

**VOCATIONAL HIGHER SECONDARY
SECOND YEAR**

RUBBER TECHNOLOGY

Teachers' Sourcebook



**Government of Kerala
Department of Education**

2006 -2007

State Council of Educational Research & Training (SCERT)

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PREFACE

Dear teachers,

The learners centered pedagogy introduced has been fetching fruitful results in the VHSE. The meaningful changes adopted in the learning process and evaluation system has got wide acceptance and appraisal.

The emerging ever widening horizon of rubber technology is a challenging area of professional education. The scope and hope of area building is ever green in this area of technology. Rubber technology is a practice rather than a science and hence activity oriented pedagogy is much relevant. The student must be equipped to face the challenges and to intake updated technology. In this regard the problem solving ability of the learner is of much importance and significance.

The source book of rubber technology is designed in such a way that the activity oriented learning process would maximize the skill and enthusiasm of the learner. The hands behind this source book are of experienced teachers of rubber technology with sufficient industrial exposure. The theoretical and practical aspect of the subject has been incorporated in a comprehensive manner. Hope this book which will offer helpful support for your planning and evaluation and also for implementing the curriculum.

Your comments and suggestions are almost welcome and whole hearted support is expected.

With regards,

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**Thiruvananthapuram,
29/06/2006**

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PART I

CHAPTER 1

GENERAL APPROACH

SIGNIFICANCE OF VOCATIONAL EDUCATION

The ultimate aim of education is human refinement. Education should enable the learner to formulate a positive outlook towards life and to accept a stand which suits the well being of the society and the individual as well.

The attitude and potential to work has determined the destiny, progress and cultural development of the human race. As we all are aware, the objective of education is to form a society and individuals having a positive work culture. The educational process expected in and outside our formal schools should concentrate upon inculcating concepts, abilities, attitudes and values in tune with these work culture. Hence vocationalised education cannot be isolated from the main stream of education. In another sense, every educational process should be vocationalised. However due to our inability to utilize the resources wisely, scarcity of job opportunities is a severe issue of the present society. For overcoming this deep crisis, emergent techniques have to be sorted out and appropriate researches have to be seriously carried out. It is in the sense that the content and methodology of Vocational Higher Secondary Education have to be approached. The need for meaningful linkages between the world of work and world of education is well recognized. The essence of the recommendations made by various commissions and committees is that the vocationalisation should be the main feature of the future system of education at the higher secondary stage, it can be extended to school level also.

Vocational education is a system of education which intends to prepare students for identified occupations, spanning several areas of activities.

The Vocational Higher Secondary course was envisaged as a part of the National Policy on Education with the noble idea of securing a job along with education. The relevance of vocational education is very great in this age of unemployment. This education system, which ensures a job along with higher education stands aloof from other systems of education.

This education imparts the life skills required by the youth to enter the world of work and

assuming the responsibilities of adulthood. As per the expert meeting report (2001) of UNESCO, the life skills are grouped under 4 categories. They are

1. Skills for personal fulfillment
2. Skills for living in society
3. Skills for dealing with changing economies
4. Skills for dealing with changing work patterns.

Vocational Education ensures fulfillment of manpower requirement or national development and for social security for the citizens through self-employment. It also helps to reduce the migration of rural youth to urban areas and thus helps in rural development.

The learners of Vocational Education get an opportunity to avail one year apprenticeship training in industries to improve their practical skill. During the course of study, on the job training (OJT) for 10 days in a year is arranged to improve the skill and efficiency of the learner. This education system motivates the attitude towards self –employment through Production Cum Service Training Centres. (PSTC)

OBJECTIVE OF VOCATIONAL EDUCATION

The National policy on education has accorded very high priority to the program of vocationalisation of education, considering the following objectives.

1. To fulfill national goals of development and the removal of unemployment and poverty.
2. To impart education relevant to increased production and productivity, economic development and individual prosperity.
3. To make available skilled work force at all levels to alleviate the rural unemployment and for the development of nation.
4. To develop environmental awareness to ensure sustainable development.
5. To develop vocational aptitude, work culture, values and attitudes of the learners so as to enrich the productivity of the nation.
6. To develop entrepreneurial competencies and skills of learners for self reliance and to undertake gainful self employment.
7. To facilitate the expansion of higher education and explore future opportunities through innovative guidance and programmes.
8. To develop vocational competencies, creative thinking in the related areas and facilitate training.
9. To create awareness on mental, physical and social health.
10. To acquire awareness about different job areas and to provide backgrounds for accruing higher level training in subjects concerned.

Learning

Learning is construction of knowledge through a continuous mental process. It is an advancement through adding and correcting in the light of comparing the new issue with the previously learned concepts. Learning is an intellectual process rather than the mere memorization of facts. Learning is a conglomeration of a variety of activities like problem solving, finding out co-relations, prediction, arriving at conclusions, rational as well as critical thinking, finding applications, grouping for other possibilities and extracting the crux when opportunities are provided for intellectual processes learning will become effective and intellectual ability will get strengthened.

Theoretical foundations of learning

Education is the best device that can be adopted for creation of a new society. It should be democratic in content and process and should acknowledge the rights of the learner. It should also provide opportunity for better citizenship training. The concept of equality at all areas should get recognition in theory and practice. There should be conscious programme of action to develop nationality, humanness and love against the encroachment of sectarianism of caste and religion. The learner should become cognisant of the implications of privatisation, liberalisation, globalisation etc.

They should develop a discrimination to use the acquired learning as a liberative weapon. They should be able to view education and life with the perspective of social well being. A basic awareness of all the subjects needed for life is essential for all students.

The remnants of perspectives formed in us during the colonial period still influence our educational philosophy. The solution to the present day perplexities of the society which approaches education on the basis of competitions and marketisation is only a comprehensive view of life.

It is high time that education was recognized on the basis of the philosophy of human education. The human approach to education has to reflect in its content, learning process and outlook. The perspective of 'learning to be' and learning to live together as expressed by the UNESCO and the concepts of existential, intrapersonal and interpersonal intelligence.

The basis of new approaches on curriculum and teaching- learning process are derived from the developments tookplace in the east and west of the world.

When we begin to see the learner at the centre of the learning process, the teaching process has to be changed timely. It is the result of the rapid growth and development of Science and Technology and Pedagogy. If we want to undergo the changing process, we have to imbibe the modern hypothesis regarding learner that they have

- great curiosity
- good imagination
- numerous other qualities and interests
- independent individuality
- interest in free thinking and working In a fearless atmosphere.
- interest in enquiring and questioning.
- ability to reach conclusions after logical thinking.
- ability for manifest and establish freely the conclusions arrived at.
- interest for recognition in the society.
- determination to face the interference of society and make components which is a part of social life.

When we consider the learning system, the domains to be stressed in education according to the modern development becomes relevant.

The knowledge domain consists of

- Facts
- Ideas
- Laws
- The temporary conclusions and principles used presently by scientists.

The learning is a process. The continuous procedures we undergo to reach a particular goal is process. The skills which are parts of the process to analyze the collected ideas and proofs and come to a conclusion is called process skills. Some important **process skills** are, **the skills;**

- To observe
- To collect data and record
- To classify
- To measure and prepare charts
- To experiment
- To predict
- To recognize and control the variables
- To raise questions
- To generalize
- To form a hypothesis and check.

- To conclude
- To communicate
- To predict and infer
- To use tools.

***Observation** is the process of acquiring knowledge through the senses. It is purely objective oriented. Learning experiences which provide the use of all the senses may be used.*

*The process of grouping is known as **classifying**. Starting from simple groupings of data, it can extend to the level of classification into minute sub-groups.*

In addition to this, consider the skills related to creative domain also, they are skills:

- To visualize
- To connect facts and ideas in new ways.
- To find out new and uncommon uses of objects
- To fantasize
- To dream
- To develop creative isolated thoughts Creativity is an essential component of process and activities. The element of creativity is involved in finding out problems, formation of hypothesis, finding 'solutions' to problems etc. Through activity oriented learning experiences, opportunities to express creativity can be created.

Again, the following factors consisting in the **Attitudinal domain** are also important as;

- Self confidence
- Love for scientific knowledge
- Attitude to know and value history
- Respect human emotions
- Decide with reasonable present problems
- Take logical decisions regarding personal values

'Hypothesis' is a temporary conclusion drawn using insight. Based on knowledge and experiences relating to the problems the causes and solutions can be guessed.

As regards the **application domain** the important factors are the ability to:

- observe in daily life examples of ideas acquired.
- take the help of scientific process to solve the problems of daily life.
- choose a scientific life style
- connect the ideas acquired with other subjects.

- integrate the subjects with other subjects.

Some basic stands have to be taken on the new scientific knowledge about intelligence learning and teaching. When such basic concepts are accepted changes are required in the following factors.

- The vision, approach, structure and content of the curriculum.
- The vision, approach, structure and content of the textbooks.
- Role of the teacher and the learner.
- Learner atmosphere, learning materials and learning techniques.

Some scientific perspectives accepted by modern world in educational psychology are given below.

Constructivism

This approach puts forward the concept that the learner constructs knowledge. New knowledge is constructed when ideas are examined and practiced in new situations relating them with the previously acquired knowledge and experience. That is assimilated into the cognitive structure of one's knowledge. This method which gives priority to critical thinking and problem solving provides opportunity for self motivated learning.

Social' Constructivism

Social constructivism is a sub section of constructivism. Knowledge is formed, spread and imbibed and it becomes relevant in a social environment. Interactive learning, group learning, co-operative participatory learning, all these are concepts put forward by social constructivism.

The main propounders of constructivism are piaget, vygotsky and Bruner.

Discovery learning and interactive learning have prime importance. Learning takes place as a part of the attempt for problem solving. The activities of a learner who confronts cognitive disequilibrium in a learning situation when he tries to overcome it leads to the renewal of cognitive structure. It is through this process construction of new knowledge and the assimilation of them take place. Observation and enquiry are unavoidable factors. The learner advances towards new areas of acquisition of knowledge where he tries to compare his new findings with the existing concepts.

Learning is a live mental process. Rather than the ability for memorization of facts cognitive process has to be given emphasis. The process of problem analysis, elucidation, critical thinking, rational thinking, finding out co-relation, prediction, hypothesis formation, application, probing for other possibilities, extracting the crux and other processes are of

critical importance in learning.

Constructivism gives greater predominance to co-operative learning. Social and cultural factors influence learning. Sharing of knowledge and experience among learners, collective enquiry, assessment and improvement, group activity and collaborative learning by sharing responsibilities with the objective of public activity, provide opportunity for effective learning.

In learning internal motivation is more important than external motivation. The learner should have interest and initiative in learning. Learning situation should be capable of forming a sense of ownership in the learner regarding the learning process.

Learning is not a linear process. It progresses in a spiralled way advancing deeper and wider.

New concepts of Learning

1. Discovery Learning

The teacher has to create a motivating atmosphere for the learner to discover concepts and facts, instead of listening always. Creating occasion to progress towards discovery is preferred. Instead of telling everything before and compelling to initiate the models, situations are to be created to help the children act models as themselves.

2 Learning by discussion

Discussion leads to learn is Burner's theory. Here discussion is not opposing each other. It is a sharing on the plane of ideas. New ideas are arrived at by seeking explanations, by mutual giving and taking of ideas and by problem solving.

3. Problem solving and learning

Only when the learner feels that some thing is a problem to be solved that he takes the responsibility of learning it. It is an inborn tendency to act to solve a problem that causes cognitive disequilibrium in a particular area. It is also needed to have confidence that one is capable of doing it. The problems are to be presented in consideration of the ability and level of attainment of the learner.

4 Collaborative learning

This is the learning in which the responsibilities are distributed among the members of the group keeping common learning objectives. The common responsibility of the group will be successful only if each member discharges his duties. All the members will reach a stage of sharing the result of learning, equally through the activity with mutual understanding.

The teachers who arrange collaborative learning will have to make clear the responsibilities to be discharged. This is possible through the discussion with the learners. Collaborative learning will help to avoid the situations of one person working for the whole group.

5 Co-operative learning

This is the learning in which the learners help one another. Those who have more knowledge, experience and competency, will help others. By this exchange of resources the learners develop a plane of social system in learning also. As there are no high ups and low ones according to status among the learners they can ask the fellow students doubts and for helps without any hesitation or in hesitation Care should be taken not to lead this seeking of help to mechanical copying. It should be on the basis of actual needs. So even while encouraging this exchange of ideas, among the members of the group cautious acceptance is to be observed as a convention. There should be an understanding that satisfactory responses should come from each member and that the achievement of the group will be assessed on the basis of the achievement of all the members

6. Zone of Proximal Development

Vygotsky observes that there is a stage of achievement where a learner can reach by himself and another higher zone where he can reach with the help of his teachers and peers and elders. Even though some can fulfil the learning activity by themselves there is the possibility Of a higher excellence. If appropriate help is forth covering every learner can better himself.

7. Scaffolding

It is natural that the learner may not be able to complete his work if he does not get support at the proper-time-The learner may require the help of the teacher in several learning activities. Here helping means to make the learner complete the activity taking responsibility by himself. The teacher has to keep in mind the objective of enabling the learner to take the responsibility and to make it successful.

Learning an active mental process

Learning being a cognitive process, the teacher needs to know cognitive processes to facilitate the creation of learning opportunities. Learning can be made effective by providing learning experiences involving mental processes like

- Retrieves/recollects/retells information
- Readily makes connections to new information based on past experiences and formulates initial ideas /concepts.
- Detects similarities and differences

- Classifies/categories/organizes information approximately.
- Translates/transfer knowledge or understanding and applies them in a new situation.
- Establishes cause-effect relationships
- Makes connections/relates prior knowledge to new information/applies reasoning and draw inferences
- Communicates knowledge/understanding through different media.
- Imagines/fantasises/designs/predicts based on received information
- Judges /appraises/evaluates the merits or demerits of an idea/develops own solutions to a problem.

9. Intrinsic Motivation

Intrinsic motivation is given more importance than extrinsic motivation. The teacher has to arouse the internal motivation of the learner. A person internally motivated alone can immerse in learning and own its responsibility

10 Multiple Intelligence

The Theory of Multiple Intelligence put forwarded by Howard Gardener has created a turning point in the field of education . The National curriculum document has recommended that the curriculum is to be designed taking into consideration of this theory

Main factors of the intellect

1. Verbal/linguistic Intelligence –

Ability to read and write , making linguistic creations , ability to lecture competence to effective communication , all these come under this . This can be developed by engaging in language games and by teaching others.

2. Logical / mathematical Intelligence

Thinking rationally with causes and effect relation and finding out patterns and relations come under this area. Finding out relations , explaining things, sequential and arithametical calculations etc. are capable of developing this area of intelligence.

Visual / spatial Intelligence In those who are able to visualize models and bringing what is in the imagination into visual form and in philosophers , designers and sculptors this area of intelligence is developed. The activities like modeling using clay and pulp, making of art equipments , sculpture , and giving illustrations to stories can help the development of this ability.

Bodily Kinesthetic Intelligence

The activities using body language come under this. This area of intelligence is more developed in dancers and actors who are able to express ideas through body movements and in experts in sports , gymnastics etc.

1. Musical Intelligence

This is an area of intelligence which is highly developed in those who are able to recognize the different elements of music in musicians and in those who can hear and enjoy songs. Playing musical instruments, imitating the songs of musicians , listening silently to the rhythms and activities like this area capable of developing this area of intelligence.

2. Interpersonal Intelligence

Those in whom this area of intelligence is developed show qualities of leadership and behave with others in a noble manner. They are capable of understanding the thought of others and carrying on activities like discussion successfully.

7. Intrapersonal Intelligence

This is the ability to understand oneself. These people can recognize their own abilities and disabilities. Writing diaries truthfully and in an analyzing way and assessing the ideas and activities of others will help developing this areas of intelligence

8 Naturalistic Intelligence

A great interest in the flora and fauna of the nature, love towards fellow beings interest in spiritual and natural factors will be capable of developing this area.

9. Existential Intelligence

The ability to see and distinguish our own existence as a part of the universe, ability to distinguish the meaning and meaninglessness of life, the ability to realize the ultimate nature of mental and physical existences, all these are the peculiarities of this faculty of intelligence.

Emotional Quotient

The concept of emotional intelligence put forward by Daniel Goleman was used in framing the new curriculum. The fact that one's Emotional Quotient (E.Q) is the greatest factor affecting success in life is now widely accepted. The teacher who aims to focus on improving the emotional intelligence of students need to concentrate on the following.

i) Ability to take decisions

Rather than imposing decision on students while planning and executing activities, the

students may be allowed to take part in the decision making process. Taking decisions through open discussion in the class, inviting students suggestions on common problems etc. are habits to be cultivated.

ii) Ability to reach consensus

- When different opinions, ideas and positions arise, the students may be given the responsibility to reach a consensus.
- Imagining what would be the course of action in some situations, allowing to intervene in a healthy way in problems between individuals.

iii) Problem solving

- Developing the idea that there is reason and solution to any problem.
- Training in finding reasons for problems.
- Suggesting solutions through individual or group efforts.
- Discussing social problems.
- Analyzing the shortcomings in methods to solve problems.

Whether plastic can be banned within school premises can be given as a problem. Group discussion will provide reasons and solutions. Problems which can influence classroom learning and for which the learner can actively contribute

Solution need to be posed

- Self criticism, evaluation
- Ability to face problem-situation in life
- Thinking what one would do if placed in the situation of others, how one would respond to certain experiences of others - All these foster the growth of emotional intelligence.

iv) Life skills

Life skills need to be given a prominent place in education. W.H.O. has listed : skills required for-success in life.

- Self awareness
- Empathy
- Inter personal relations
- Communication
- Critical thinking
- Creative thinking
- Decision making

- Problem solving
- Coping with emotion
- Coping with stress

The new curriculum addresses these areas.

Knowing the characteristics of the learner, role of the teacher and how to use the teachers handbook help the teacher to plan and effectively implement learning activities.

Role of a Teacher

In the earlier approach the teacher was mainly depending on the lecture method for teaching. But in the new method of education the student centered approach is given more importance than the teacher centered approach. Under this changed scenario the teacher has to perform the following roles in the classroom.

The teacher should be

- A facilitator of learning
- A guide to the overall development of the student
- A good observer and motivator
- Able to consider the activities, needs, special features and age group of students at higher secondary level.
- Able to understand the limitations of learner and their learning problems.
- An instructional material developer
- A good communicator
- An innovator
- Able to raise leadership qualities and self confidence of the learner
- An authoritarian in the concerned subject
- Able to arrest and sustain the attention of the learner
- Able to bring out and encourage the inborn talents.
- A resource manager to ensure the optimum utilization of resources.
- A systematic record keeper
- A controller to issue guidance to the students
- A person with high level of practical competency
- Able to correlate area of study with familiar environmental situations
- A self evaluator and good listener
- Able to create awareness in social problems

- A person with democratic and humanitarian approach
- A professionalist as well as philosopher
- A good evaluator
- A good organizer and a friend.
- A co-learner as well as co-researcher
- Able to give assistance and advice in placement needs and self employment by giving moral and technical support
- Able to keep moral values
- A person equipped with skill for using new techniques of learning
- Optimistic and impartial

Child friendly Class Room Atmosphere

Learning can be effective and enjoyable only when the class atmosphere is according to the new conception of learning and the characteristics of higher secondary teacher.

- Class and seating are arranged in an attractive way
- Democratic nature is upheld
- Always active
- Students interact with teachers without fear
- Opportunity for a variety of activities
- Students allowed to involve interesting group activities
- Learning speed, learning style and differencing levels of attitudes are considered. Help is extended whenever needed.
- Sufficient instructional materials are available
- There is freedom of expression, students share their ideas and experiences
- Students are given acceptance and encouragement
- Healthy atmosphere
- Needs of each student is given consideration. Happy and energetic atmosphere
- Teachers work considering the rights of students
- Problems handled in a patient way
- Teachers look at all events from the student's view point

There will be students of various ability levels in any class because learning style, learning speed, varying exposure to language experiences, physical and psychological problems and varying socio-cultural background.

The learning experiences provided must help to bring the low activities to an expected level and extended the breadth and depth of the skills of the high activities.

By repeating experiences, introducing variations in a learning experience to suit different levels and if needed, formulating additional experiences the problem of varying ability levels can be tackled.

Role of Learner

The learner in second year has undergone a learner centered and process oriented learning experience up to first year. The learner at this age is in awakening stage and he is enthusiastic about environment. He needs recognition and encouragement from environment and also recognize as a grown up man. He is adequately competent to select vocational subjects according to his aptitude and interact and to acquire higher education and profession as he wishes. The aspirations about future life is framed in this particular age for seeming national and international job opportunities. Some of the peculiarities of learner at this stage are;

- Physical, intellectual and emotional planer are intensive changes during the age and their reflections can be observed
- Ability to enquire discover and establish cause effect relationship between phenomena
- Headiness to undertake challenges
- Capacity to shoulder leadership roles
- Attempt to interpret oneself
- Susceptibility to different pressures
- Doubts, anxieties and eagerness about sex
- Imaging for social recognition

Needs of Learner

- To make acquaintance with a job or self employment through vocational education
- To acquire more knowledge in the concerned area through higher education
- To recognize and encourage the peculiar personality of the later adolescent period
- To enable him to defined against the unfavorable circumstances without any help

Role of learner

- Active participant in the learning process
- Act as a researcher
- Sharer of information
- Sharer of responsibilities

- Collect information
- Jakes leadership
- Involves in group work
- Act as a co-participant
- Observes his environment
- Experiments and realize
- Make interpretations and draw inferences
- Mould himself in to an active contributor for the welfare of the society

Evaluation

In vocational higher secondary education, a new approach to education and evaluation should be made. Evaluation must be a systematic and continuous process. As the curriculum is based on vocational stream, capacity building is a most important part and it should be evaluated accordingly. The technical skills, interest in the particular field, communication skill, analysis organizing and presentation skills etc have to be evaluated. The personal and social qualities also have to be evaluated. Therefore, evaluation should be transparent, continuous and comprehensive.

Learning Aids

To make the teaching and learning process simple and effective , certain learning aids and necessary use of such aids are transacting a complex idea makes the class room live and students get more and more involved. The advances in science and technology may be effectively utilized for this purpose. Some of the learning aids listed below.

- Multimedia
- Over Head Projector
- Computer
- Internet
- Liquid Crystal display Projector
- TV, VCD, DVD and tape recorders
- Working models
- Charts
- Slides

- Video Conferencing facility
- Library
- Text book
- Source book

Society

The new educational policy uplifts the social commitment of the learner. Therefore the society can also give some valuable contributions in this changing situation. The new system also ensures that the learner can perform certain useful services for the betterment of society. The social obligations can be illustrated as follows.

- To enrich social values, aptitude and ability in learner
- To develop entrepreneurial aptitude and ability which helps social welfare and self employment
- New system of education adrpts OJT, PSTC etc is a part of vocational curriculum which helps to make close contact with the society.
- The resources available from our society can be positively utilized to convene seminars, interview etc.
- Social organizations can help learners to make their education socially committed.
- The social clubs like NSS, Tourism club, CDO club, energy club etc functioning in schools can make direct link with the society.

CHAPTER 2

SUBJECT APPROACH

APPROACH TO RUBBER TECHNOLOGY

Introduction

Rubber has become one of the most versatile and strategic raw materials catering to wide range of applications. About 92% of the natural rubber produced in India is contributed by Kerala and only 14% of the total production in the state is consumed by the rubber industries within the state. The percapita consumption of rubber in India is 0.4 kg per year against the world average of 4 Kg. Per year . This gives an idea about the enormous potential for the growth in the domestic market. Thus there is good potential for the development of rubber based industries in Kerala especially in the small scale sector.

