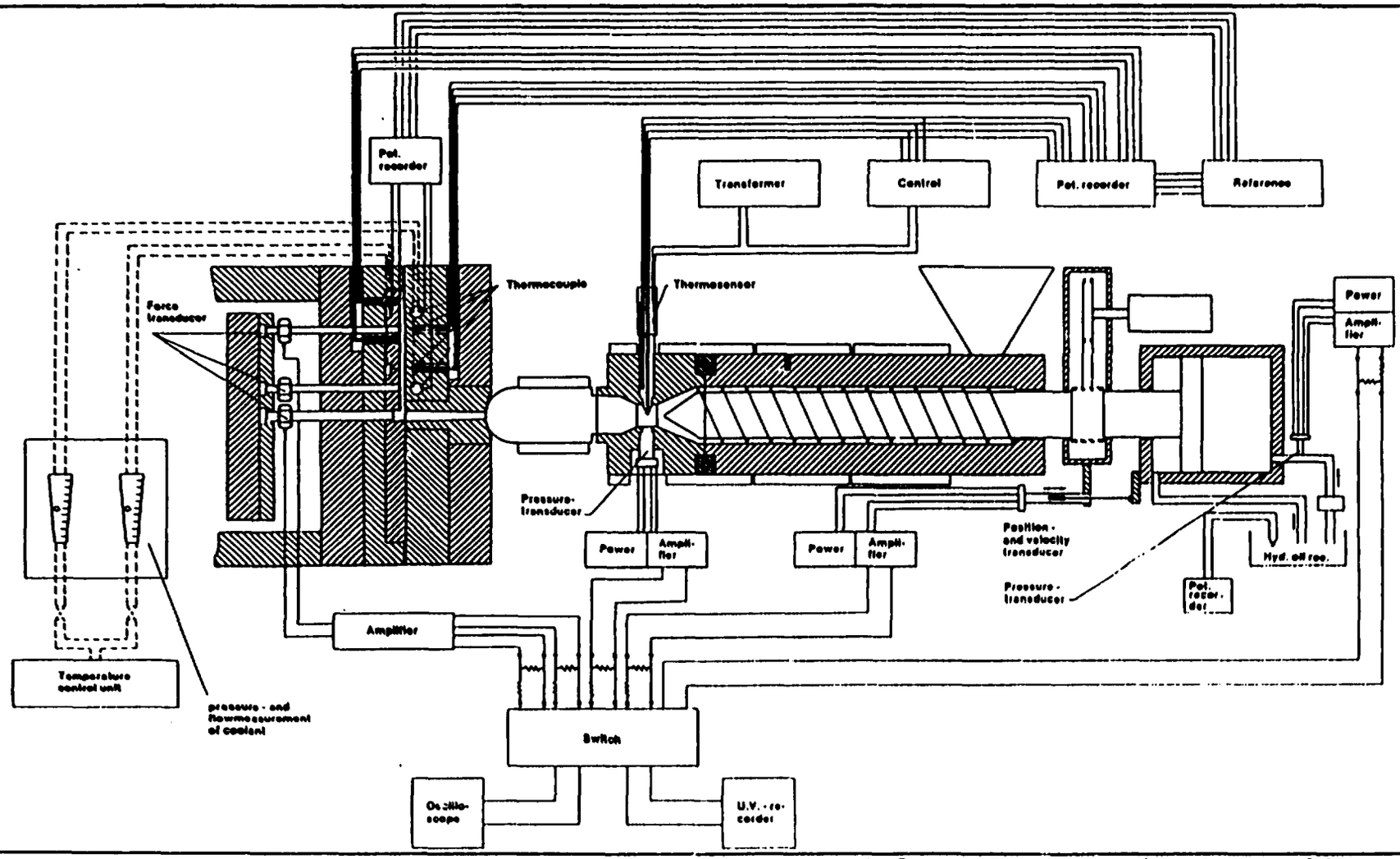

Fig. 6.5 Instrumentation of injection moulding machine

Ref: M. Jensen, Injection Moulding Variables and their Influence on some Properties of Semi-crystalline polymers. Ph.D. Thesis, Loughborough University