Rubber Technology course helps to study different methods of value added rubber product manufacturing. This course helps to impart technical knowledge to students.

The state government is now giving various incentives such as technical assistance, investment subsidy, training of entrepreneur for concession, rehabilitation of weak units and development of infrastructure for the promotion of big as well as small scale industries. In order to give greater thrust to the promotion of rubber based industries, the Department of Industries and Commerce, Government of Kerala is conducting Entrepreneur Development Programme (EDP).

The influence of Rubber Technology in various fields like transport health and engineering have much importance. Students should acquire the working principle and handling methods of various equipments and machinery used in Rubber Industry

Learning Approach

Learning approach of this course based on the learning to know, learning together, and learning to deal. Learning is construction of knowledge . Following methods are used for construction of knowledge.

1. Discovery learning

2. Enquiry learning
3. Collaborative learning
4. Co-operative learning
5. social culture learning

Above methods can be used in Rubber Technology course. Learning approach should stimulate the multiple intelligence and EQ of the students. Learning should be learner centred, locally specific, life related and problem oriented process. The process based approach is an important feature of new curriculum. In the new activity oriented approach the role of teacher changes to facilitator of knowledge. He facilitates various learning situations from which learner can create knowledge.

Need of new approach

Students should develop skills to use rubber machineries, equipments, chemicals to study, practical methods of manufacturing rubber products. Learner centred learning should be used. Technical aptitude, discover learning and group working skills of the students will be enhanced.

The following skills to be achieved by the students.

1. Enhance curiosity.
2. Achieve Capability to analyse.
3. Skills to assimilate higher levels of knowledge.
4. skills to use rubber technology in day to day life.
5. Skills to convey the knowledge to society.
6. Skills to communication.
7. Skills to face technical problem and solving of which related to rubber product manufacture.

Role of teacher

In the learner centered curriculum the teacher is a person who has to give intrinsic motivation among students. For achieving this goal teacher should be

1. A facilitator of learning.
2. A good communicator
3. An innovator.
4. A good evaluator.
5. A good organiser.
6. Able to consider the abilities, needs of special features and age group of students to higher

secondary level.

7. Able to understand the limitation of the students and their learning problems.
8. A good guide to the over all development of the students.
9. An innovator.
10. Able to raise the leadership qualities and self confidence of the students.
11. An authoritarian in the concerned subject.
12. Able to arrest and sustain the attention of the students.
13. Able to bring out and encourage the inborn talents.
14. A resource manager.
15. A systematic record keeper.
16. A counselor to issue guidance for students
17. A person with a high level of practical competency.
18. A self conductor evaluator and good listener.
19. Able to create awareness in social problems.
20. A person with democratic and humanitarian approach.
21. A professional as well as philosopher.
22. Able to keep social values.
23. Optimistic and impartial.

ROLE OF STUDENTS

1. Collection of data from fields like rubber factories, research institution and plantation.
2. Collection of specimen from selling outlets and automobile workshop.
3. Make reports of products or their news with special mention to rubber factories.
4. Discussion, seminar and field visit with the active participation of faculty members, subject experts and research organization in the filed of rubber technology.
5. Preparation of project report which enables in effective exposure to realities of rubber field.
6. Conduct case studies about the technical problems in industries/ product development.

LEARNING AIDS

1. Text books, reference books, source book.
2. Flip charts, discussion notes, seminar reports, projects.
3. Learning equipment like OHP, LCD projector etc.
4. Charts, slides, diagrams, pattern

5. Laboratory workshop
6. Factories, research institutes, higher study centers.
7. Study Tour/Exhibition
8. Journals
9. Field visit
10. Internal Library

LEARNING STRATEGIES

Some of the important learning strategies are experiment, field visit, discussion, seminar, debate, project work, audio visual aids etc. These activities help students to develop their skills, abilities, leadership, quality research mentality and over all performance. The detailed description of learning strategies are given in the chapter 'learning strategies'.

CHAPTER 3

LEARNING STRATEGIES

Learning approach

A learner-centered and activity-based learning approach is to be adopted. The many-sided intelligence of the students should be explored to gain in-depth knowledge. The method of teaching should be based on the student's needs, their expectations and interest. Their participation also should be ensured. For this we can adopt different strategies and techniques.

1 Discovery learning

The teacher has to create an atmosphere that encourages the learner to discover ideas and facts on his own. For example, the teacher can assign the students to identify the characteristics of different breeds. This gives an opportunity for the learner to observe the different breeds in their surroundings or they can collect information from different sources like internet and print media. Their observation can be consolidated into the product.

2 Co-operative learning

In this method the learners learn by helping each other. The negotiations among peers take place here.

For example if we want to create an awareness among the students about different milking methods, the students can be divided into different groups and a group discussion on the topic can be conducted. The ideas evolved from the discussion can be consolidated and presented in the class.

3 Collaborative learning

The two important aspects of this method of learning are sharing of ideas and negotiation among the learners. Suppose we want to deal with different feeding materials for animals. Here also they can be divided into groups and the teacher can ask them to collect different varieties of feeding materials and their characteristics. Their observation can be consolidated and presented in the class.

4 Socio cultural related learning

This method of learning pertains to the social and cultural aspects of the society. For example, an informal interview can be conducted by the learner to study the influence of different poultry products on the people of a particular locality. A suggested topic can be the problems related to marketing of pork in a Muslim dominated area.

LEARNING OBJECTIVES

- 1 To create an awareness about importance of poultry industry
- 2 To get an idea about nutritive value of poultry products.
- 3 To familiarise the anatomy and physiology of poultry
- 4 To make learner aware about breeds and breeding.
- 5 To create awareness about rearing and housing system of poultry.
- 6 To get an idea about feeding of poultry.
- 7 To create an awareness about management of chicks.
- 8 To understand the management of growers.
- 9 To get an idea about management of layers.
- 10 To analyse the management of breeders.
- 11 To know about different aspects of managing broilers.
- 12 To understand the importance of table eggs and eggs products.
- 13 To get acquainted with hatchery operations.
- 14 To get an idea about common diseases of poultry.
- 15 To know about the care and management of ducks, turkeys and quails.

Learning strategies

In the modern era of globalization the introduction of new technologies ensure only the survival of the fittest. So it becomes a necessity to equip the leanness to face the growing challenges in the competitive world. Hence the traditional approach to learning is no more relevant in the present context. The teacher should use instructional techniques that motivate the student to construct his own knowledge. Now the learners are not passive listeners , but they are the active participants in the construction of knowledge. Here the teacher – student interaction should be given much importance.

In the new instructional strategy while selecting the methods of teaching, the social and psychological aspects of the learner is to be taken into consideration. The given activities for learning are only suggested one. It can be altered according to the discretion of the teacher.

To obtain the objectives, the new system of education is introduced in the Vocational Higher Secondary Education for attaining the objectives of the courses in this system, we can adopt the following strategies.

1. Assignment

Assignment is some specific work assigned to the students as a part of their academic enrichment. There are learning activities undertaken as a continuation of class room activities to realize the curriculum objectives to a broader extent . They should be completed in time bound manner. They help to lead learner to higher level of learning from the present status. Challenging assignment can motivate the students to involve in group dynamics and achieve fruitful results . The teachers may act as a guide.

Assignment may be given on individuals or group basis. Assignment includes preparation of notes, preparation of charts, models, collection, of materials from institutions etc. Assignment develop skills of reference, observation, enquire reporting etc. It ensure the effective utilization of leisure time of the students.

2. Seminar

Seminar is a learning strategy involving an in-depth analysis of specific topic, preparation of a paper and presentation . The paper is presented by either one student or a group of students. After the presentation, there will be a discussion/ interaction in which all the students can participate . The students get an opportunity to clear their doubts and make clarification. Seminar helps to develop communication skill and overcome stage fright.

Stages

1. Selection of Topic

The topic of seminar should be relevant to the subject of study

2. Assignment of topic to individuals students or team

The topic may be assigned to one student or may be given to a group of students

3. Collection of relevant information

Information required for seminar can be collected from various sources namely books, magazines, internet, institutions, place and persons.

4. Preparation of draft paper

Based on the information collected the student may prepare a draft paper and submit it to the teachers for comments. Revise the draft paper based on the comments of the teachers. The required drafts is submitted for approval.

5. Program Scheduling

The date, time and venue of the seminar is fixed. A seminar leader may be selected from the students

6. Seminar paper presentation

The student/ students shall present the paper in the seminar. The teacher may function as the moderator during the initial stages.

7. Discussion / Interaction

A number of respondents from the students make comments on the topic. This will be followed by a general discussion. All the group members should actively participate in discussion.

8. Summing up deliberation

The moderator sums up the deliberation

9. Evaluation / Feed back

Both teachers and students evaluate the programme.

10. Preparation of final report

A final seminar report is prepared covering all the additional points discussed and consolidated.

3. Panel Discussion

It is a learning strategy in which a panel of experts are allowed to discuss a specific subjects under the control and direction of a moderator. Subjects can be divided according to the number of panel members. Number of panel members are fixed according to subdivision of points in the subject. Relevant materials and hand out may be given in advance to the learners. The monitor or moderator introduces the subject of discussion and invite a panel member to start the discussion. Each panel member is invited for discussion afterwards. After briefing by the panel members the question are raised from the audience and the panel members give suitable answer to them. A report should be submitted by each learner to the moderator .

4. Project

Project is a self-learning strategy which can exert great influence on the overall development of the learner. Project as learning strategy is to be selected where a problem arises in any part of the curriculum. The students may be divided into groups and assigned different aspects of the problem. Each group works independently .Specific aspects of the problem such as data collection, classification, analysis, report preparation and presentation is to be undertaken

by each of the members. Even though the work is divided among the members, it must be ensured that the execution of each and every activity is done with the active participation of all. After analyzing data collected from different sources, the learner arrives at a conclusion that can help to solve the problem. There by learner learns the topic though his own activity. The other advantage of this learning activities is that it helps the learner to scientifically handle any problematic situation. It helps in the development of scientific thinking and thereby builds up the students aptitude for the subject.

Stages of the project

1. Selection of a topic

The project selected should be related to the curriculum and it should not be a project for projects sake. The topic or problem should arise from the curriculum.

2. Planning of the Project

(A) Hypothesizing: Hypothesizing means making assumptions based on the available primary information.

(B) Methods and Technique : The methods and Technique should be based on the aim and Hypothesizing of the Project. The nature of the project, suitability of the tools, and the methods of learning should be related to each other.

3. Collection and Tabulation of Data

The data may be primary, Secondary or tertiary. Either census or sambling method can be used based on the objective of the project. Suitable questionnaires are to be prepared for the collection of primary data.

The collected data is to be classified and tabulated so as to make it easily understandable.

4. Analysis of data and formulation of conclusion

By analyzing the data, the reliability of the hypotheses can be examined. Preparation of graphs and diagrams and maps will positively help the analysis. The similarities relations and differences gathered from the analyzed information would tell whether the hypotheses should be accepted or rejected.

5. Preparation of Report

The cover page should have the title of the project, the period of study, name (s) of investigator / group, and the address of the school. The report should be structured in the following order.

1. Title

2. Preface
3. Hypotheses and aim
4. Methodology
5. Sources of data
6. Analysis and conclusion
7. Suggestions (if any)
8. References
9. Appendices (Questionnaire, Observation schedule, check list Etc.)

6. Presentation of the Project

When the project is presented , the learner is being evaluated and accepted. It is through this presentation that ideas are shared with others in the class and society.

The project methods promotes scientific self learning and makes him capable of solving the problem arising in real life situations.

5. Debate

Debate is a hot and interesting learning activities. A debate can be organized only on a topic on which there is difference of opinion. Therefore a topic suitable for debate has to be found.

Debate can be on relevant topic that is different and interesting to the students and relevant to society. Students with different opinion have to be identified for discussion. Those who have similar opinion should join together to form a side . Those who hold the opposite view with form the other side. It would be good to write down the topic of the debate and displayed in advance. There should also a person to control debate.

Students should be given opportunity to absorb the ideas obtained from discussion and debate, develop the idea through reading and study, and to express them through writing or other means

1. Topic Selection
2. Selection of panels keeping in balance with intelligence, gender etc.
3. Selection of moderator
4. Collection of information guided by the teacher
5. Conducting the debate under the control of moderator by avoiding any sort of personal conflicts
6. Conclusion by the moderator expressing his final version or verdict.

6. Case Study

A case may be a person, institution or a community case study is an indepth analysis of an actual event or situation. It presents real pictures of situation with facts, objective information or data : learners analyse the case to interpret, predict and resolve issues associated with it. The case study provides the learner an opportunity to analyse and apply concepts, data and theory taught from the class. Learners can work individually or in groups.

By studying realistic cases in the classroom, students develop new insights into the solution of specific on – the – job problem and also acquire knowledge of the latest concepts and principles used in problem solving.

Case may be presented by the teachers or may be provided in print form.

A simple case study may have the following steps

1. collection of data
2. Conversion of data into information
3. Analysis of the case in groups
4. Presentation of the finding by each group leader.

5. Evaluation

In addition to the above mentioned learning strategy there are many other learning strategies which can be used in appropriate situations to enrich leaning process such as problem solving, Role play, brain storming, debate etc.

7. Brain Storming

This is the best method for solving creative problems. It facilitates generation of ideas quickly. Rules for conducting Brain storming.

1. No response is wrong. So welcome every response.
2. Welcome as many responses as possible
3. No criticism is allowed
4. allow to work on others idea

Steps in Brain storming

1. Presentation of the problem
2. Provide relevant information
3. Record the ideas put forth by the participants
4. Combine similar ideas
5. Evaluate each idea and solution

6. Selection of the best solution

If brainstorming is used as an instruction strategy, the last step is not essential

8. Discussion

Discussion is essential for the student to share new finding, idea and conclusion at each stage of learning with follow students and teachers. In general discussion the teachers should guide the discussion though questioning and summarizing. The major steps involved are

1. Introduction initiated by the teacher
2. Development of discussion by giving lead points and follow up interactions
3. Transaction stage in which the key points are reviewed by the teacher and
4. Summarizing stage in which teacher provides additional support materials to ensure the achievement of the objectives

9. Group Discussion

Group discussion is an ideal method to develop Co-operation, democratic attitude, friendliness and compromising attitude which are the ultimate aims of education. During group discussion the teacher may observe each group and it needed help them to Channel the discussion towards the common objectives. All students may be given opportunity to take part and express their ideas within a time limit. The conclusion reached may be entered by each students. A group representative must present this during consolidation in which the teacher may correct or add information's to ensure that all the relevant ideas have been covered

10. Collection

Collection is a continuous learning activity, which ensure complete participation of students. The Collected item may be materials, pictures, charts, ideas, data etc. Collection provides direct experience to learn. An exhibition of collected materials will help to strengthen the concept.

11. Practical works

Experimentation contains the process skill in an integrated way. In the new approach of curriculum the student forms idea and comes to conclusion though process. The term 'Practical' when associated with a science subject usually means an experiment. The objective of doing a experiment is to explore new ideas though investigation only. Its main purpose is to verify some principles associated with theory. The Subjects ends here. But this is not the case with 'Vocational Practical'

The ultimate goal of a Vocational Education is to generate skill through continuous practice along with investigation and invention. Continuous practice transforms the unskilled

to the skilled. This is the significance and importance of practicals in the Vocational stream. Hence it is very crucial that Vocational teachers as well as instructor should understand the importance of vocational practical and act accordingly.

10. Quiz

Quiz programmes can be used as an interesting class room tool for transaction of curriculum objectives as well as to evaluate the effectiveness of transaction and achievement of students.

For conducting a quiz programme a topic should be selected based on the above objective

The students are asked to prepare question based on the topic individually. The next day / next hour the students are grouped into 3-4 groups randomly. A question is raised by a particular team and the other teams to answer them if they can answer the question they get points for that if all other teams fail to answer the question raised by the 1st team the 1st team answer the question and explain the background if necessary. All the teams get equal number of chance to ask the question. Time limit is also prescribed for the conduction of the programme. The team who scores maximum points wins

All the participants can make notes on the questions asked answer and their explanation which help them in learning

13. Models

Models are used in learning process. It enhanced the leaning experience. This is based on the 'seeing is believing'. It helps the learner a chance to see feel the model presented. Still models and working models help the students to understand the structure, working principles, actual operation etc.

Several steps are involved

1. Feeling the problem
2. The teacher should plan the type of model according to co's
3. Grouping the students
4. Briefing the tasks - Aim
 - Need
 - Material required
 - Source & Materials
 - Cost of materials
 - Division of Labour
 - Guidance

- Fixing of a time limit

5. Presentation y each group about

- (A) How the models were prepared
- (B) Details of - Expenses

working and principles

Finally Documentation of the process

6. Evaluation

- By the other groups
- later a consolidation by teachers are to be done.

14. Games

Class rooms can be made attractive by introducing different types of games. Games should be interesting as well as informative some of suitable games are

1. Odd man out
2. Cross word puzzles
3. Match the following
4. Aswamedham
5. Link game – Answer using clues.

15. Survey

This strategy involves collection of data from the group under study (book, person, materials etc.) It develop the social interaction and communication ability of the learner. It also provide a scope for discovery learning.

Step involved in survey

- Objective of survey
- Selection of area for survey/sampling frame
- Selection of survey method
- .Direct method
- With help of questionnaire/schedule
- Tabulation and analysis
- Considation and Presentation

16. Exhibition

It is a learning strategy by which the learner can get a chance to show the skill developed.

It provides the intrinsic motivation and exposure.

Exhibition item can be conducted either individually or as a group task. It can be conducted at school / Regional/State/National Level. Necessary publicity and other arrangement can be provided. Presentation, documentation participation and innovative skills of the learner can be evaluated.

17. Interview

Interview is one of the important learning strategy taking the help of a resource person. Interview is an innerview. It provide opinion and information about a topic.

An interview is conducted by the following steps

1. How to introduce a problem?
2. Invite a resource person
3. Decide the questions by learners
4. Decide the time, place etc.
5. How to discuss
6. How many students to participate
7. Implementation of the interview
8. Conclusion (Facilitator)

Items required

1. Interview Schedule

List of question prepared by learners Selection of students, selected names sequence of question

18. Field Visit

Field visit is an inevitable vocational tool to be implemented in vocational Higher Secondary Education. This helps the students to familiarise with the modern technologies and new situation in a different atmosphere. It provides learning though viewing. It is based on the principle that seeing is better than having. It enables the learning to retain the learned informations longer and to make the subject more interesting. It motivates and give more confidence in his/her particular vocation.

The facilitation should identify suitable center/ institution/site. Get prior permission from the authorities before conducting the field visit. Give instructions to the learners for collection data's/information's/materials/Specimens. Teacher may assign different duties to learners by working them different groups.

Each learner should take utmost care and interest during the visit. He/She should observe and interact at the center/ institution where the field visit is conducted

After the visit, learner should acquire the ability to apply the ideas/concepts in his future carrier. Each learner should submit a detailed report about the field visit.

20. Demonstration

Though demonstration we can present an item/product and emphasize its features very effectively

Eg:- To understand the functioning of a computer

1. Material/Item/Process
2. Demonstration
3. Venue
4. Additional requirements depending upon the nature of the item

Demonstration Process

1. Introduction about the item/Material
2. Principles – Working
3. Operation
4. Components
5. Merits of the item

20. Chart display

It is also one of the important teaching aid. It can be used in every activities of a learning process.

Chart display is a written or pictorial representation of idea or concept. It is abbreviated, brief and clear. It is prepared by study

Benefits

1. A learner gets clear idea about the concept
2. The learner can retain the ideas in his mind for longer periods
3. A complicated idea can be simplified through a chart
4. Cheap method of teaching aid.

21. Audio Visual aids

CD Rom, video clipping, slide projector, website, etc. can be used to convey information and knowledge about rubber technology. The facilitator prepares the topic and presents through audio-visual medium. Topics related to rubber technology are effectively communicated by this way.

22. Reference

Referencing is an unavoidable learning method for technical subjects. Texts and books are very costly in the case of Rubber Technology and the availability is also less. Hence group referencing is encouraged in this subject. Student groups

refer the materials relevant to the topic and prepare write up. These write ups are presented in the whole group and thus the sharing of ideas is resulted. The strategy develops the positive attitudes and skills of the learner. Since the participation of the learner is assured, their enthusiasm and communication skills are manifolded. The validated write up are compiled in the students subject Diary.

The list of reference books are given at the end of each unit which are only samples. The facilitator and students can search for further sources; Internet sites, pamphlets, articles, journals etc, can also be effectively used in referencing.

CHAPTER 4

CURRICULUM OBJECTIVES

CURRICULUM OBJECTIVES (THEORY)

UNIT. 1

Processing Technology

- 1.1 To get a clear picture about mastication and blending of raw rubber through. Discussion and experiment and presented them as write up and record.
- 1.2 To get an idea about master batching, mixing and compounding of rubber through general discussion, experiment and chart display and presented as write up and record
- 1.3 To understand different processing methods like spreading calendaring, sheeting and fabric coating through IT, show seminar and reference and presented them as field visit report, write up and seminar reports
- 1.4 To conceive the idea of extrusion process through IT show, and panel discussion and presented them as write up and flow chart.
- 1.5 To acquire the concepts of different molding techniques and curing methods through. Group discussion, Experiment and assignment and presented them as write up, record and assignment.

UNIT II.

Manufacture of later Products

- 2.1 To conceive the idea about equipments and machinery used for manufacturing of dipped goods through seminar, discussion and experiments and presented them as seminar report, and write ups.
- 2.2 To attain idea about compounding of late for manufacture of various types dipped goods and typical dipping compound formulation through chart, project, specimen collection and experiment. The project report, write-ups & collected specimens are presented.
- 2.3 To acquire idea on manufacture of important dipped good like gloves, balloons, rubber bands through experiment flow chart and assignment. The assignment work, chart and write ups are to be presented.

- 2.4 To attain idea on latex casting and latex thread through assignment, seminar and flow-chart. The write-ups chart and seminar report is to be presented.
- 2.5 To conceive more knowledge on manufacture of latex foam by Talalay and Dunlop process, typical compound formulation, machinery and equipment required for foam products through field visit, discussions and chart display. And also presented them as write-ups and field visit report.
- 2.6 To attain more idea on manufacture of latex cement and adhesives, latex paint and protective coatings and rubberized road through assignments, write-up and discussion notes, and presented them as write up and discussion notes

UNIT III

Non Tyre Rubber Products

- 3.1 To get a clear idea about compounding and manufacturing methods of rubber footwear and belting through experiment, project, and field visit, Audiovisual and reference and presented them as report.
- 3.2 To get awareness about compounding and manufacturing methods of rubber. Hose and cables and wires through assignment, discussion, reference, field visit and audio visual aids and presented them as write up, assignment and field visit report.
- 3.3 To get a clear picture about compounding and manufacturing methods of moulded goods, rubber to metal bonded products like rubber covered rollers, rubber lining of chemical plants, shock absorbers and ant vibration mountings through experiment, assignment, discussion and reference and presented them as record, assignment & write up

UNIT IV.

Tyres

- 4.1 To familiarize the history of tire industry and tire components of tire through reference, chart display and group discussion and presented them as write up
- 4.2 To acquire the idea about tire manufacturing through chart display, group discussion, factory visit and reference. Also presented them as field visit report and write up.
- 4.3 To attain the idea about cycle tire, cycle tubes and automobile tubes through general discussion, assignment and factory visit and presented them as field visit report.
- 4.4 To acquire the idea about finishing operations through assignment and reference. And presented as assignments and reference notes.

UNIT V

Testing and Specification of Rubber

- 5.1 To acquire a clear idea about testing and specification of latex through experiment and

reference and presented them as reports.

- 5.2 To get a clear idea about dry rubber testing such as shear and compression, flex resistance through experiment, and assignment and presented them as report.
- 5.3 To conceive the ideas of abrasion, hardness, swelling and ageing, stress strain relationship of elastomers through experiment, debates and assignment and present them as report.
- 5.4 To get an awareness about ISI standards of various rubber and rubber products through reference quiz and assignment and presented them as report

CURRICULUM OBJECTIVE (PRACTICAL)

UNIT I

Preparation of dispersion, emulsion and solution

- 1.1 To acquire the skill to make dispersions, emulsions and solutions for latex compounding through work practice.

UNIT II

Latex Compounding

- 2.1 To achieve the ability to prepare latex compound through work practice.

UNIT III

Latex products

- 3.1 To acquire the ability to make latex compound and produce rubber band through work practice.
- 3.2 To attain the ability to make latex compound and to produce hand made gloves (house hold gloves) and finger cap through work practice.
- 3.3 To acquire the skill to make latex compound and to make balloon through work practice.
- 3.4 To achieve the ability to prepare latex compound and to make latex foam through field visit/OJT

UNIT IV

Mastication & Blending of different elastomers.

- 4.1 To attain the ability to do the mastication of the raw natural rubber through work practice.
- 4.2 To achieve the ability to do blending of NR with SBR through work practice.

UNIT V

Dry rubber compounding

- 5.1 To acquire the ability to make dry rubber compound through work practice.

UNIT VI

On the Job Training Programme (OJT)

- 6.1 To familiarize the real work situation and attain the skill to operate giant machineries.

UNIT VII

Dry rubber products

- 7.1 To achieve the ability to do rubber compounding and to produce mats through work practice.
- 7.2 To acquire the ability to do rubber compounding to produce paperweight, washer, rubber ball through work practice.

To attain the skill to produce Hawaii sole and strap by blending synthetic rubber and NR through work practice.

CHAPTER 5

SYLLABUS

RUBBER TECHNOLOGY SECOND YEAR

Syllabus (140 hours)

THEORY

UNIT I
PROCESSING TECHNOLOGY (20hrs)

Processing methods for manufacturing of products from dry rubber – Blending and mastication – Master batching – Mixing and compounding, spreading, calendaring, sheeting and Fabric coating extrusion, moulding, curing in auto clave, and hot air and hot water.

UNIT II
MANUFACTURE OF LATEX PRODUCTS (45hrs)

- a) Dipping, compounding of latex for manufacture of various types of dipped goods –typical dipping compound Formulation – manufacture of important dipped goods like gloves, balloons, rubber bands – equipment and machinery used for manufacture of dipped goods.
- b) Latex casting – solid articles by latex casting – rubber threads.
- c) Latex foam – The two important processing methods for latex foam manufacture and important steps involved in the process. Some typical compound formulation – machinery mould and equipment required for foam products.
- d) Manufacture of latex cement and adhesives, latex paints and protective coatings, road rubberizing

UNIT III
NON TYRE RUBBER PRODUCTS (40hrs)

Compounding and manufacturing methods – rubber footwear conveyer and transmission betting's, hoses and tubing – cables and electrical installations, rubber moulded goods, rubber to metal bonds – rubber covered rollers, rubber lining of chemical plants, shock absorbers, and ant vibration mountings.

UNIT IV

TYRES

(25hrs)

History of tyre Industry in India –Manufacture of tyres, cycle Tyres, cycle Tubes, automobile tubes – tire treads, bead wire, carcass, and sidewall – introduction to tire building. Bagomatic and auto form press cure –finishing operations.

UNIT V

TESTING AND SPECIFICATION OF RUBBER

(10HRS)

- a) Specification and tests for preserved Natural rubber lattices
- b) Principles of testing of elastomers, stress –strain relationship, of shear and compression flex resistance –abrasion – hardness testing – swelling in solvents – ageing tests.
- c) ISI standards for various rubber and rubber products.

. BIS

PRACTICAL SYLLABUS

(420Hrs)

1 LATEX PRODUCTS

- (a) Preparation of latex compound for dipped goods like balloons, gloves and rubber bands.
- (b) Preparation of compound for making latex foams.
- (c) Factory visit.

2 DRY RUBBER PRODUCTS

Compounding and work practice and production of non tyre rubber product using natural synthetic and reclaimed rubber and their blends – foot wear – tubing – moulded goods – tread rubber, hoses – factory visits.

CHAPTER 1

PLANNING

INTRODUCTION

The role of the teacher has been changed as facilitator in the context of changing scenario in the field of education. The learning process should be learner centred and activity oriented learning activities would help to develop process skills and multiple intelligence. The activities are conducted in the class room or outside and they are to be completed in a time bound manner.

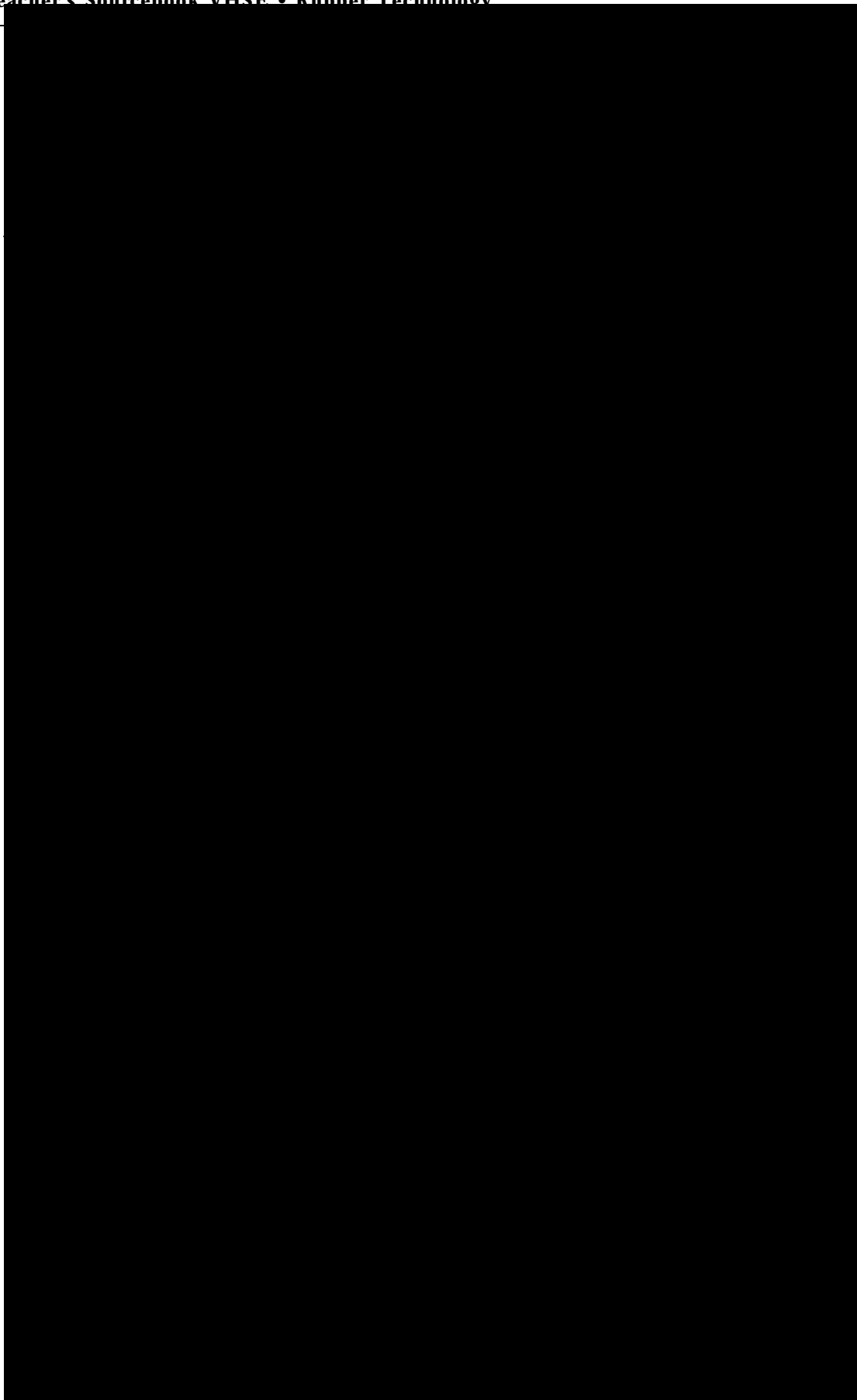
The teacher has to plan the activities necessary to ensure effectiveness learning. The plan must be structured as

- Year plan
- Unit plan
- Daily plan

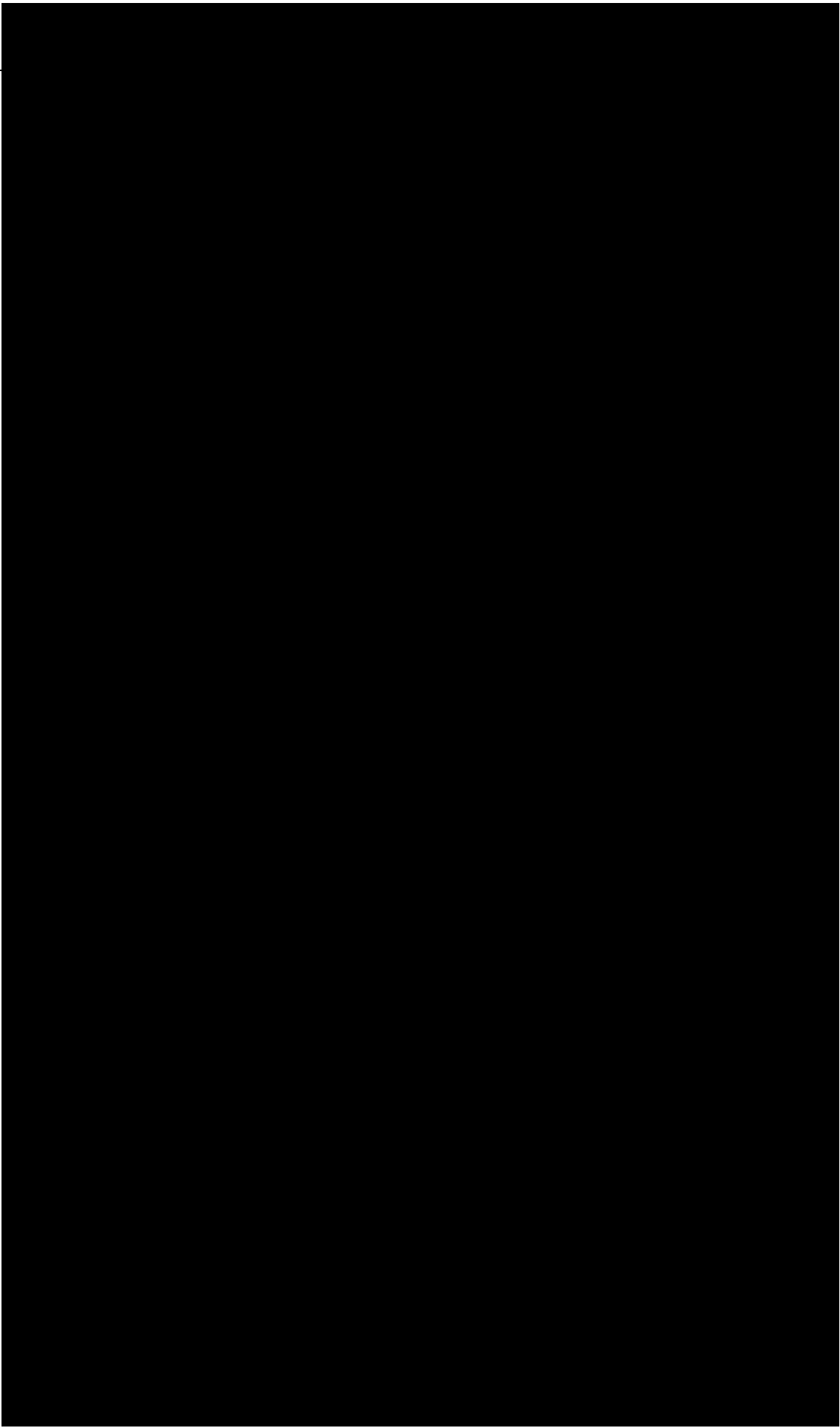
Year plan

As year plan has to be prepared in order to for seen the picture of the whole activities to be conducted in the academic year. The annual plan is to be prepared by the teacher after examining the curriculum objectives textbook, source book and other learning materials.

YEAR PLAN (THEORY)

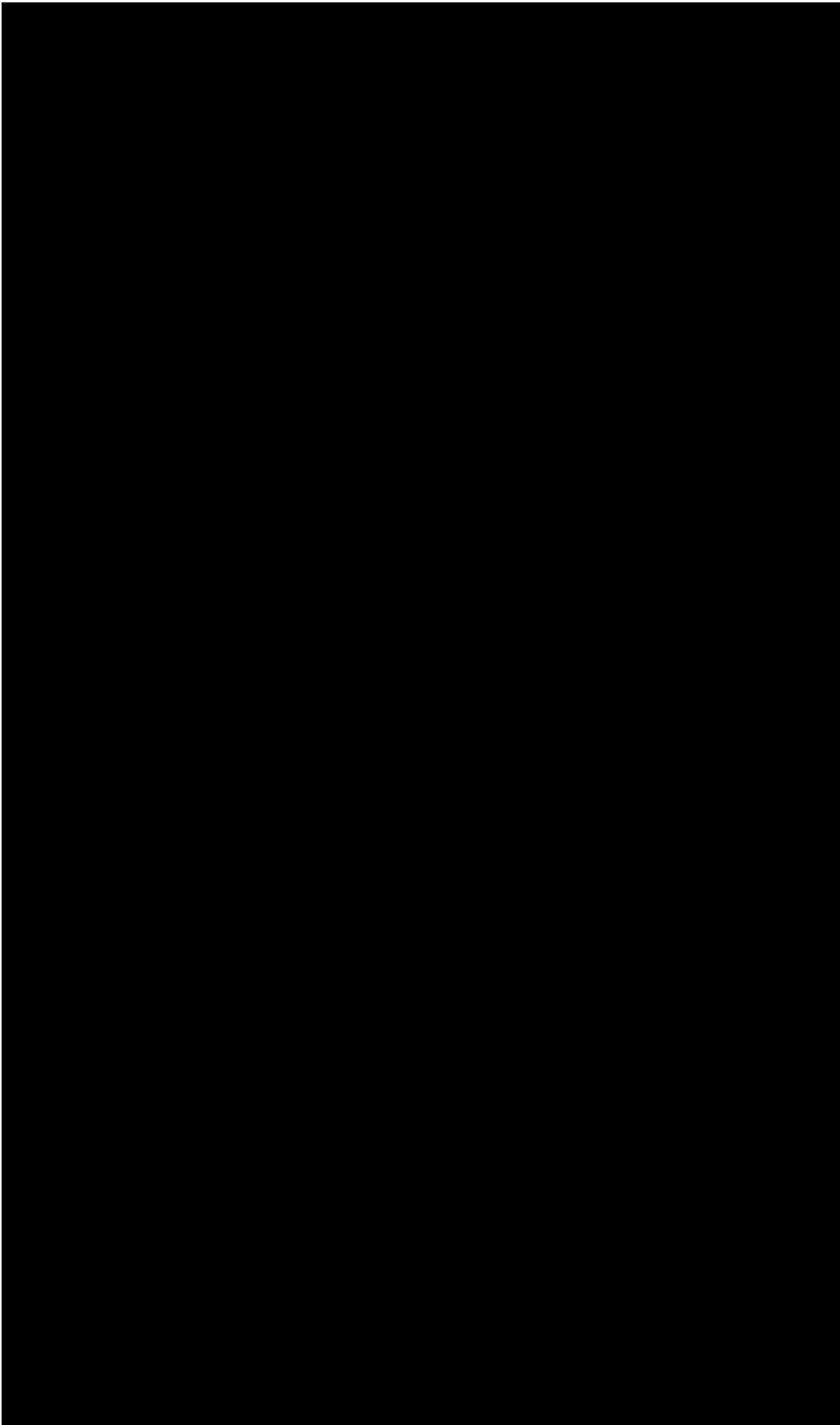


YEAR PLAN (PRACTICAL)



UNIT PLAN

The facilitator should prepare unit plan before actual transaction of the lesson in the class room. This plan includes curriculum objectives, ideas to be transacted, process skills, learning materials required, the product is obtained, evaluation methods and periods required. A model of unit plan is given below.



MODEL UNIT PLAN - TYRES (UNIT 4)
DAILY PLAN

The objective of daily plan is to transact the concept of curriculum objectives during class period. A model of daily plan is given below:

Daily lesson plan for Discussion

Class XII	:	Subject Rubber Technology
Date	:	Discussion
	:	Time
Curriculum Objective and cables	:	To conceive the idea of structure of hose Through discussion.

CHAPTER 7

EVALUATION

EVALUATION

Evaluation is a systematic process of collecting, analyzing, synthesizing and interpreting evidences of students' progress and achievements both in cognitive and non-cognitive areas of learning. Evaluation has to play significant role in making the learning process more effective. It provides diverse experiences to the learners, keeping in view the skill to be attained continuously by them.

As the curriculum is based on a particular vocation in the selected stream is the most important part and it should be evaluated accordingly. Technical skills, interest and devotion in the field, communication skills, organizational and presentation skills are to be evaluated. Evaluation of the personal and social qualities also should be done. So the evaluation should be continuous and comprehensive.

Terminal or Term End Evaluation (TE)

It is the written form of evaluation aimed at evaluating the facts, concepts and ideas gained by the learner. The test should not be aimed to evaluate the memory alone. Questions are framed in such a way that the learners are able to apply different mental process while answering. The Terminal Evaluation questions give more emphasis on application, analysis and synthesis level.

The maximum scores for TE is 80 and the minimum is 24 (30%). The questions should be formulated taking into consideration the time required to read, think, understands and write answers. These aspects should be considered while fixing the scores also. To avoid blind guessing, multiple choice and application level questions may be mixed. The total number of questions may vary from time to time. All the questions should be based on the curricular objectives. Open ended questions but the choice questions also should be based on the same curricular objectives.

Continuous and comprehensive evaluation (CCE)

Our traditional evaluation method measures only the memory and recollection capacity of the learner. To eliminate/ overcome the limitation the evaluation should be done on multi dimensional ways by measuring multiple intellectual capacities of the learner. So it is better to evaluate the learner in a continuous and comprehensive manner. CCE helps the learner to understand and develop adequate his own progress and to develop adequate strategies for further improvement.

Merits.

- Assess the all round development of the learner on a continuous basis through a variety of activities.
- Effective feed back is possible
- Remedial diagnostic teaching is possible
- Process as well as products are assessed.

A series of learning activities are grouped into five major thrust areas as follows

1) Investigative activities

Activities which create a spirit of enquiry, investigation and a mind for research in the learner belongs to this group for example.

- Study project
- Case study
- Field study

2) Interactive activities

Activities which improve the communication skill, activities of sharing ideas, etc.

For eg:-

- Seminar
- Panel discussion'
- Debate
- Group discussion

3) Assigned task

Activities assigned to the learners to enrich/ strengthen the concept and ideas.

For eg:-

- Assignment
- Collections

4) Performance task (Tests)

Activities related to the achievements of the learner.

For eg:-

- Class test (oral/ written/ performance test)
- Quiz
- Open book examination
- Interview
- Group testing

5) Practical based activities like

- Preparation of working model
- Album
- Improvisation

From the above five group of activities, the teacher has the freedom to choose any four areas for evaluation purpose.

1. Investigation Activity

1 STUDY PROJECT

Sl.No	Stages	Criteria	Score	Total Scores
1.	Planning	Relevatice of the study Identification of problem Ability to select appropriate tools, ability to select suitable bearing method.	4/3/2/1	
2.	Data Collection	Ability to collect sufficient and relevant data. Ability to classify and arrange data for analysis. Reliability and authenticity of the data collected.	4/3/2/1	
3.	Analysis and Inference	Ability to analyses the data Systematic arrangements. Ability to draw inferences based on analysis. Ability to give suggestions based on inference.	4/3/2/1	
4.	Report presentation	Ability to present in logical and sequential order, authenticity of report, time bound comparison.	4/3/2/1	
5.	Viva-Voice	Knowledge of content and process. Ability to analyze data. Ability to justify inference. Ability to explain. Strategies and methods adopted.	4/3/2/1	

2 CASE STUDY

Sl.No	Criteria	Score	Total Scores
1.	Identifying the problem	4/3/2/1	
2.	Approach to the problem	4/3/2/1	
3.	Time bound Action	4/3/2/1	
4.	Analysis of the problem	4/3/2/1	
5.	Problem solving / Reporting	4/3/2/1	
	1. 3.FIELD STUDY	4/3/2/1	
1.	Attitude and readiness towards the task	4/3/2/1	
2.	Capacity for Observation	4/3/2/1	
3.	Data collection	4/3/2/1	
4.	Application of ideas	4/3/2/1	
5.	Documentation / Recording	4/3/2/1	
	. 4.ASSIGNMENT		
1.	Awareness of the content	4/3/2/1	
2.	Comprehensiveness of the content	4/3/2/1	
3.	Systematic and sequential arrangement	4/3/2/1	
4.	Observation/suggestion/views/judgment/evaluation	4/3/2/1	
5.	Timely Submission	4/3/2/1	
	. 5 .SEMINAR		
1.	Planning and Organization	4/3/2/1	
2.	Collection and data / content	4/3/2/1	
3.	Observation / appraisal and clarity	4/3/2/1	
4.	Content knowledge	4/3/2/1	
5.	Presentation	4/3/2/1	
	. 6.DEBATE		
1.	Readiness to participate	4/3/2/1	
2.	Depth of subject knowledge	4/3/2/1	
3.	Communication skill	4/3/2/1	
4.	Ability to justify the stand	4/3/2/1	
5.	Presentation	4/3/2/1	
	7.GROUP DISCUSSION		
1.	Readiness to participate	4/3/2/1	
2.	Depth of subject knowledge	4/3/2/1	
3.	Communication skill	4/3/2/1	
4.	Ability to justify in a democratic way	4/3/2/1	
5.	Leadership quality	4/3/2/1	
	8. INTERVIEW		
1.	Planning	4/3/2/1	
2.	Preparation of Questions	4/3/2/1	
3.	Communication skill	4/3/2/1	
4.	Participation	4/3/2/1	
5.	Report preparation	4/3/2/1	

Practical Evaluation (PE)

The goal of vocational Education is to generate skills through continuous practices along with investigation and innovations. Continues and comprehensive practice transforms the unskilled learner to a skilled one. This is the importance and significance of vocational practicals.

PE is done to evaluate the practical skills achieved by the learner in the concerned vocational subject Total Scores for PE is 150 and minimum is 60 score ie 40%. Practical Examination is conducted for a batch of 8 learners having 6 hours duration.

Practical evaluation should be done taking into account the whole practicals included in the curriculum since Learning of practical skills is a continuous process through out the period of study.

PRACTICAL EVALUATION(P.E)

The following general indication are identified for P.E.

Identification	-	20%
Procedure(Writing)	-	10%
Handling of tools & Equipments	-	10%
Observation/Tabulation	-	20%
Record Result	-	20%
Viva	-	20%
Total Score for PE	-	150

PE should be done before the end of each term.

PE should be done before the end of each term.

Vocational Competency Evaluation (VCE)

Vocational Competency Evaluation is to evaluate the vocational skill and aptitude developed by the students during the learning process. This is a system to judiciously evaluate the required value addition and consequent capacity building in the concerned vocational curriculum. The vocational education is aimed at developing interest, skills and devotion in specific vocational fields. As other evaluation components like CE, PE and TE cannot assess the vocational ampetences and professional skills, acquired by the students an internship evaluation (IE) components has been introduced to meet this requirement.

Internship evaluation should be done based on the following components like regularity and punctuality, value addition and capacity building.

1. Regularity and punctuality

Regularity and punctuality has vital role in vocational education learning continuous process, the regular presence of the Learner is must for attaining maximum efficiency.

2. Value Addition

Value addition is the qualitative measure of the learner's interest, devotion perseverance and efficiency. Value addition can be evaluated through conducting field visits/ vocational survey. The experiences gained through field visit / vocational survey increases the level of intrinsic motivation and positive attitude towards the vocational field and thereby increase his value as a semiprofessional.

3. Capacity Building

It gives a quantitative measure of the student's skill in graded area exposure. Capacity building can be evaluated through conducting the following activities.

1. OJT / Simulated experiment
2. Performance – camp/exhibition/clinic
3. Performance – PCT/Service cum Training center.

These components help the learner to practice the acquired skills in the real situation and thereby increasing self-confidence and promoting self reliance.

Vocational Competency Evaluation Indicators

No	Items	Scores
1.	Regularity and punctuality	10
2.	Field visit / survey (anyone) vocational project	20
3.	OJT/Simulated experiment performance – Camp/exhibition/clinic Performance – PSCTC (anyone)/Practical skills	20
	TOTAL	50

1. Regularity and punctuality can be assessed by using attendance of the learner and time bound completion of tasks. It is evaluated by using 5 point grading system.

Rating Scale

Sl.No	Items	1	2	3	4	5
1.	Regularity	Never regular	After regular	Equally regular	Most of the time regular	Always regular
2.	Puntuality	Never punctual	Often punctual	Usually Punctual	Most of the time punctual	Always punctual

VCE Item	Evaluation indicators	Rating	Score
Equality and punctuality Value addition			10
	Field visit		
	1. Attitude and readiness towards the task	4/3/2/1	
	2. Capacity for observation	4/3/2/1	
	3. Data collection	4/3/2/1	
	4. Application of ideas	4/3/2/1	
	5. Documentation/recording	4/3/2/1	20
	Or		
	Survey		
	1. Planning	4/3/2/1	
	2. Data collection	4/3/2/1	
	3. Consolidation of data and analysis	4/3/2/1	
	4. Drawing inference		
	5. Reporting	4/3/2/1	
	4/3/2/1		
Capacity Building	OJT/Simulated experiment		
	1. Involvement/participation	4/3/2/1	
	2. Skills in doing work/ communication skills	4/3/2/1	
	3. Time bound action	4/3/2/1	
	4. Capacity for observation, analysis and innovation	4/3/2/1	
	5. Documentation, recording and display	4/3/2/1	20
	Or		
	Performance in camp/exhibition/clinic		
	1. Ability for planning and organizing		
	2. Mastery of subject	4/3/2/1	
	3. Ability for communication		
	4. Innovation	4/3/2/1	
	5. Involvement/social commitment	4/3/2/1	
	Or		
	Performance in production/service cum training center (PSCTC)	4/3/2/1	
		4/3/2/1	
	1. Mastery of vocational skills	4/3/2/1	
	2. Managerial capacity	4/3/2/1	
	3. Promoting self confidence	4/3/2/1	
4. Innovation approach	4/3/2/1		
5. Promoting self reliance	4/3/2/1		

CRITERIA FOR PROMOTION

- A minimum of 80% attendance is required to register for the public examination. Those who are having at least 65% can apply for condonation from higher authorities. Those who have shortage of attendance below 65% should re[eat the second year.
- The students should obtain minimum 30% score in all subjects separately in TE. In first year if the student failed to obtain 30% minimum score in any subject he will be promoted and will be given chance for improvement.
- The students should obtain a minimum of 40% score in the vocational practical Evaluation (PE) that is 60 out 150 score. If a student fails to attain the minimum required score for TE and secure minimum score for pass in TE, he need not reappear for practical examination and vice versa.
- A minimum of 30% is required for VCE . The componenets other than regularity and punctuality can be improved before the end of the academic year for those who fail to attain this minimum.

Chances will be given for improvement of the TE, PE and VCE for those who fail to attain the minimum even after formal completion of the course.

Course certificate will be issued to those students who have successfully completed part I and II. A learner is eligible for higher studies provided he secures minimum score in all subjects including part III.

CONTINUOUS EVALUATION ITEMS (CE)

No:	Subject	Performance test(Class test,open text)	Project/Data collection/ Group discussion/Debate	Assaignment/Seminar/ Report/Class test	Total
1	Rubber technology	1	2	3	4

**RECORDING OF GRADES
PROJECT**

Subject-RUBBER TECHNOLOGY

Item-Project

Sl.No	Name	Grading Indicators					Total Score (20)
		I (4)	II (4)	III (4)	IV (4)	V (4)	
1	Sunil	2	3	2	2	3	11
2	Latha	2	2	3	4	4	15
3	Rani	3	2	4	3	4	16
4	Twinkle	3	4	4	4	3	18

Grading Indicators:

1. Ability to plan
2. Ability to collect data
3. Ability to analyze the data and drawing conclusions /inference
4. Ability to prepare project report
voce(content and process)

Assignment

Subject: Rubber Technology		Item: Assignment					
SL No	Name	Grading Indicators					Total Score (20)
		I (4)	II (4)	I (4)	II (4)	I (4)	II (4)
1	Sunil	2	2	4	4	4	16
2	Latha	3	3	3	4	4	17

I Knowledge about content

II Comprehensiveness of the content

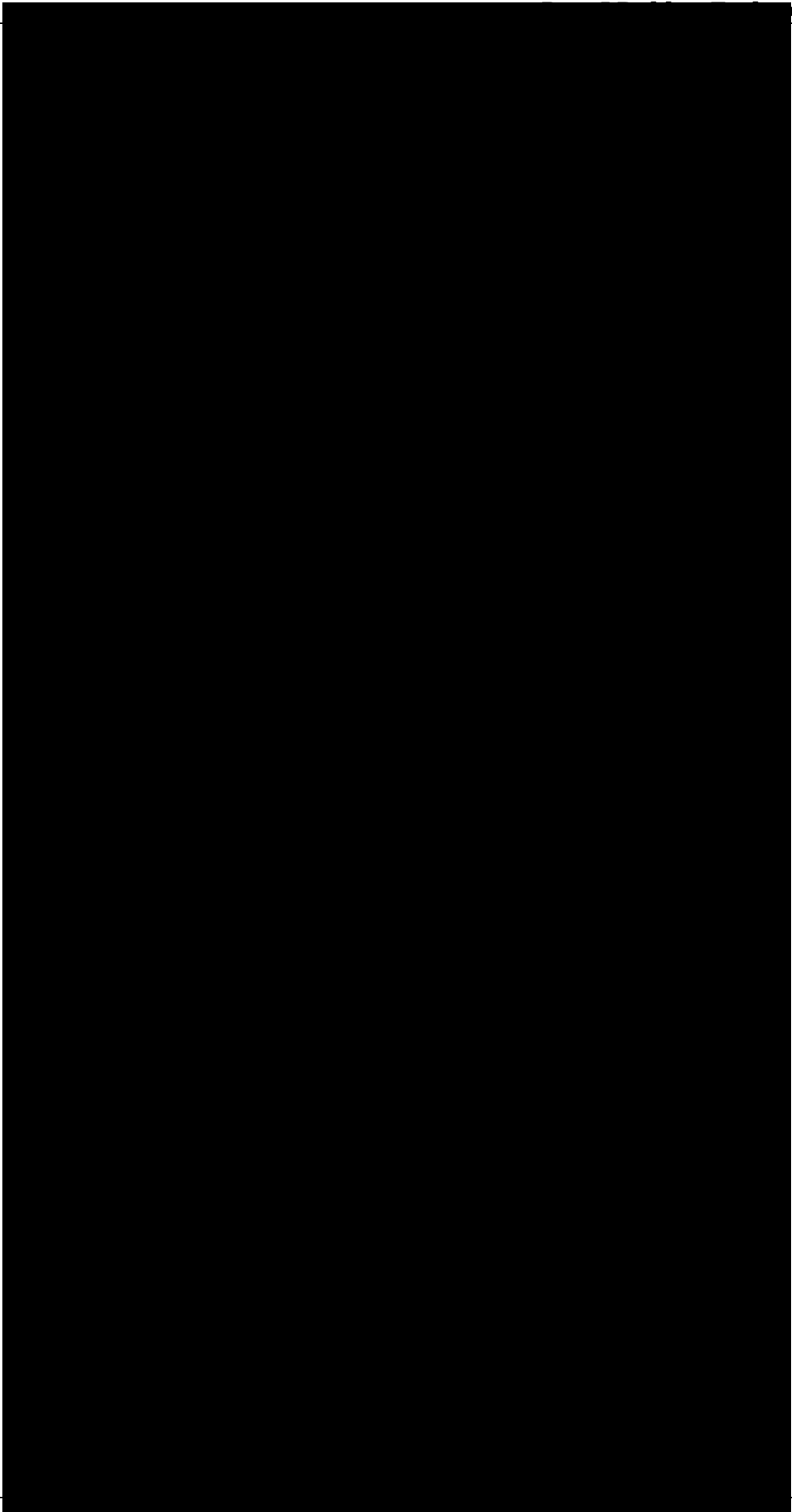
III Sequential arrangements

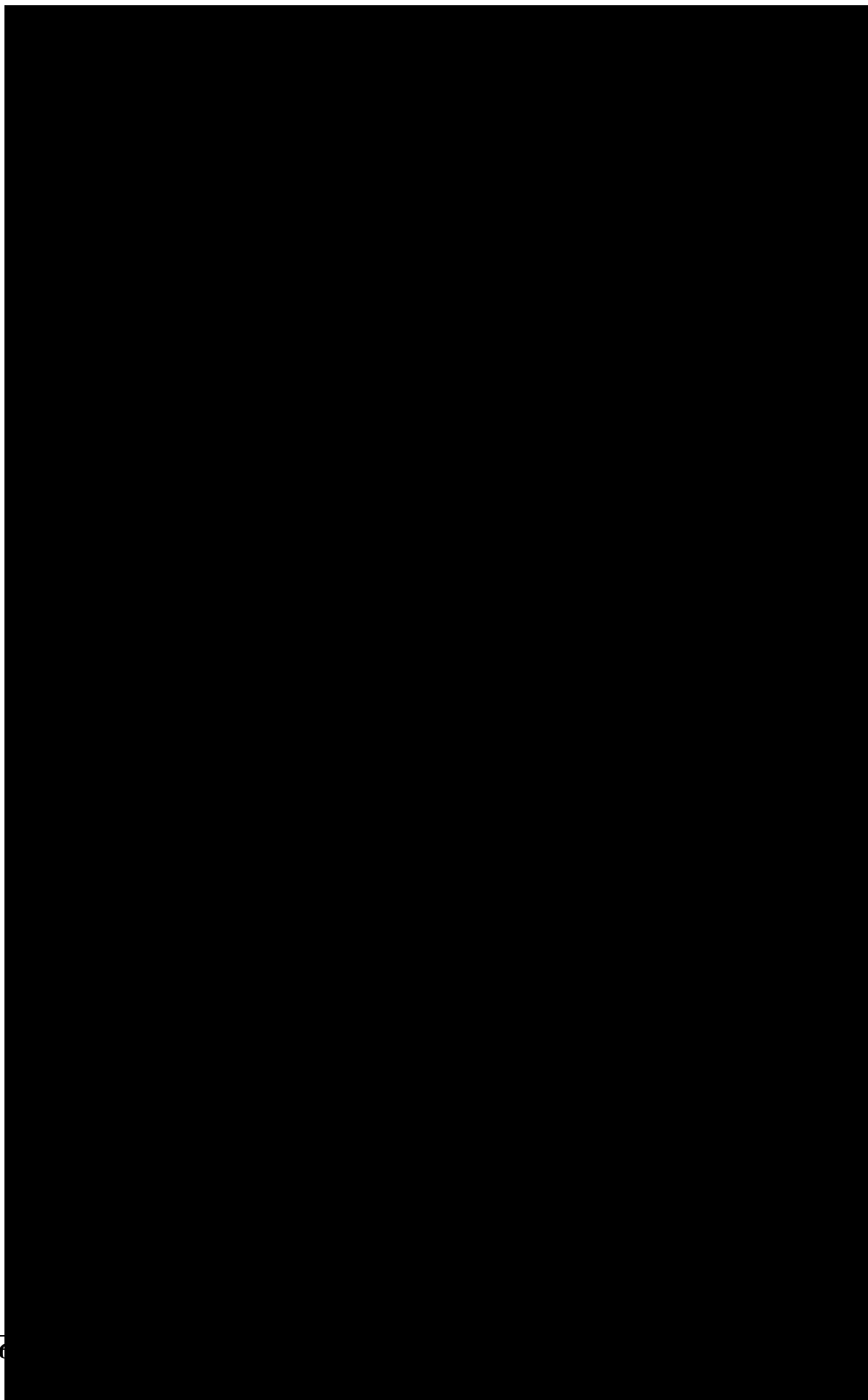
IV Own observation/Suggestions/views/judgment/evaluation

V Timely submission

CE Score-Rubber Technology (Consolidated statement)

Sl.No	Name	Subjects of CE Score				
		English (20)	GFC (20)	Rubber Tehnology (20)	Physics (20)	Chemistry (20)
1						
2						
3						
4						
Date:		Signature:				





Terminal Evaluation (TE)

Terminal evaluation should be in written form. The intention of the test must not be confined to memory test alone. It is an important text for evaluating the facts, concepts and ideas general by the learner. While preparing, questions for the terminal evaluation, more emphasis should be given to the level of application, analysis, synthesis and evaluation then knowledge and understanding. The questions should be framed with provisions for student to apply various mental process like:

- retrieve / recollects / retells information.
- Readily makes connections to new information found in past experiences and formulates initial ideas/concepts.
- Detects similarities and differences
- Classifies/categories/organizes information appropriately.
- Translates/transfers knowledge or understanding and applies them in new situations.
- Establish cause effect relationships.
- Makes connections/relates, prior knowledge to new information/applies reasoning and draw inferences.
- Communicates knowledge/understanding through different media
- Imagines/hypothesis/designs /predicts based on received information.
- Judges/appraises/evaluation the merits or demerits of an idea/develops own solution to a problem.

Guidelines for the preparation of question paper.

1. Questions should be prepared based on the curriculum objectives.
2. Prime consideration should be given to the curriculum objectives which lead to the learned to diverse thinking process. Along with this, ideas related to the intent should also be taken into consideration.
3. More than one curriculum objectives can be combined if necessary.
4. Questions which test only the memory of the learner should be avoided. Priority should be given to analysis, synthesis and evaluation type questions.
5. Different learning levels should be considered in making questions. That is all questions should hit at all levels of learners.
6. Even in questions of higher mental process there should be a chance for below average students to make an attempt.
7. Questions should be familiar and challenging in connection with the situations.
8. To avoid blind flexing, multiple choice and supply type questions may be mixed.

9. Along with questions does can be fixes, if necessary.
 10. Questions should be clear and legitimate.
 11. Skills which are evaluated is a part of CE may be given less importance.
 12. Drawing and picture which develop various components of mental process may be included in the question.
 13. Questions which demand neat labeled diagram should be avoided.
 14. Arrangement of questions can be done in the order of scores.
 15. No fixed number and pattern of questions necessary.
 16. Questions may be modeled so as to raise the curiosity in the recent scientific development.
 17. Questions may be moulded so as to promote interest and positive attitude towards technology.
 18. Questions may be able to help the learners to face challenges in future and to equip themselves to appear competitive examinations.
 19. Stress should be given to apply the innovative thinking mental abilities of pupil.
- Life related questions should be included.

CHAPTER 8

MONITORING AND SUPPORTING SYSTEM

Supporting System

In learner centered vocational education, a learning methodology has to be organized and a proper learning atmosphere is to be provided. Many organizations can support the learning activity. They are:-

1) School Resource Group (SRG)

Comprising all teachers (vocational and non vocational) instructors, and lab assistants with academic head as the group leader.

2) School support Group (SSG)

Comprising PTA president, members of local bodies, members of social clubs, subject experts etc who can contribute guidance /technology /infrastructure /financial assistance etc.

3) Parent Teacher Association (PTA)

Can provide adequate funds for field trips, production cum training centers (PCTC), exhibition, On Job training (OJT) etc.

4) Local bodies

Grama Panchayat, district panchayat and block panchayat can provide infrastructure ie, class rooms, laboratory, library, seminar hall, audiovisual equipment etc.

5) Subject club

All vocational teachers handling same vocational subjects should form a subject at regional level or district level. This will helps to share the knowledge and practical facilities, production and marketing of materials, service etc.

6) Based on the excellency, district wise nodal schools may be selected to provide

facilities like central library, museums, video conferencing etc.

7) Institution Industry Interaction Project (III P)

This should be implemented in every institution to update knowledge this also helps for OJT , PSTC and field visit.

Monitoring system

Education is a kind of journey from darkness to light satisfying the needs and the wants of the individual and the society. The modernization of education through activity oriented system enhances free thinking and working in a fearless atmosphere. It is a qualitative process not a quantitative one this necessitates a proper monitoring system. The system of monitoring should have the following features.

- 1) It must be transparent
- 2) It must enrich the ideas of the facilitator through innovative process
- 3) It must be time bound and rational
- 4) It must motive the facilitator to adopt new strategies
- 5) It must be recordable and ensure effective feedback for the effective monitoring of the system, three levels of the mechanism should be setup.
 1. School level monitoring group
 2. Regional level monitoring group
 3. State level monitoring group

Moreover a social auditing system is advisable to attain the objective effectively.

Features of learning process in the new system of education

In the new system of education the learning process should be modified in such a way as to enable the learner to construct the knowledge of his own through observation, co-operation, problem solving, social interaction etc. The learning process should consider the nature ability, social setup, inborn talents and subject selected by the learner. Therefore the learning process should be,

- A continuous mental process
- Simple learner must feel that he is able to undertake the task
- Enable the learner to attain the curriculum objective
- Interesting
- Suitable to the age and attitude of the learner

- Future possibilities
- Enable group activity
- Challenging
- Time bound
- Constructive and curiosity developing
- Possibilities for evaluation
- Capacity to generate independent thinking
- Ability to enquire discover and establish cause effect relationship between phenomena.

PARTII

CHAPTER 1

PROCESSING TECHNOLOGY

LEARNING ACTIVITIES

1. PROCESSING TECHNOLOGY

Introduction

Those unfamiliar with the nuts and bolts aspects of the industry may all too readily attribute artistic practice to the exotic process techniques involved in manufacturing of rubber articles. Raw rubber is of little use and application unless it is processed. The goal of rubber processing is to provide useful properties and suitable processability with as high a level of consistency as possible. In this unit we deal with high techniques like mastication, blending, compound preparation and manufacturing techniques like processing spreading calendaring, extrusion and molding. The vastness and inevitability of rubber products may be convinced by the systematic study of processing techniques of products ranging from tiny balloons to huge tires. The art of compounding consists of specifying the type and amount of the various ingredients in a mixture, the manner of many processes of the finishes mix and the method of vulcanization based on the requirement of end product.

Curriculum Objectives.

- ◆ To get a clear picture about mastication and blending of raw natural rubber through discussion and experiment and presented as write up and record.
- ◆ To get a clear picture about master batching, mixing and compounding of rubber through general discussions, experiment and chart display and presented as write up and record.
- ◆ To attain a clear idea about different processing methods like spreading, calendaring, sheeting and fabric coating through seminar, reference and IT show and present them as seminar report and write up.
- ◆ To conceive the idea of extrusion process through IT show and panel discussion and

present them as write up and flow chart.

- ◆ To acquire the concepts of different moulding techniques and curing methods through group discussion, experiment and assignment and present them as write ups, record and assignment.

Syllabus

Processing methods for manufacture of products from dry rubber – Blending and mastication – master batching – mixing and compounding, spreading, calendering, sheeting and fabric coating – extrusion – moulding, curing in autoclave, and hot air and hot water

1.1 Mastication and Blending

Activity 1.1.1. Discussion

Facilitator gives to students some raw rubber and masticated rubber samples and ask them to compare and classify the properties. Students should discuss and clarify similarities, differences and causes. From the above data students prepare a write up. Facilitator summaries the write up and it is evaluated.

Consolidation

- ◆ Viscosity reduction
- ◆ Chain scission
- ◆ Peptizing.

Product

- ◆ Write up.

Activity 1.1.2. Experiment

Students are divided into two groups and allow the first group to do the softening process by passing rubber sheet through two-roll mill in the school laboratory. Thus the students get a clear idea about mastication process.

The second group is also allowed to do the same procedure but add a peptizer and observe the speed of softening. Then add SBR to masticated NR at a ratio of 1 : 1 with the help of facilitators to produce NR – SBR blend.

Consolidation

- ◆ Viscosity change
- ◆ Blending
- ◆ Peptizing

Product

- ◆ Record

1.2 Master batching, mixing and compounding

Activity 1.2.1 General discussion.

The facilitator brings the attention of the learners to the topic of mixing and compounding by raising following questions and lead points.

- ◆ What is a rubber mix?
- ◆ How it differs from raw rubber?
- ◆ How mix is prepared?
- ◆ What are the factors, which influence the compound design?
- ◆ The classification of rubber chemicals.
- ◆ **A typical Formulation for dry rubber compounding**

		Phr
NR	-	100
Zno	-	3
Stearic acid	-	2
Whiting	-	150
Process oil	-	7
Sp	-	1
MBT	-	1.5
TMT	-	0.25
S	-	2.5

Active participation of the students should be assured. Students make their opinions and actively take part in the discussion. The facilitator summaries the discussion points.

- ◆ Students are asked to prepare a write up
- ◆ Facilitator evaluates the write up.

Consolidation

- ◆ Mixing
- ◆ Rubber compound
- ◆ Principle of compounding
- ◆ Classification of rubber chemical
- ◆ Compound design

- ◆ Compounding for specific properties viz Oil resistance, heat resistance, weather resistance, Fire resistance.
- ◆ Typical formulation.

Product

- ◆ Write up

Activity 1.2.2. Experiment

The facilitator divide the students as two or three groups. According to the formulation given the students take the weight of the rubber chemical and label them.

- ◆ The rubber first masticated in the mill

(See Activity 1.1.1)

- ◆ Rubber chemicals are added under the guidance of the facilitator.
- ◆ Facilitators evaluates the record

Consolidation.

- ◆ Steps of compounding
- ◆ Precautions to be taken during mixing

Product

- ◆ Record

Activity 1.2.3. Chart display

A chart is shown to the students and are asked to observe and analyse data and make a write up so as to reach a conclusion regarding points,

- ◆ Similarities and dissimilarities of master batch and Final batch
- ◆ Advantages and disadvantages of masters batch

A chart relating the topic master batch and final batch is shown below

Master Batch	Final Batch
NR – 100	Master Batch +
Zno – 3	MBT- 1.2
Stearic Acid -2	TMTD – 0.1
Whiting – 150	Sulfer – 2.5
SP -1	

- ◆ Students should prepare a write up and classification table
- ◆ Facilitator evaluates the write up and tables.

Consolidation

- ◆ Master batch
- ◆ Final batch
- ◆ Scorching
- ◆ Advantages and disadvantages.
- ◆ Mixing time for master batch and final batch.

Product

- ◆ Write up
- ◆ Classification labels.

1.3 Spreading and calendering

Activity 1.3.1 Reference

Relevant books are given to the student (Rubber Technology and manufacture by C M Blow, Introduction to rubber Technology – Maurice Morton). By referring these books the students are asked to prepare write up and schematic diagrams regarding the processing method skim coating, frictioning, spreading and sheeting.

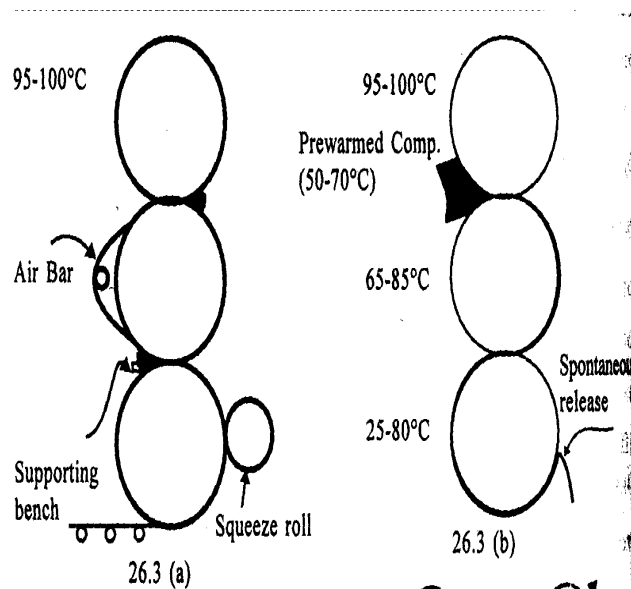
- ◆ The write up is evaluated by the facilitator.

Consolidation

- ◆ Principle of spreading
- ◆ Dough preparation
- ◆ Frictioning
- ◆ Sheeting
- ◆ Spreading

Product

- ◆ Write up
- ◆ Diagrams



Activity 1.3.2 I T Show

Facilitator should collect CDS of calendaring, and spreading plant operations and present through audiovisual media.

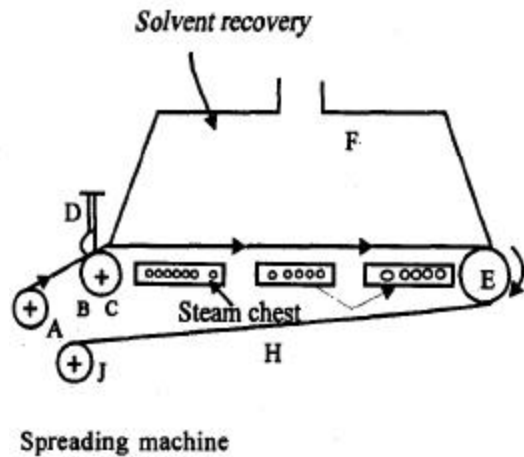
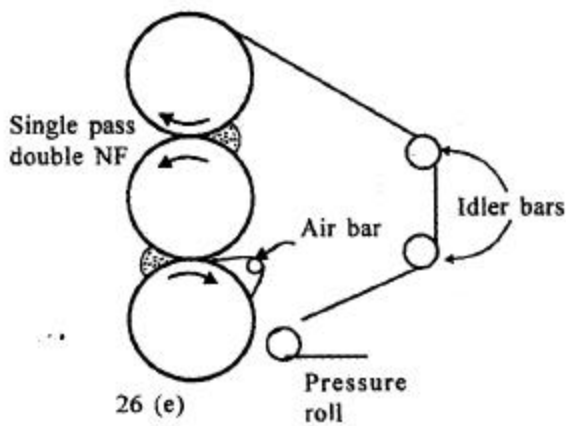
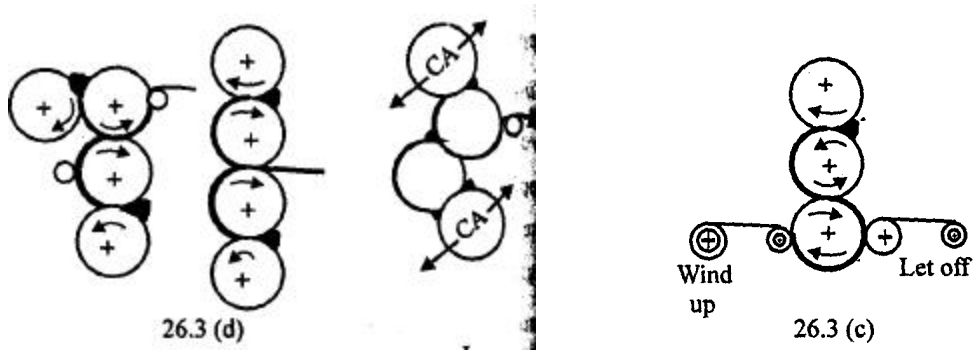
- ◆ Students are asked to prepare flow charts
- ◆ Facilitator evaluated the flow chart

Consolidation

- ◆ Doctor blade
- ◆ Extraction unit
- ◆ Winding mechanism
- ◆ Topping
- ◆ Sheeting
- ◆ Frictioning
- ◆ Profile calendaring

Product

- ◆ Flow chart



Activity 1.3.3 Seminar

Any two students are selected and asked to present seminar on spreading and calendaring respectively.

- ◆ Students clarify doubts raised by other students.
- ◆ Timely interventions of facilitator is desirable.

Consolidation

- ◆ Spreading
- ◆ Doctor blade
- ◆ Dough preparation
- ◆ Rubber sheeting

Product

- ◆ Write up

1.4 Extrusion

Activity 1.4.1 I T Show

Facilitator conducts an I T show regarding the process extrusion. The students are asked to prepare a flow chart and write up.

- ◆ The facilitator evaluates the chart and writes up consolidation.

Consolidation

- ◆ Compound Feeding
- ◆ Extrusion process
- ◆ Tube forming
- ◆ Channel forming

Product

- ◆ Write up
- ◆ Flow chart

Activity 1.4.2 Panel Discussion

Four students are selected and are directed to refer the topics , dieswell , L/D ratio, hot and cold extrusion and back thrust which are divided among them. In the next class the above students should be the panel experts convey their ideas one by one. The doubts and questions relating each topic are clarified by the concerned experts. Further clarification and summarization of the panel discussion points are done by the facilitator .

- ◆ Students prepare write-up
- ◆ Facilitator evaluates the write up.

Consolidation

- ◆ Extrusion
- ◆ Dieswell
- ◆ Cold and hot feed extrusion
- ◆ L/D ratio
- ◆ Back thrust

Product

- ◆ Write up

1.5 Molding and curing.

Activity 1.5.1. Group discussion

- ◆ Students are divided into four or five groups
- ◆ Pam lets, journals, books etc are given to them (Rubber Asia, Rubber Technology & Manufacture - CM Blow)

Lead points

- ◆ Compression molding
- ◆ Transfer molding
- ◆ Injection molding
- ◆ Comparison between them

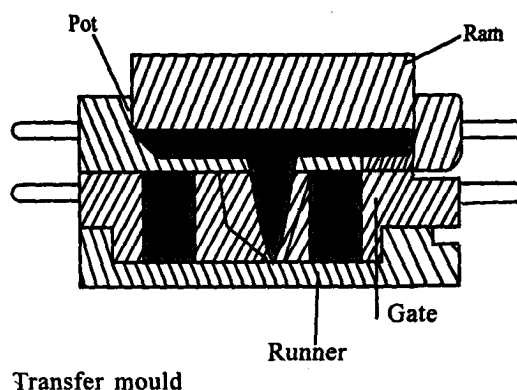
Group wise discussion is carried out. Each group prepares write-ups, charts and diagrams and group leaders presented them to the whole class. Timely interventions of the facilitator is advisable. The points and ideas were consolidated and shared to the whole group. Facilitator evaluates the write-ups, diagrams and charts.

Consolidation

- ◆ Compression molding
- ◆ Preheating
- ◆ Mould release agent
- ◆ De gassing
- ◆ Trimming
- ◆ Mould flow
- ◆ Shrinkage
- ◆ Transfer molding
- ◆ Injection molding

Product

- ◆ Write up
- ◆ Chart
- ◆ Diagrams



Activity 1.5.2 Experiment

Facilitator arranges provisions for observing the different compression moulds in the school laboratory students are identified these mould as straight type and positive moulds with the help of schematic diagram provided.

- ◆ A gum stock is prepared as per the given formulation.
- ◆ Apply mould release agent to the Preheated mould
- ◆ Fill with the compound and cured in the press

Students get a clear idea of compression moulding technique through this experiment

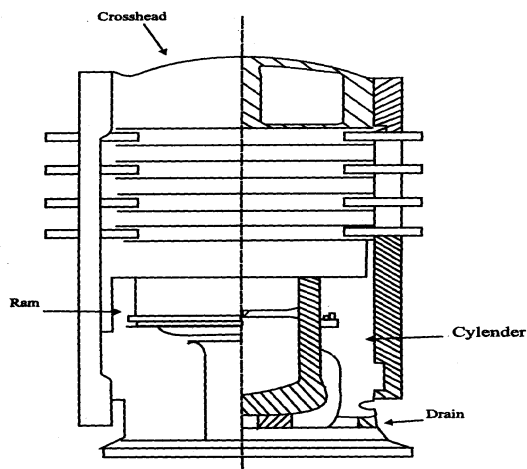
- ◆ Facilitator evaluates the active participation and record of the students.

Consolidation

- ◆ Straight and positive moulds
- ◆ Mould releasing agent
- ◆ Pre heating
- ◆ Blank preparation
- ◆ Cure time
- ◆ Cure temperature
- ◆ Cure pressure

Product

- ◆ Record



Activity 1.5.3

Assignment

- ◆ Students are asked to prepare an assignment on curing methods.
- ◆ Advise to refer the following books
 1. Introduction to Rubber Technology by Maurice morten
 2. Rubber Technology & manufacture by C.M Blow.
- ◆ Facilitator scrutinises the content and a valuates assignment.

Consolidation

- ◆ Batch curing
- ◆ Continuous curing
- ◆ Auto clave curing

Product

Assignment

C.E Questions

1. Conduct a seminar on spreading.
2. Prepare a write up about molding techniques based on group discussion held in your class.

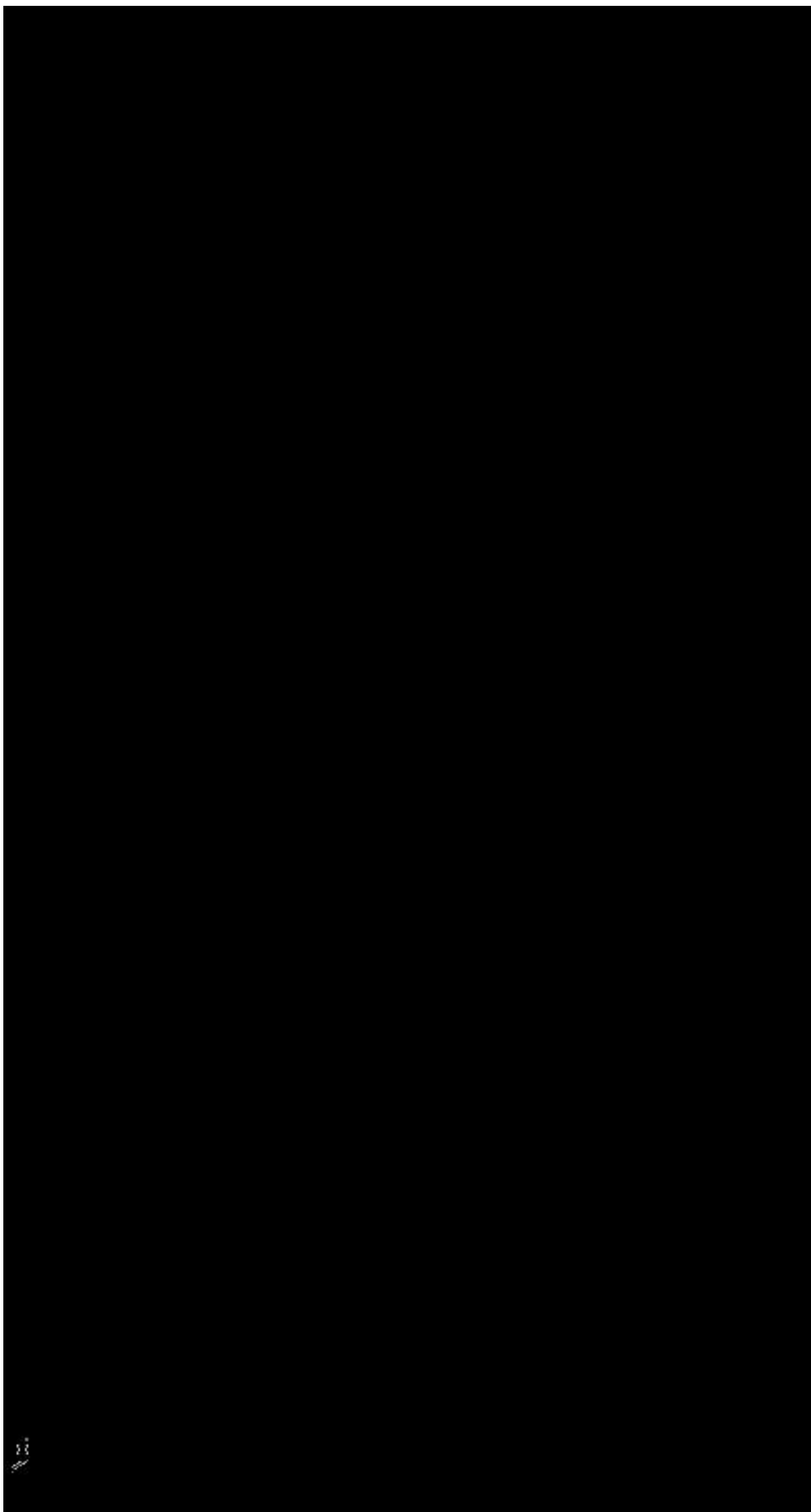
T.E Questions

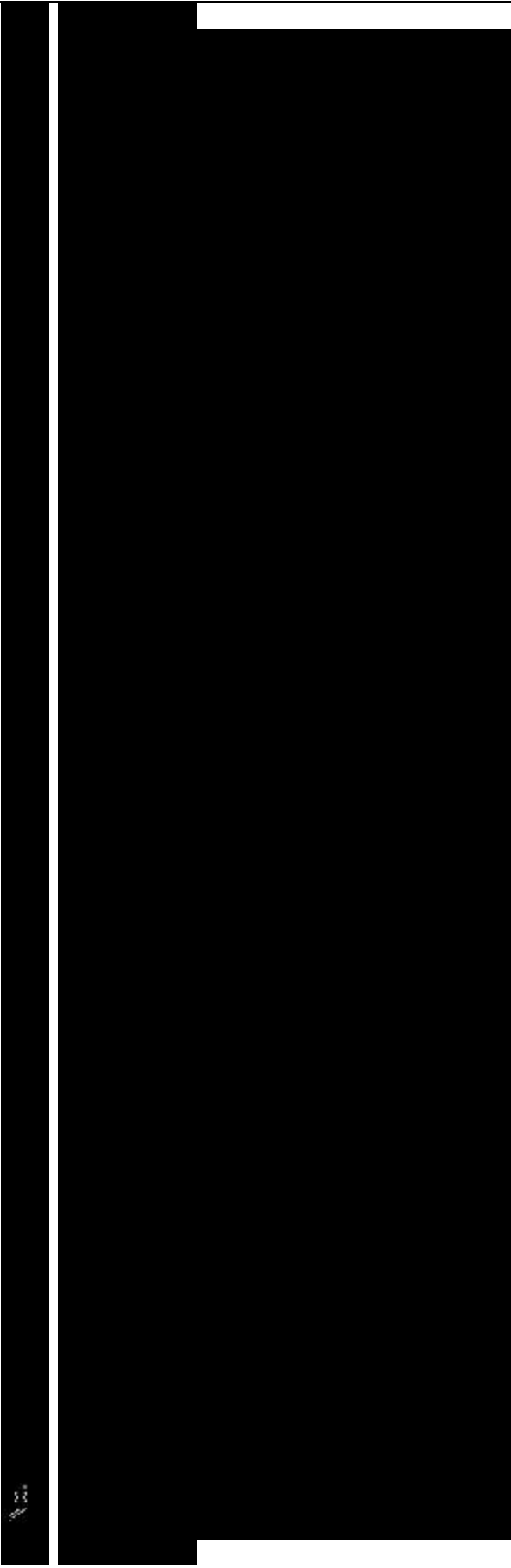
1. When you visited a rubber factory you saw that rubber was passing through the open roll mill before the addition of chemicals for a few minutes. Why it is done? Draw your inference.
2. NR - 100
Zno - 2
Stearic acid - 2
Whiting - 100
Sp - 1

Produce tea mat from above formulation. Will you get the finished product ? If not why? Give remedies.

PROCESSING TECHNOLOGY

UNIT 1





CHAPTER 2

MANUFACTURE OF LATEX PRODUCTS

Introduction

Like solid rubber, latex also finds many applications, principle among them being foam products, fabric binder, latex adhesive, dipped goods or those obtained by moulding and casting. For obtain any of these products a whole range of compounding and processing technique have been developed. A number of value added products can be manufactured from NR latex by simple manufacturing techniques which is much relevant in the industrialisation of kerala. Latex industry cause less health hazard compared to other industries

This unit includes typical formulation of dipped goods, their manufacture and also other processing techniques. This unit also covers different equipments and machines used in latex industries. The scope is to equip students to gather more knowledge about latex industries and this in turn will boost up their self reliance.

Curriculum Objectives.

- ◆ To acquire idea about equipments and machinery used for manufacture of dipped goods through seminar, discussion and experiment, and presented them as seminar report and write ups
- ◆ To attain idea about compounding of latex for manufacture of various types of dipped goods and typical dipping compound formulation through chart, project, specimen collection and experiments. The project reports, write up and collected specimens are presented.
- ◆ Manufacture of latex cements and adhesives, latex paints and protection coating, road, rubberizing.
- To acquire idea on manufacture of important dipped goods like gloves, balloons, rubber bands through experiment, Flow chart and assignment. The assignment work, chart and write – ups are to be presented.
- ◆ To attain idea on latex casting and latex thread through assignment, seminar and flow-

chart. The write –ups, chart and seminar report are to be presented.

- ◆ To conceive more knowledge on latex foam manufacture, typical compound formulation, machinery, moulds and equipment through field visit, discussion & chart display, and also present write – ups and field visit report.
- ◆ To attain more idea in manufacture of latex cements and adhesives, latex paints and protective coatings, road rubberising through assignment, experiment, discussion and debate. And also present assignment, write – ups and discussion notes.

Syllabus

(45 hours)

- ◆ Dipping – compounding of latex for manufacture of various types of dipped goods – typical dipping compound formulations – manufacture of important dipped goods like gloves, balloons, rubber bands, condoms – equipments and machinery used for manufacture of dipped goods.
- ◆ Latex casting – Solid articles by latex costing – rubber threads.
- ◆ Latex foam – Two important processing methods for latex foam manufacture and important steps involved in the process. Some typical compound formulations-machinery, moulds and equipments required for foam products.
- ◆ Manufacture of latex cements and adhesives, latex paints and protective coatings, road rubberising

2.1 Machines & Equipments for dipped goods

Activity 2.1.1. Discussion

- ◆ The students observe the Ball mill and Rubber band cutting machine in the school lab
- ◆ Student list the various part & functions of the above machine with the help of handouts & labeled diagram's.
- ◆ The students are divided in to two groups
- ◆ Group 1. Discuss about the parts & function of Ball mill and prepare discussion notes.
- ◆ Group.2 discuss about the parts & functions of Rubber Band cutting machine & discussion note is prepared.
- ◆ Group leader present the discussion notes and the facilitator validate the same.

Consolidation

Ball Mill - Parts & functions

Rubber Band cutting machine - Blade alignment

Crank shaft mechanism - Working of machine

Product

Discussion note

List of parts & functions of RBC machine.

Activity 2.1.2 Experiment

- ◆ Facilitator provides a sample formulation for the preparation of dispersions & emulsions.
- ◆ Student groups prepare dispersions & emulsions in laboratory and record the procedure for each
- ◆ The dispersions & emulsions are tested and the observations are recorded.
- ◆ Students prepare a write up containing the features of the stirrer
- ◆ The write-ups are presented in the class and the facilitator validates the same.

Consolidation.

- ◆ Dry weight
- ◆ Wet weight
- ◆ Dispersions - particle size reduction, dispersing agent
- ◆ Emulsions –emulsifier
- ◆ Stirrer
- ◆ Cloud test
- ◆ Cracking of emulsions.

Product

- ◆ Observation chart
- ◆ Write ups
- ◆ Test results.

Activity 2.1.3 Seminar

- ◆ The students are asked to prepare seminar on “ Factors attesting the effecting of Ball Milling” through reference.
- ◆ Students conduct seminar and present the report.
- ◆ Facilitator validates the seminar report.

Consolidation

- ◆ Velocity of jar
- ◆ Size & number of pebbles
- ◆ Speed of rotation
- ◆ Grinding action

- ◆ Time & temperature

Product

- ◆ Seminar Report

2.2 Typical formulations & Compounding

Activity 2.2.1 Chart display

- ◆ Students observe the chart containing a typical formulation prepared by facilitator.
- ◆ Some points & Hints about the Principle of compounding is given by the facilitator
- ◆ A general discussion on these points and the functions & dos age of chemicals conducted. (In accordance with the first year portion ‘Compounding Ingredients’)
- ◆ Students prepare a chart containing the fractions and dosage of chemicals for latex compounding.
- ◆ The facilitator supplements the points and the student’s prepare notes on principle of compounding.
- ◆ Students prepare typical formulation of different latex goods.

Consolidation

- ◆ Typical formulation
- ◆ Latex compounding
- ◆ Wet weight formula
- ◆ Functions and dosage of chemicals.

Product

- ◆ Chart
- ◆ Discussion notes
- ◆ Sample formulations.

Activity 2.2.2 Specimen Collection

- ◆ Students are asked to collect the different latex products.
- ◆ The collection is classified and displayed
- ◆ A chart containing the name of product, method of manufacture & end use is prepared.
- ◆ Facilitator supplements the data

Consolidation

- ◆ Familiarization of latex products
- ◆ Jazzing
- ◆ Spraying

- ◆ Classification.

Product

- ◆ Specimen Display
- ◆ Classification chart

Activity 2.2.3. Project

- ◆ Facilitator provides the general formulations and hints about latex compounding.
- ◆ Students groups are asked to prepare compounds for different latex product.
- ◆ Students make latex compounds and project report is prepared.
- ◆ The Facilitator evaluates the project report.

Consolidation

- ◆ Compounding of latex for different latex products.
- ◆ Wet weight & Dry weight formulations.
- ◆ maturation & sieving
- ◆ Compound stocking.

Product

- ◆ Project report
- ◆ Latex compounds.

2.3 Dipped goods

Activity 2.3.1 Experiment

- ◆ Students are allowed for a dipping practice in the school laboratory
- ◆ The steps in dipping process are demonstrated by the facilitator.
- ◆ The steps are recorded as a write up.
- ◆ A table of coacervants is prepared.
- ◆ The facilitator validates the flow chart and table.

Consolidation

- ◆ Former
- ◆ Pre treatments
- ◆ Dwell time
- ◆ Inversion
- ◆ Rotation
- ◆ Drying

- ◆ Beading
- ◆ Dusting
- ◆ Striping
- ◆ Leaching
- ◆ Straight dipping
- ◆ Coagulant dipping
- ◆ Dry co servant
- ◆ Wet co servant
- ◆ Chlorination

Product.

- ◆ Write up
- ◆ Table

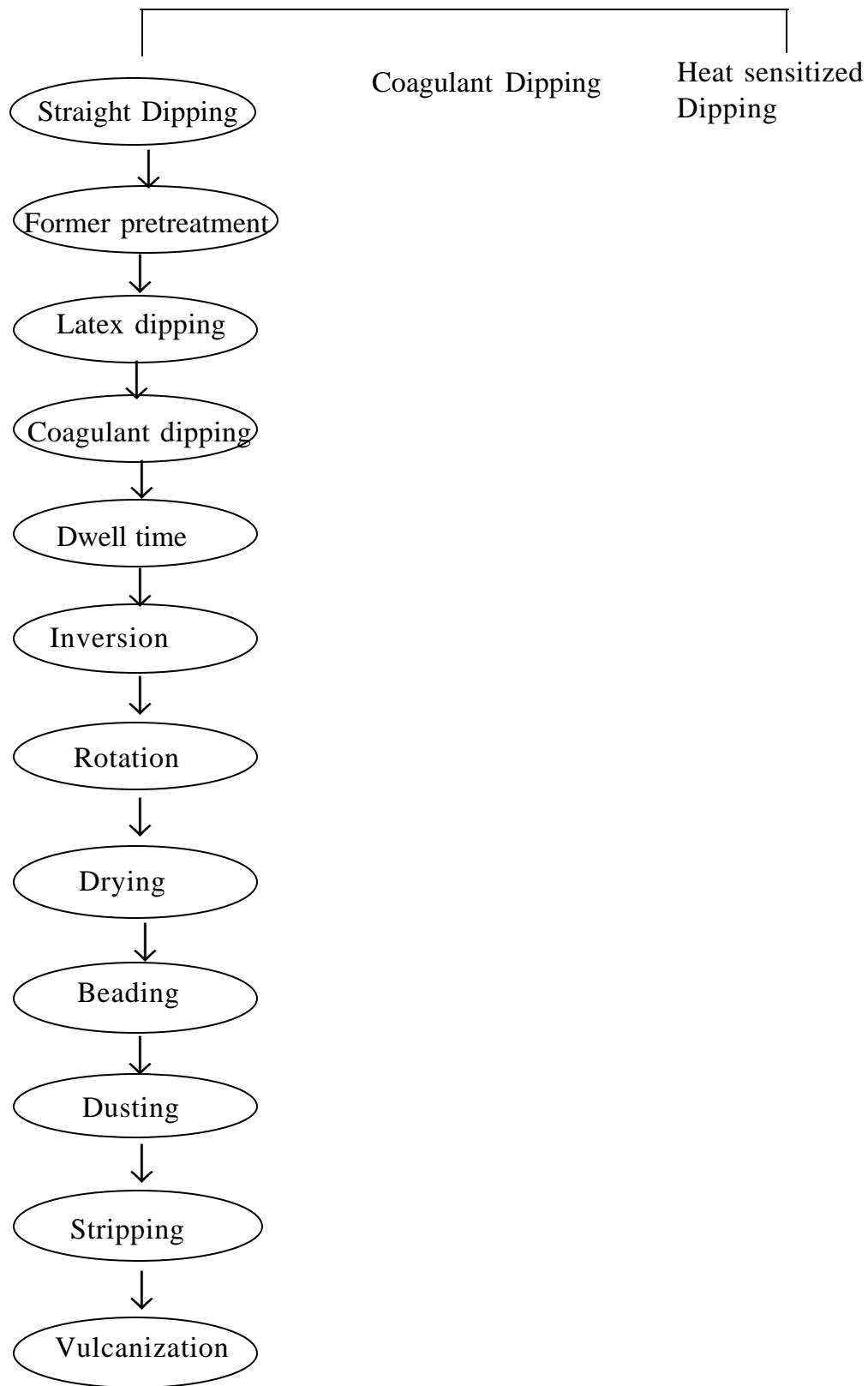
Activity 2.3.2 Chart Preparation

- ◆ Facilitator gives some of idea about heat sensitized dipping
- ◆ Students are asked to prepare a flow chart of dipping process.
- ◆ Facilitator checks the correctness of the chart.

Product

- ◆ Flow chart

Activity 2.3.3. Reference



- ◆ Students are asked to prepare a write up on heat sensitized dipping through reference.
- ◆ The reference write up is verified by the facilitator

Consolidation.

- ◆ Heat sensitized dipping

Heat – Deposit relation

Product

- ◆ Write up

Reference:- High polymer lattices by D.C.Blackly Vol. III

2.4 Casting

Activity 2.4.1 Seminar

- ◆ Facilitator gives a brief disruption on latex casting process.
- ◆ Students are asked to conduct a seminar on latex easting (Ref. Rubber Technology) and manufacture by Steven Blow)
- ◆ The facilitator valuate seminar report.

Consolidation

- ◆ Plaster of parries mould
- ◆ Alluminium mould
- ◆ Compounds for casting
- ◆ Hollow casting
- ◆ Curing of casted items
- ◆ Comparison of metal moulds & plaster moulds

Product

- ◆ Seminar Report

Activity 2.4.2 Flow chart preparation

- ◆ Facilitator gives some points about the manufacturing process of latex thread.
- ◆ Students prepare a labeled diagram me of latex thread manufacturing process (by referring Rub. Tech & manufacture by C. M. Blow)
- ◆ The facilitator verifies diagram.

Consolidation

- ◆ Different steps of manufacture
- ◆ Nozzle, spinneret

- ◆ Speed control
- ◆ Acid strength.

Product

- ◆ Flow Chart

Activity 2.4.3 Assignment

- ◆ Student are asked to prepare an assignment on latex thread manufacture by referring.
- ◆ The facilitator values the assignment.

Consolidation

- ◆ Pressure Regulation
- ◆ Acid bath, water bath
- ◆ Drying, baking
- ◆ Curing
- ◆ Specification

Product

- ◆ Assignment

2.5 Latex foam

Activity 2.5.1 Factory Visit

- ◆ Necessary permission is obtained from the factory.
- ◆ Students are given some preliminary ideas/ points about foam manufacture.
- ◆ Students visit a foam-manufacturing unit.
- ◆ Students clarify their doubts by acting with factory personnel's
- ◆ Students prepare visit report.
- ◆ The report is scrutinized by the facilitator

Consolidation

- ◆ De – ammoniation
- ◆ Latex compounding
- ◆ Dunlop process/ Thalalay process
- ◆ Hobart mixer / backer mixer
- ◆ Foam mould
- ◆ Washing & De watering
- ◆ Drying & Vulcanization

- ◆ Common defects in latex foam.

Product

- ◆ Factory visit report

Activity 2.5.2 Chart Preparation

- ◆ Typical formulation for latex foam is given by the facilitator.
- ◆ Students prepare a chart containing the manufacturing steps of latex foam & formulation (modified)
- ◆ Facilitator evaluates the chart

Consolidation

- ◆ Formulation for foam
- ◆ Latex compounding
- ◆ Froathing.
- ◆ Gelling agent, drying – manufacturing steps & machines

Product

- ◆ Chart (formulation & machines)
- ◆ Flow chart.

Activity 2.5.3 Discussion

- ◆ Students are divided into two groups.
- ◆ One group discuss about Dunlop process.
- ◆ Second group discuss about Thalalay process.
- ◆ Each group prepare a write up about foam manufacture and group leaders present it commonly.
- ◆ Facilitator evaluates the presentation & suggests modifications.

Consolidation

- ◆ Dunlop process - machines & equipments
- ◆ Thalalay process – different steps.
- ◆ Defects & remedies of foam

Product

- ◆ Discussion note

2.6 Latex Adhesive

Activity 2.6.1 Experiment

- ◆ Students observe some simple experiments proving the adhesion & sticking property of latex (using leather, cloth, paper etc)
- ◆ The facilitator gives some hints for improving the adhesion & sticking g properties.
- ◆ Students groups conduct some experiments to prepare latex cement / adhesive using starch / ceasing etc.
- ◆ Students' summaries their experiences as experiment record.
- ◆ Facilitator evaluates the record.

Consolidation

- ◆ Formulation of latex covert
- ◆ Formulation of latex adhesive
- ◆ Methods for improving the adhesive properties of latex

Product

- ◆ Experiment record

Activity 2.6.2 Discussion

- ◆ Facilitator gives some points about the manufacture of latex cement & adhesives
- ◆ Students prepare a write up about latex cement & adhesive referring some books.
- ◆ 2 or 3 Students present the write up and the ideas of the whole group get unified.
- ◆ The facilitator evaluates the write-ups.

Consolidation

- ◆ Advantages of latex cement
- ◆ Manufacture of latex adhesives
- ◆ Properties & formulations of adhesives
- ◆ Major applications of adhesives

Product

- ◆ Write up

Activity 2.6.3 Assignment

- Facilitator presents a curtain raiser about protective coating & latex based paints.
- ◆ Students prepare and submit an assignment about the protective coatings

Of latex based paints

- ◆ The facilitator evaluates the assignments

Consolidation

- ◆ Properties of paints & protective coating
- ◆ Manufacture of latex based paints & coatings
- ◆ Advantages of latex based paints & protective coating.

Product

- ◆ Assignment

Activity 2.6.4

Debate

- ◆ Facilitator open up a general discussion about Road rubberisation
- ◆ Students are divided into two groups and a date is fixed for a debate “The advantages and disadvantages of Road rubberisation”
- ◆ Debate is conducted. (A moderator must be elected by the students before the starting)
- ◆ Timely interventions of the moderator is desirable
- ◆ Main points are recorded by the students.
- ◆ The recordings are refined and enriched with some sample formulations and a report on “Road Rubberisation” is prepared by each.
- ◆ The report is validated by the facilitator.

Consolidation

- ◆ The feasibility of Road Rubberisation
- ◆ The ecological aspects of road Rubberisation
- ◆ Sample formulations
- ◆ Road rubberisation techniques.
- ◆ Advantages & disadvantages of Road Rubberisation.

Product

- ◆ Debate Record

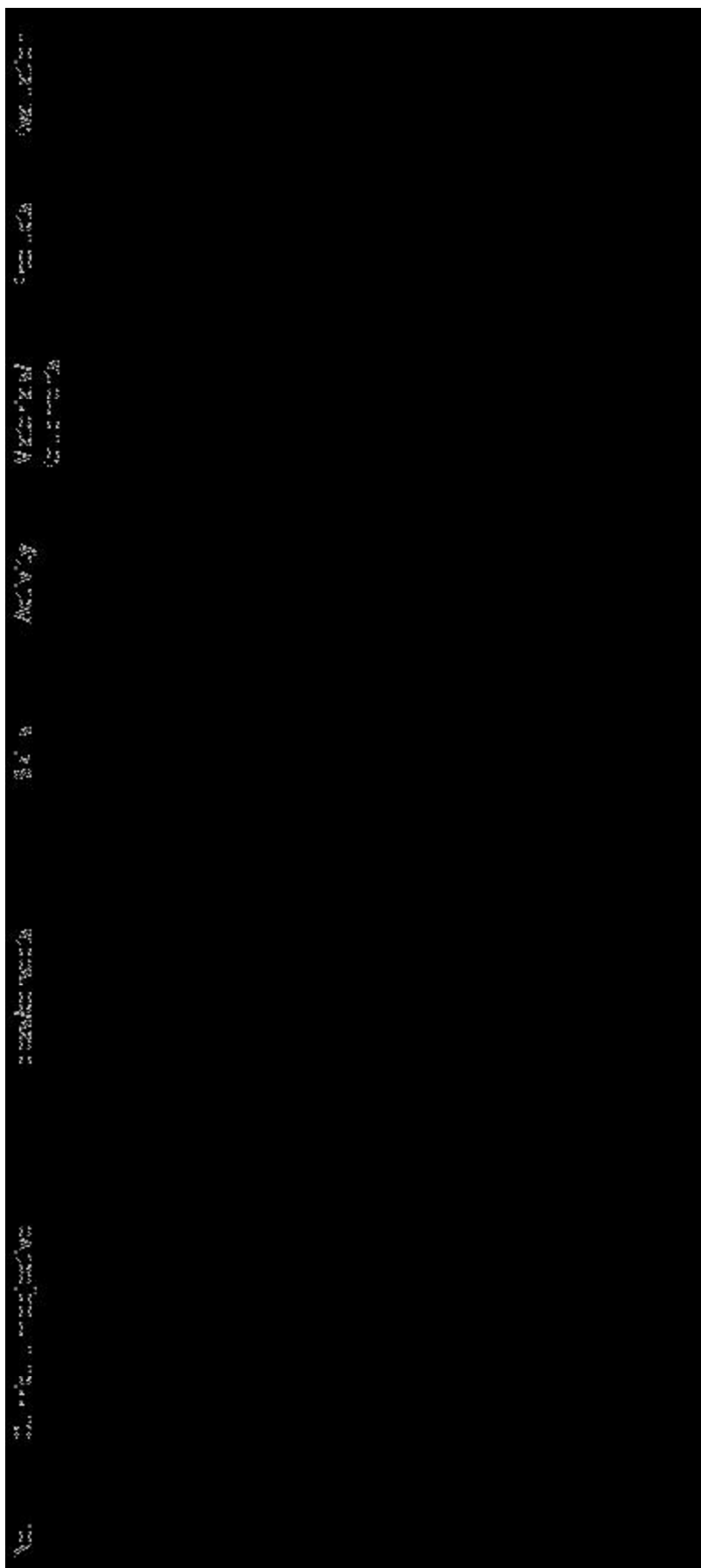
Sample Questions of Manufacture of Latex Products

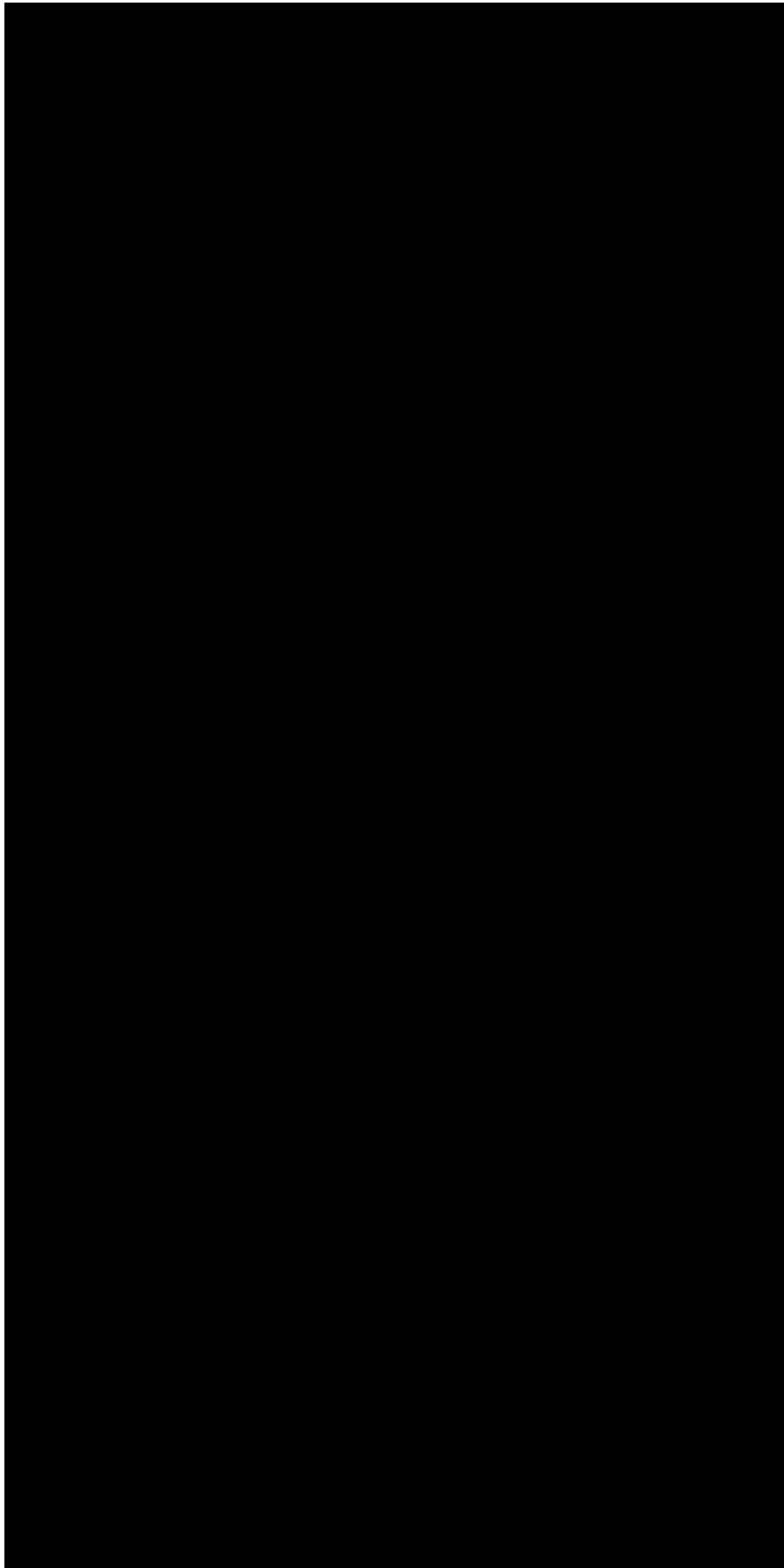
C E Questions

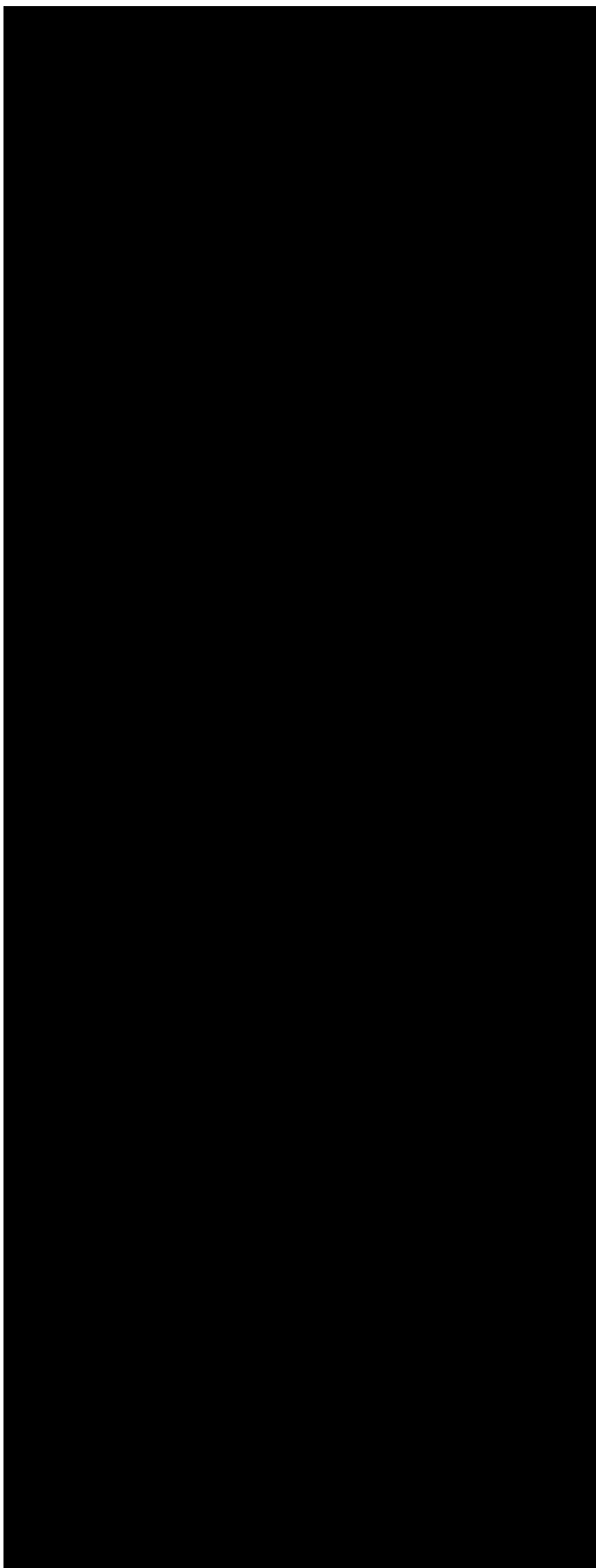
- 1) Illustrate the properties, advantages and applications of latex cement, adhesive and Paint
- 2) Prepare an assignment on latex thread with its working and a labeled neat diagram.

T E Questions

- 1) One of your friends has a glove factory. The gloves made by him is having defects
Like pin holes and sticking. You have to suggest some remedies for this.
- 2) Make a chart of the equipment and machinery used to produce dispersion and Emulsion.







CHAPTER 3

NON - TYRE RUBBER PRODUCTS

Introduction

A number of rubber articles are made in modern life, which increase the comfort and safety of modern living. Though these articles are large in number, their manufacturing process are much similar and common. This unit aims to familiarize the compounding and manufacturing methods of various non tyre rubber products. This unit includes molded goods, hoses, cables, rubber to metal bonding etc. Rubber can be bonded to metal parts, fabrics like rayon, nylon etc to produce variety goods. These goods find application in electrical, mechanical, construction etc. For example, to protect buildings form earthquakes we input dampers and to get smooth drive shock absorbers are used in vehicles.

CURRICULUM OBJECTIVES

- 3.1 To get a clear idea about compounding and manufacturing methods of rubber Footwear and beltings through experiment reference visual media project, field visit and present them as reports.
- 3.2 To acquire clear idea about hoses cables and electrical insullation through project, Field visit and autio – visual aids.
- 3.3 To acquire idea on molded goods and compounding and manufacturing methods of Rubber to metal bonding, rubber-covered rolls, rubber lining of chemical plants shock Absorber and antivibration mounting through experiment, assignment, field visit and Project and present them as report.

Syllabus (40 Hrs)

- ◆ Compounding and manufacturing methods rubber footwear, conveyor and transmission

beltings, hoses and tubing – cable and electrical insulation, rubber moulded goods, rubber to metal bonds, rubber covered roller, rubber lining of chemical plants shock absorbers and anti vibration mountings.

Rubber Footwear & beltings

ACTIVITY .3.1.1. EXPERIMENT

- ◆ Conduct an experiment to produce Hawaii chapel sheeting

Consolidation

- ◆ Cell structure
- ◆ Decomposition temperature
- ◆ Blowing agent

Product

- ◆ Hawaii Chappell sheet

ACTIVITY 3.1.2

PROJECT

The facilitator gives a project to small groups regarding belt compound.

- ◆ Compounding of beltings.
- ◆ Facilitator evaluates the product – belt compound
- ◆ Whether the student builds up capacity.

Consolidation

- ◆ Belt compound preparation
- ◆ Belt play, cover, lamination, Batch cure rote cure

Product

- ◆ Belt compound

ACTIVITY – 3.1.3

FIELD VISIT

- ◆ Students are divided into groups
- ◆ Assign work to each group
- ◆ V'-Belt manufacturing process
- ◆ Conclude the field visits Report.

Consolidation

- ◆ V – Belt manufacturing process

Product

- ◆ Field Visit Report

ACTIVITY - 3.1.4 AUDIO VISUAL AIDS

- ◆ Demonstrate the production of conveyor belt, passenger belt and transmission belt
- ◆ Issue print – out.

Consolidation

- ◆ Production process of conveyor belt
- ◆ Production process of passenger belt
- ◆ Production process of Transmission belt
- ◆ Belt slagging.

Product

- ◆ Print out

ACTIVITY - 3.1.5 REFERENCE

- ◆ The facilitator provides the details of reference sources
- ◆ The students prepare write ups about curing methods or beltings
- ◆ The write ups scrutinized by the facilitator

3.2.Hose & cables

ACTIVITY 3.2.1. ASSIGNMENT

- ◆ Students are asked to prepare an assignment regarding classification of hoses & cables.
- ◆ This assignment should contain a detailed classification of hose and cables according to their manufacture use & functions.
- ◆ This assignment are scrutinised by the facilitation

Consolidation

- ◆ Classification of hoses & cables

Product

- ◆ Write up

ACTIVITY - 3.2.2 GROUP DISCUSSION

- ◆ Students are divided into small groups
- ◆ Give them the topic and points to be noted about structure of hoses and cables.
- ◆ Summaries the discussion points

Consolidation

- ◆ Structure of Hose* Carcass, cover, inner
- ◆ Structure of cable. * Cover, insulation, wire.

Product

- ◆ Write up

ACTIVITY - 3.2.3 REFERENCE

- ◆ The facilitator provides the details of reference sources.
- ◆ Students prepare a detailed write up about the curing methods of Hose & Cable
- ◆ The write ups are scrutinized by the facilitator

Consolidation

- ◆ Batch curing of Hose
- ◆ Batch curing of cable
- ◆ Continuous curing of Hose
- ◆ Continuous curing of cable.

Product

- ◆ Write up

ACTIVITY - 3.2.4 FIELD VISIT

- ◆ Facilitator gives the hints about the points to be noted during visit.
- ◆ Conduct a field visit to the nearest rubber factories of Hose & Cable
- ◆ Students prepare a visit report of Hose manufacture and cable manufacture.

Consolidation

- ◆ Manufacture of Hose
- ◆ Manufacture of Cable

Product

- ◆ Visit Report

ACTIVITY - 3.2.5 AUDIO-VISUAL AIDS

- ◆ Exhibition of video clippings / CD'S related to the manufacture of cable.
- ◆ Students prepare short notes/ Print out.

Consolidation

- ◆ Manufacturing process of cable.

Duel extrusion, Batch cure continuous vulcanisation

Product

- ◆ Print out/ Short note

3.3 MOULDED GOODS & RUBBER TO METAL BONDING

ACTIVITY - 3.3.1 EXPERIMENT

- ◆ Conduct an experiment to produce ball, & doormat & Tea mat in the lab orating.

Consolidation

- ◆ Production of molded goods like ball, door mat & Tea mat
- ◆ Dump-bell piece, blowing mixture, over cure, under cure.
- ◆ Cure chant (See Annexure)

Product

- ◆ Door mat
- ◆ Ball
- ◆ Tea mat

ACTIVITY - 3.3.2 ASSIGNMENT

- ◆ Students are asked to prepare as assignment regarding rubber to metal bonding.
- ◆ The assignment should contain different types of rubber to metal bonding process.
- ◆ The assignments are scrutinised by the facilitator.

Consolidation

- ◆ Different types of rubber to metal bonding process.

*Ebonite bonding *Direct bonding.

*Brass bonding *Oregano – Chemical bonding

Product

- ◆ Write up

ACTIVITY - 3.3.3 GROUP DISCUSSION

- ◆ Students are divided into small groups
- ◆ Give them topics and points to be noted, about rubber covered rolls and rubber lining of chemical plants.
- ◆ Summerise the discussion points consolidation
- ◆ Rubber covered roller manufacture

Product

- ◆ Write up

ACTIVITY 3.3.4 REFERENCE

- ◆ The facilitator provides the details of reference sources.

- ◆ Students prepare a write up about shock absorbers and anti vibration mounting
- ◆ The write-ups are scrutinized by the facilitator.

Consolidation

- ◆ Idea about shock absorbers.
- ◆ Idea about vibration mountings.

Product

- ◆ Write up

References

- ◆ Rubber Technology & manufacture by C.M.Blow
- ◆ Rubber Technology Hand Book by Steve Blow
- ◆ Introduction to Rubber Technology by Mourice Morton.
- ◆ Vander built Rubber Hand Book by Vander Burt it.

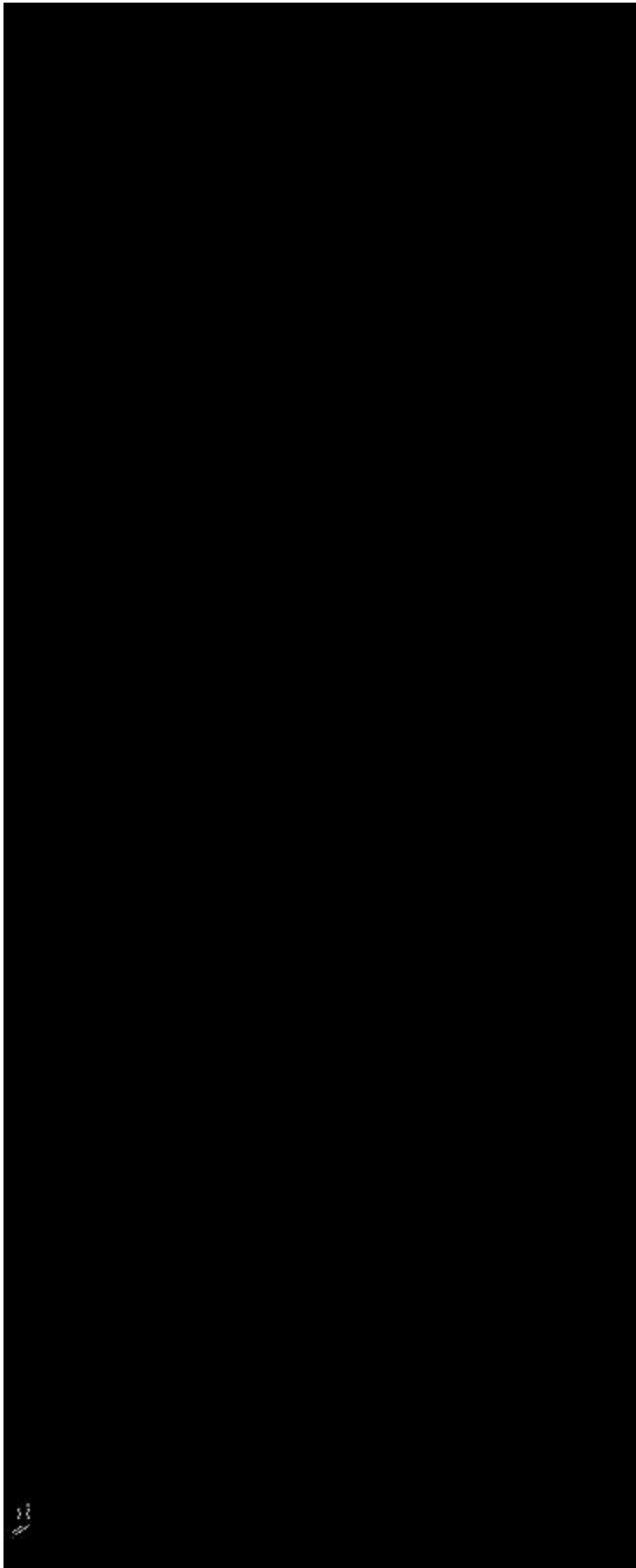
Sample CE Question

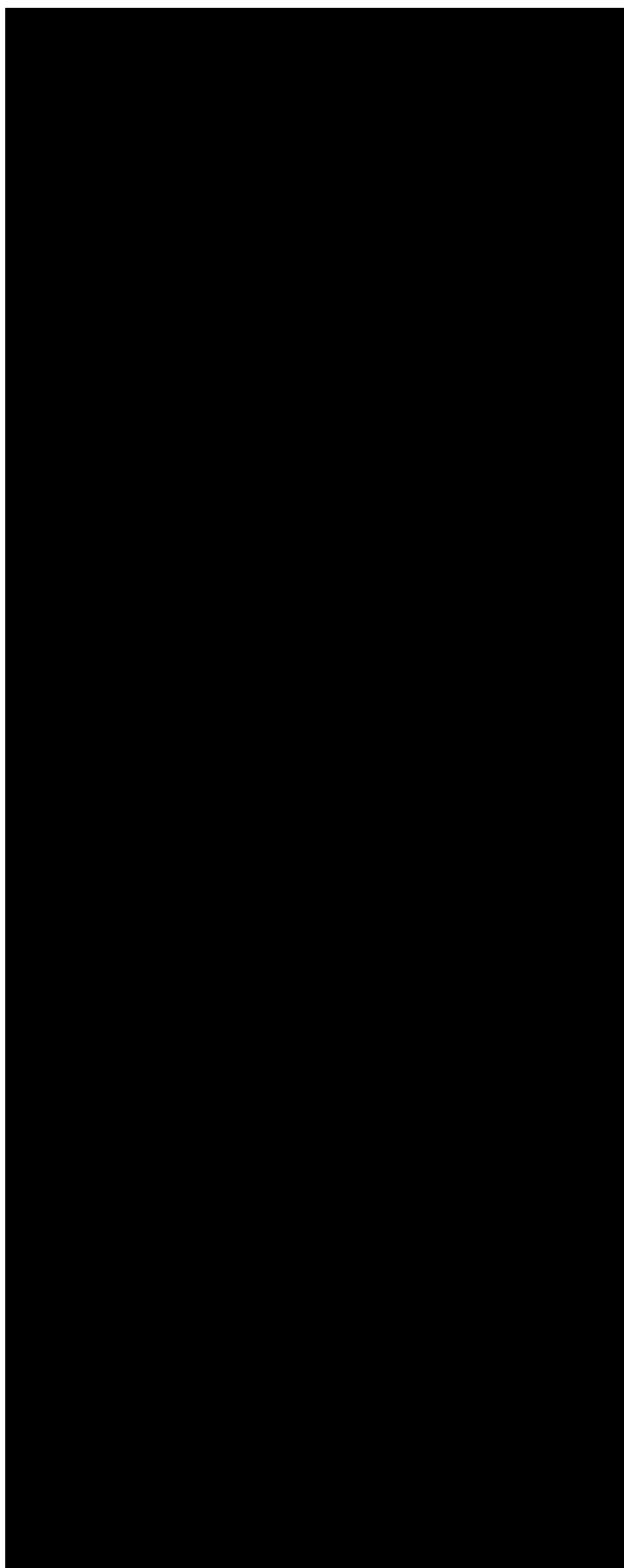
- ◆ Prepare a project report of conveyor Beltings.
- ◆ Prepare an assignment report of classification of hoses & cables.
- ◆ Prepare an assignment report A rubber to metal bonding.

Sample TE Question

- ◆ Mr. Akash decided to start a Door mat production unit suggests the suitable procedure for the Door mat production .
- ◆ Match the following

(1)DNPT	Oil resistant	Blowing agent
(2)Petrol hose	Hawaii Chappell	NBR
(3)Conveyor beltings	Material transmission	Power transmission
(4)V – belt	Trapezium	Rotocure





CHAPTER 4

TYRES

Introduction

Early tyre development took place mainly in Great Britain. Hancock made rubber tyres. The first inflated tyre which commercially successful was invented by J.B. Dunlop. The first successful cord type tyre – a bicycle tyre – was invented in the USA by J.F. Palmer.

88-90% of rubber in the world is used for tyre industries. Automobile industry cannot exist without tyres. Tyres range from animal driven tyres to aeroplane tyres. In this modern era, radial tyres and tubeless tyres find greater application. This unit includes parts of tyres, tyre building, curing, after – treatment, testing and also manufacturing of cycle tyres and tube. More emphasis is given to factory visit so as to get exposure to tyre industry. From this unit students get opening to various tyre industries. Also they get more awareness about tyre – retreading

Curriculum Objectives.

- ◆ To familiarize the history of tyre industry and components of tyre through reference, chart display and group discussions, and present it as write – ups.
- ◆ To acquire idea about tyre manufacturing through chart display, group discussion, factory visit and reference. Also present factory visit report and write – ups.
- ◆ To acquire idea about cycle tyres, Cycle tubes and automobile tubes through group's discussions, assignments and factory visit, and present it as visit report and write – ups.
- ◆ To attain idea about finishing operations through assignment, and present it as assignment report.

Syllabus

(25 Hours)

- ◆ History of tyres industry in India – Manufacture of tyres, cycle tyres, cycle tubes – automobile tubeless tyre treads, bead wire, carcass, side wall, introduction to tyre building, tyre curing, Bagmati and auto form press cure – finishing operations.

4.1 History of tyre industry and classification of tyre components.

Activity 4.1.1 Reference

- ◆ Students are provided with reference books / Handouts.
- ◆ Some point lint's about the topic is given by the facilitator
- ◆ Students are asked to prepare a write – Up about the history of tyre industries.
- ◆ The write ups are scrutinized by the facilitator.

Consolidation

- ◆ History of tyre.
- ◆ History of tyre industries

Product

- ◆ Write up describing the history of tyre and tyre industry.

Activity 4.1.2 Chart Display

- ◆ Various charts describing the tyre components are displayed.
- ◆ Students are asked to list the components.
- ◆ The data is summarized with the help of facilitator.

Components Function

1. Bead Area	*Proper alignment with rim * To maintain torridal shape * Fitting and removal of tyre
2. Carcass/Ply	* Gives strength to tyre
3.Inner liner	*Prevents chafing of tube *Smooth inner surface.
4.Chafer	*Prevent rim chafing
5.Sidewall	*Protect carcass structure *Prevent from chafing damage
6. Breaker / Belt	*Extra strength to tread
7. Tread.	*Holds the vehicle with Road.

Consolidation

- ◆ Bead Area
- ◆ Carcass / Ply
- ◆ Inner liner

- ◆ Chafer
- ◆ Side wall
- ◆ Breaker / Belt
- ◆ Tread.

Product

- ◆ Chart

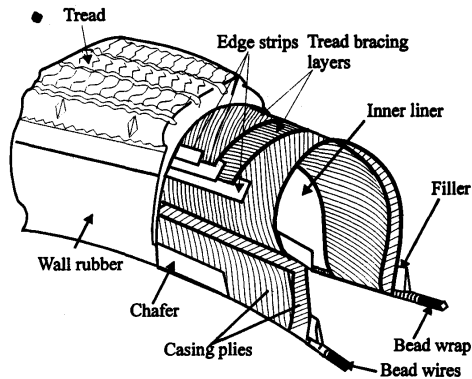


Figure 27.2 Belted bias tyre (two-ply construction), tubeless

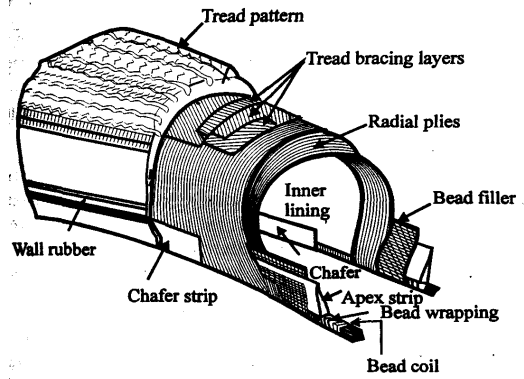


Figure 27.3 Radial ply tyre (two-ply construction), tubeless

Activity 4.1.3 Discussion

- ◆ The students are divided into groups
- ◆ Each group discusses the write – ups (See Activity 4.1.1.) and list of components (See Activity 4.1.2)
- ◆ The functions of tyre components are identified through discussions and prepared write – Ups.
- ◆ Facilitator evaluates the write-ups & list.

Consolidation

- ◆ History of tyre industries in India
- ◆ Functions of tyre components.

Product

- ◆ Write – ups
- ◆ Data list

4.2 Tyre Manufacturing

Activity 4.2.1 Factory Visit

- ◆ Visit is arranged to nearest tyre factory.

- ◆ Brief idea and some points on tyre is given by facilitator.
- ◆ Students interact with factory personnel.
- ◆ Students prepare write-ups at the spot itself.
- ◆ Facilitator evaluates the write-ups and asks to prepare visit report.

Consolidation

- ◆ Tyre compounding
- ◆ Components of tyre
- ◆ Tyre building
- ◆ Tyre curing
- ◆ After treatments
- ◆ Testing

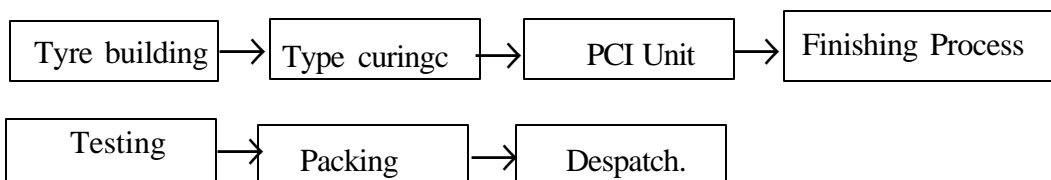
Products

- ◆ Visit Report
- ◆ Collection of tyre section.

Activity 4.2.2. Chart Preparation

- ◆ Students are asked to prepare chart on tyre, from tyre building to dispatch through reference books and hand outs
- ◆ Clarification and evaluation is done by facilitator.

Consolidation



Product

- ◆ Chart

4.2.3 Group Discussion

- ◆ Students are divided into three groups

Group 1 – Topic : Tyre Building

- ◆ Students discuss about tyre building steps and building drum through referring books and hand outs.
- ◆ Prepares write – ups.

Group 2 – Topic: Tyre curing .

Students discuss about tyre curing through reference books and hand outs

- ◆ Prepares write – ups.

Students discuss about tyre curing through reference books and hand outs

- ◆ Groups 3 – Topic After – Treatment
- ◆ Students discuss about the following through reference books.
- ◆ PCI Unit
- ◆ Trimming
- ◆ Testing & tyre sizing
- ◆ Write – ups are prepared.
- ◆ Common Presentation by each groups leaders.
- ◆ Facilitator scrutinizes the write – ups.

Consolidation

- ◆ Tyre building
- ◆ Tyre curing
- ◆ After treatment.

Product

- ◆ Write – Ups.

4.2.4 Reference

Facilitator asks the students to follow –ups books like – Handbook of Rubber Technology by Steven Blow.

4.3 Cycle tyres, tubes and automobile tube.

Activity 4.3.1 Factory Visit

- ◆ Factory visit is arranged to nearest tyre / tube industry.
- ◆ Facilitator gives hints and points to be noted during visit.
- ◆ Students are divided into groups and assign task to each group classified.
- ◆ Students observe the manufacturing process and note the points.
- ◆ The points are deified by discussing with technicians / managers.
- ◆ Consolidate all groups visit report
- ◆ Students prepare factory visit report.
- ◆ The facilitator evaluates the report.

Consolidation

- ◆ Extrusion process
- ◆ Tube manufacture
- ◆ Defects of tube
- ◆ Finishing operations.

Products

- ◆ Factory visit Report

Activity 4.3.2 Group Discussion

- ◆ Students are divided into 5 groups
- ◆ Each group is provided with reference books / Hand out containing the details of consolidation points.
- ◆ The group leader presents the write-ups prepared in the groups.
- ◆ The students prepare discussion notes
- ◆ The facilitator evaluates the notes.

Consolidation

- ◆ Extrusion
- ◆ Mandrel curing
- ◆ Valve fitting
- ◆ Splicing
- ◆ Finishing & Testing

Product

- ◆ Write – Ups

Activity 4.3.3 Assignment

- ◆ The facilitator presents a curtain raiser about cycle tyres
- ◆ Students are asked to prepare assignment on cycle tyre manufacture.
- ◆ The facilitator checks the assignment.

Consolidation

- ◆ Bead
- ◆ Carcass
- ◆ Tread
- ◆ Collapsible drum

- ◆ Monoband method
- ◆ Curing & finishing

Product

- ◆ Assignment

4.4 Finishing Operations

Activity 4.4.1 Assignment

- ◆ Students are asked to prepare assignment on finishing operations through reference books.
- ◆ The assignment should contain all relevant operation points.
- ◆ The assignments are scrutinized by facilitator.

Consolidation

- ◆ Trimming
- ◆ Shot blasting
- ◆ Painting
- ◆ Chemical treatment
- ◆ Tumbling.

Product

- ◆ Write – ups

4.4.2 Reference

- ◆ Each student is asked to refer book & prepare reference notes – Handbook of Rubber Technology by Steven Blow.
- ◆ Facilitator Scrutinizes these notes
- ◆ Reference notes.

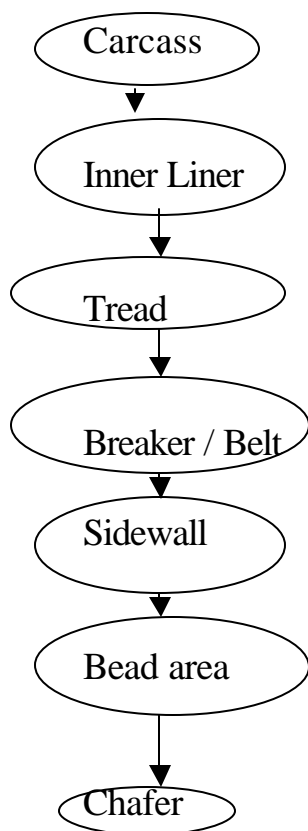
Sample Questions of Tyres

CE Questions

- 1) Conduct a seminar on tyre curing process.
- 2) List out 5 different finishing operations.

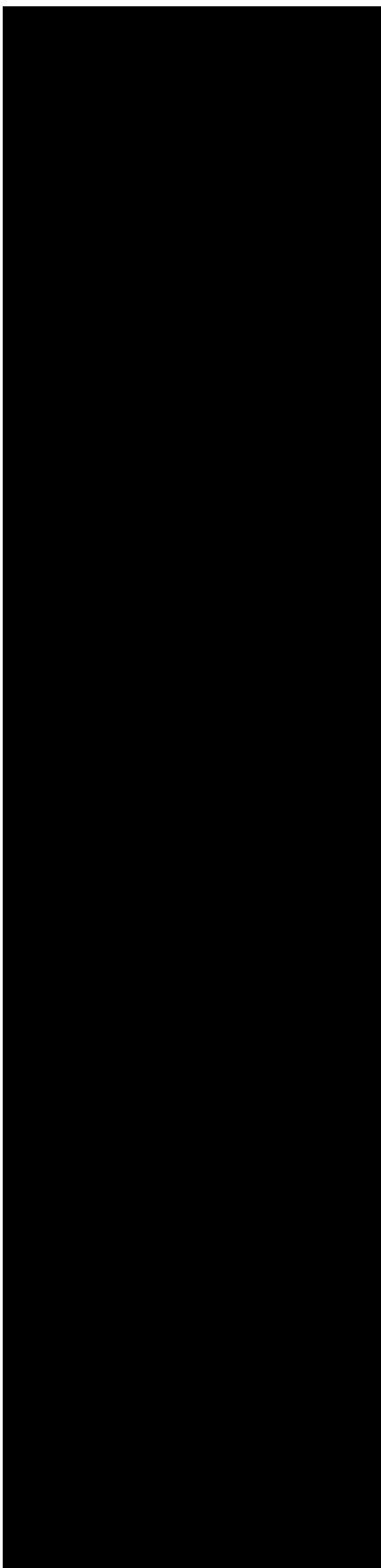
TE Questions

- 1) Suggest a curing method for truck tyre and cycle tyre.
- 2) A flow chart of tyre components are given below. Arrange it in order of building.



**UNIT ANALYSIS – UNIT 4
TYRES**





CHAPTER 5

TESTING AND SPECIFICATION OF RUBBERS

Introduction

For quality control purpose, bureau of India standards from time to time specified some specification standard for rubber additives and products. Without quality, industry cannot survive. Specification standards are essential components in implementing quality in rubber products. BIS specifications for rubber and rubber products have been oriented to internal needs as well as to requirements of export market. The major parameters responsible for quality control are quality of design, quality of performance, the abilities and field service. This unit mainly includes ISI standards for rubber and rubber products. Through this students will get more idea about standards and quality of products

Curriculum Objective.

- ◆ To acquire a clear idea about testing and specification of latex through experiment and reference and present them as reports.
- ◆ To get a clear idea about dry rubber product testing such as shear and compression flex resistance through experiment and assignment and present them as report
- ◆ To conceive the ideas off abrasion, hardness swelling and age sing, stress strain relationship of soft vulcanisates through experiment, debate and assignment and present them as report.
- ◆ To get as awareness about ISI standards of various rubber , additives and rubber products through reference, quiz and assignment and present them as report

Syllabus (10 Hours).

- (a) Specification and test for preserved natural latex.
- (b) Principles of testing of elastomers. Stress – strain relationship, shear and compression flex resistance – abrossim – harden – testing – swelling in solvents – ageing tests.

© ISI standards for various rubber and rubber products.

5.1 Latex Testing

Activity 5.1.1. Experiment

- ◆ Conduct experiments to determine the various testing parameters of latex.
- ◆ Various parameter like DRC, TSC, NRC, NH₃, VFA NO, MST, KOH NO. sludge, coagulum content are measured and recorded
- ◆ Facilitator evaluates the results.

Consolidation

- ◆ Various specification parameter of latex, as per BIS standards.

Product

- ◆ Record

Activity 5.1.2 Reference

- ◆ Students are advised to refer relevant ISI standards of latex and make brief notes on them.

Consolidation

- ◆ BIS standards of latex

Product

- ◆ Write up
- ◆ Record

5.2 Dry Rubber Testing

Activity 5.2.1 Experiment

- ◆ Conduct experiment to determine shear resistance, compression resistance and flex resistance in the laboratory.

Consolidation

- ◆ Shear resistance of rubber
- ◆ Compression resistance of rubber.
- ◆ Flex resistance of rubber.

Product

- ◆ Record

Activity 5.2.2 Assignment

- ◆ Students are asked to prepare as assignment report of De-Mattie flexing machine.(Ref. Annexure – 1)

Consolidation

- ◆ Various parts of De-Mattia flexing machine
- ◆ Testing method using De Mattie flexing machine.
- ◆ Significance and expression of results of Dematta flexing machine

Product

- ◆ Report

5.3 Abrasion & Hardness Testing

Activity 5.3.1 Experiment

- ◆ Conduct experiment to determine
- ◆ Abrasion resistance
- ◆ Hardness
- ◆ Tensile strength
- ◆ Elongation at break(E.B. %)
- ◆ Tearing strength
- ◆ Swelling & ageing

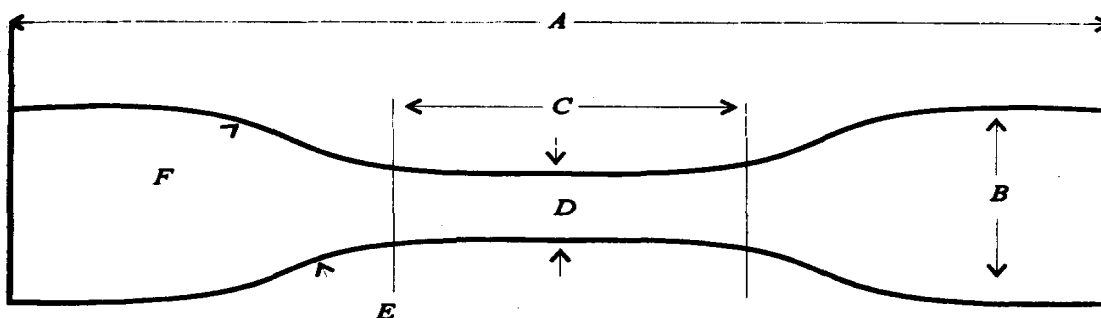
(Ref. Annexure)

Consolidation

- ◆ Abrasion resistance of rubber
- ◆ Hardness of rubber
- ◆ Tensile strength of rubber
- ◆ Elongation at break

Product

- ◆ Record



Dimension	Type 1	Type 2	Type 3	Type 4
A Overall length (minimum)	115	75	50	35
B Width of ends	25.0 ± 1.0	12.5 ± 1.0	8.5 ± 0.5	6.0 ± 0.5
C Length of narrow portion	33.0 ± 2.0	25.0 ± 1.0	16.0 ± 1.0	12.0 ± 0.5
D Width of narrow portion	6.0 ± 0.4	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.1
E Transition radius outside	14.0 ± 1.0	8.0 ± 0.5	7.5 ± 0.5	3.0 ± 0.1
F Transition radius inside	25.0 ± 2.0	12.5 ± 1.0	10.0 ± 0.5	3.0 ± 0.1

Figure 29.20 Dumb-bell test piece. Dimensions are given in mm

Activity 5.3.2 Debate

- ◆ Conduct a debate on stress – strain relationship of elastomeris.
- ◆ Conclude the discussion points.

Consolidation

- ◆ Stress –Strain relationship of elastomers.

Product

- ◆ Report

Activity 5.3.3 Assignment

- ◆ Students are asked to prepare as assignment regarding Tensile Testing machines.

Consolidation

- ◆ Various part of /tensile Testing machine
- ◆ Testing methods
- ◆ Product
- ◆ Report

5.4 BIS Standards of various rubber products.

Activity 5.4.1 Reference

- ◆ The facilitator provides the details of reference sources of BIS standards of various rubber products.
- ◆ Students prepare write up of specification of various rubber products.

- ◆ The write-ups are scrutinized by the facilitator.

Consolidation

- ◆ Bills specification of various rubber products.

Product

- ◆ Write up

Activity 5.4.2 Quiz

- ◆ Conduct a quiz programme regarding specification of various rubber products.
- ◆ Students prepare a write up of Quiz programme.

Consolidation

- ◆ BIS' standards of various rubber products.

Products

- ◆ Write up

Activity 5.4.3 Assignment

- ◆ Students are asked to prepare an assignment regarding particular rubber product's BIS specification.
- ◆ The assignment reports are scrutinized by the facilitator.

Consolidation

- ◆ BIS specification of various rubber products.

Products

- ◆ Report

References

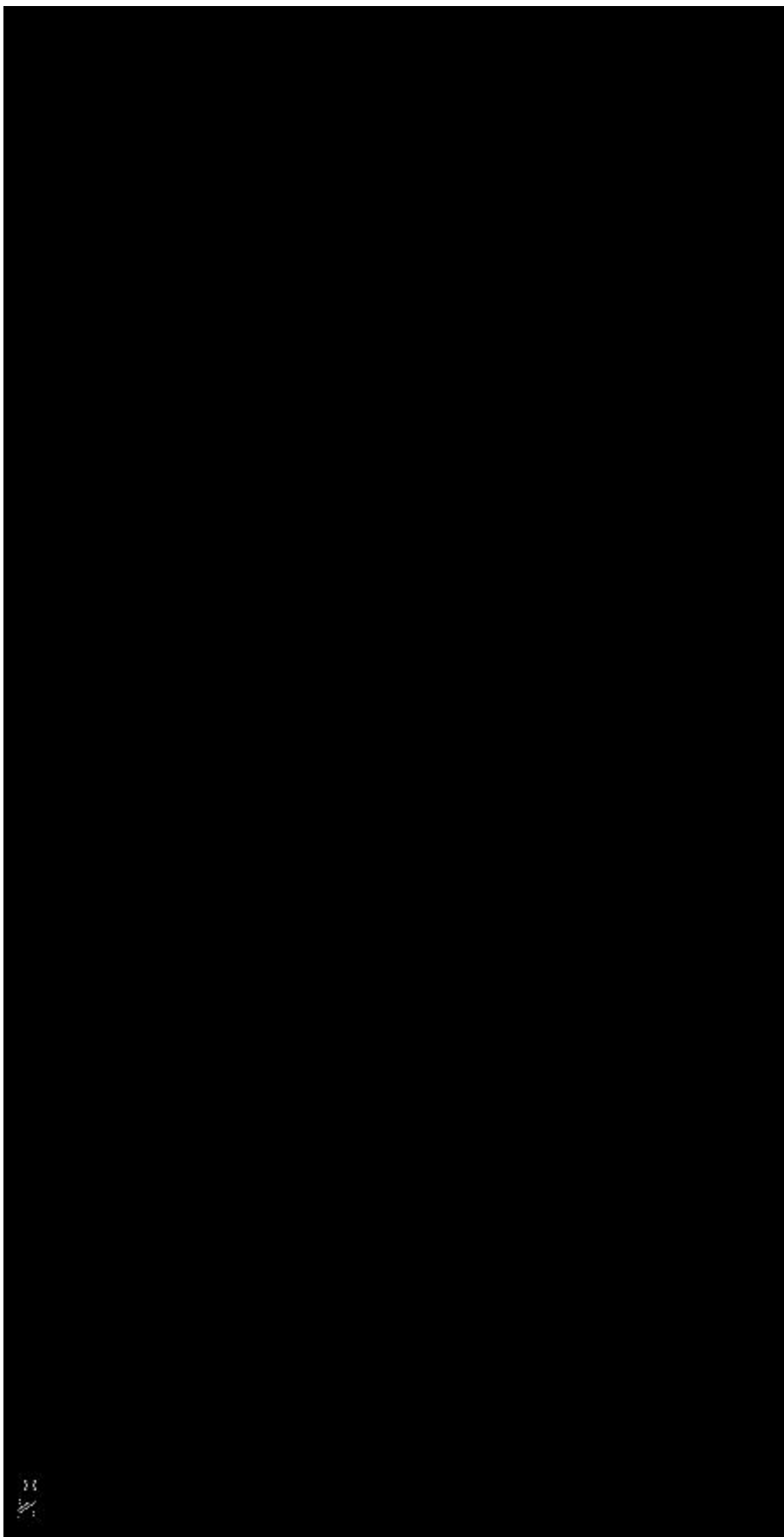
- ◆ BIS' standards of various rubber products.
- ◆ Hand Book of Rubber Technology by Steven Blow
- ◆ Vander built Rubber Hand book.

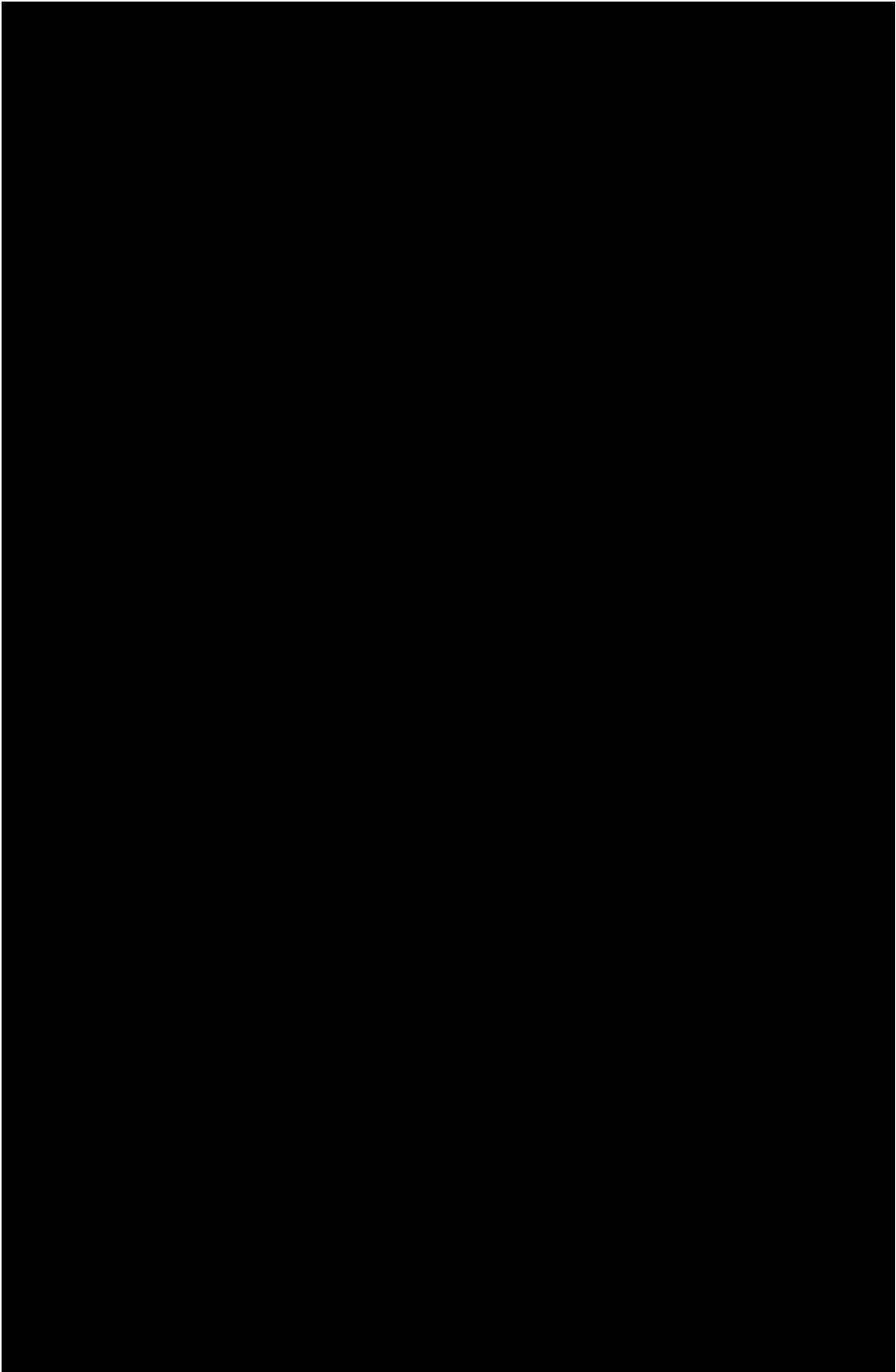
Sample CE Questions

- ◆ Prepare an assignment report of De – Mattia flexing machine.
- ◆ Prepare an assignment report of BIS – specification of surgical gloves

Sample TE Questions.

Mr. George Abraham decided to start the production units of surgical gloves with ISI asperity suggests the specifications of surgical gloves as per BIS Standards.





CHAPTER 1

RUBBER TECHNOLOGY

PRACTICAL

1. Preparation of dispersion, emulsion & solution

Introduction

Rubber chemicals cannot be directly dissolved in the latex. To make this possible particle size of the compounding chemicals has to be reduced. Similarly, oils and other solutions, which are immiscible, are added as emulsions. This unit is meant to make dispersions and emulsions. Using different equipments students are exposed to sufficient training in the preparation of dispersion and emulsion, which are the primary step of latex compounding.

Curriculum Objective

- To acquire the skill to make dispersions, emulsions and solutions for latex compounding through, work practice.

Syllabus

(36 Hours)

- ◆ Preparation of dispersion, emulsion & solution.

1.1 Dispersion

Activity 1.1.1 Work practice

- ◆ Students are divided into three groups
- ◆ First group is direct to prepare dispersions of the following chemicals.
- ◆ ZnO, ZDC, Sulphur, TiO₂, TMTD, ZMBT.
- ◆ Students are asked to design dispersion formulae.
- ◆ Facilitator should make corrections if necessary.
- ◆ Some typical eg: are given below.

Sulphur dispersion (50 %)

S - 100 Dispersal

F	-	3
Water	-	97
Ball Mill For	-	72 Hrs.
Zno Dispersion	-	50 %
Zno	-	100
Dispersol F	-	2
Water	-	98
Ball mill for	-	48 hrs.

- ◆ Chemicals are weighed accurately.
- ◆ Ball mill jar is charged with porcelain balls and chemicals. Jar should not be more than three quarter full and half of this volume should be filled with balls.
- ◆ Timely intervention of facilitator is desirable.
- ◆ Ball mill for specified time.
- ◆ Slurry sample is taken and quality test is conducted.
- ◆ A record is prepared by each student.

Quality Testing

Cloudy Test: Add a drop of slurry into water taken in a glass jar. A cloudy appearance indicates good dispersion. Rapids settling needs further ball milling.

Facilitator evaluates record and quality of the product.

Consolidation

- ◆ Preparation of Zno dispersion.
- ◆ ZDC dispersion
- ◆ ZMBT dispersion
- ◆ TiO₂ dispersion
- ◆ Sulphur dispersion
- ◆ Cloudy test.

Product

- ◆ Dispersions
- ◆ Record.

Emulsion

Activity 1.1.2 Work Practice

The records is prepared by the students and are evaluated by the facilitator.

Consolidation

- ◆ Solution preparation
- ◆ Preparation of Ammonia solution
- ◆ Preparation of Cal. Chloride solutions.

Product

- ◆ Solution
- ◆ Record.

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CHAPTER 2

LATEX COMPOUNDING

Introduction

Fresh latex alone cannot be used to make products. To get stable and durable products some chemicals are to be added. For this unit students are exposed to latex stabilisation, sequence of additives of dispersions, maturation and sieving. Sufficient training has to be given to students in latex compounding, as it is the basic operation of latex product manufacture.

Curriculum Objectives

- ◆ To achieve the ability to prepare latex compound through work practice.

Syllabus

(48 hrs)

- ◆ Latex compounding

2.1 Latex Compounding

Activity 2.1.1 Work Practice

- ◆ The students are divided into groups and groupwise instructions are given to prepare the latex compound.
- ◆ Weighing of chemicals dispersion, emulsion & solution according to the formulations.
- ◆ A typical formulation is given below.

		Dry weight	Wet weighs
60 % NR latex	-	100	167
10 % KOH solution	-	0.2	2
50 % Sp emulsion	-	1	2
50 % ZDC dispersion	-	1	2
50 % ZMBT dispersion	-	0.5	1
50 % S dispersion	-	1.75	3.5
50 % Zno dispersion	-	0.3	0.6

- ◆ Ammonia content is reduced to 0.2-0.3%
- ◆ Stabilization of latex by the addition 20% KOH solution.
- ◆ Other ingredients are added under the guidance of facilitator.
- ◆ The compound is kept for 24 to 48 hrs for maturation. The students are asked to prepare the record. The facilitator evaluates the record and the latex compound.

Consolidation

- ◆ Deammoniation
- ◆ Stabilisation
- ◆ Awareness of wet weight and dry weight
- ◆ Sequence of addition of chemicals
- ◆ Maturation

Product

- ◆ Latex compound
- ◆ Record

NO	Classification	Description	Sci	Activity	Medium	Process	Material
2.	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex	2.1. Latex 2.2. Latex 2.3. Latex 2.4. Latex 2.5. Latex 2.6. Latex 2.7. Latex 2.8. Latex 2.9. Latex 2.10. Latex

CHAPTER 3

LATEX PRODUCT

Introduction

Many of the latex products can be produced in cottage and tiny industries with less investments and rubber cost. We are gifted with abundance of NR latex, which can be marketed as value added product with simple operations. This unit gives opportunity to produce rubber bands, balloon, finger caps, gloves etc.

Curriculum Objectives

- ◆ To acquire the ability to make latex compound and produce rubber band through work practice.
- ◆ To attain the ability to make latex compound and to produce hand made gloves (house hold gloves) and finger cap through work practice.
- ◆ To acquire the skill to make latex compound and to make balloon through work practice.
- ◆ To achieve the ability to prepare latex compound and to make latex foam through field visit / OJT.

Syllabus

(84 hrs)

- ◆ Latex Products

3.1 Rubber band

Activity 3.1.1. Work Practice

- ◆ Students are divided in to groups.
- ◆ Dispersions, emulsions & solutions are prepared as per the formulation developed with the help of facilitator.
- ◆ An incomplete formulation can be given and students are asked to develop a suitable formulation for rubber band.

- Facilitator should make corrections of necessary.

Typical formulations for rubber band

		Wet wt.
60 % NR Creamed latex	-	167
20 % Vulcaused D-paste	-	1.25
50 % Sulpher dispersion	-	3
50 % ZDC	-	2
50 % Zno	-	0.5
50 % Sp emulsion	-	2
33 % TiO ₂ dispersion	-	6
60 % Clay dispersion	-	8

Co lour as required

Cure 60' at 100oc

- ◆ Ingrediants are weighed
- ◆ Students this prepare latex compound by addting dispersions and emulsions as per the formulations.
- ◆ Kept for maturation.
- ◆ Wooden/ aluminum/ PVC formers are cleaned and immersed in the co servant solution
- ◆ Students immerse the former is latex slowly.
- ◆ Give dwell time (1-5 minutes)
- ◆ Slow with drawl of the former 1-2 feet/minute
- ◆ Former is inverted and notated.
- ◆ Dry at 60oC.
- ◆ Facilitator can demonstrate dipping process.
- ◆ Dipping is repeated till the required thickness is obtained.
- ◆ After drying a bead is formed
- ◆ Dusting and stripping
- ◆ Vulcanization is hot water for 1-2 hours
- ◆ Tubes are cut in to bands.
- ◆ Students prepare a record.
- ◆ Facilitator evaluates rubber band and record.

Consolidation

- ◆ Design of rubber band compound.
- ◆ Preparation of CaCl_2 solution.
- ◆ Sequence of dipping
- ◆ Dwell time
- ◆ Drying
- ◆ Beading
- ◆ Stripping
- ◆ Vulcanization.

Product

- ◆ Rubber band (size 1" to 4")
- ◆ Record

3.2 House holds gloves and Finger cap

Activity 3.2.1 Work practice

- ◆ The students are divided as groups.
- ◆ Students are directed to design the latex compound for the household gloves.
- ◆ Necessary corrections given by the facilitator.
- ◆ Typical Formulation.

60% Centrifuged latex	-	167
10% KOH	-	3
50% S	-	3
33% TiO_2	-	6
50% Zno	-	2
50% ZDC	-	2
50% SP	-	2
50% mineral oil emulsion		6
30 mints at 125°C hot air		

- ◆ Latex compound is prepared by mixing suitable chemical dispersious and emulsions(See 2.1 activity)
- ◆ Kept for maturation (24-48 hrs)

Dipping

Wooden / porceliain/ aluminum formers are cleaned and heated to 50°C and dipped in to coacervant. Calcium nitrate or calcium chloride 30% is used as coagulant. (See activity 3.1)

Drying:- 70-80°C in air oven

Leaching:- 10 minutes in warm water.

Vulcanization:- 30 minutes at 120°C in air oven

Chlorination

- ◆ Gloves are treated with chlorine solution to obtain smooth surface.
- ◆ Dipping in ammonia solution is to neutralise acid.
- ◆ Air inflation test can be done to detect pinholes.
- ◆ Students should complete the work under the guidance of facilitator.
- ◆ Students prepare a record.
- ◆ Facilitator evaluates active participation of each student and records.

Consolidation

- ◆ Formers
- ◆ Preparation of co servants
- ◆ Dipping
- ◆ Drying
- ◆ Leaching
- ◆ Chlorination
- ◆ NH₃ Solution
- ◆ Air inflation test

Product

- ◆ House hold Gloves
- ◆ Record

3.2 Finger Caps

3.2.2 Work Practice

- ◆ Students are divided in to groups.
- ◆ Compound formulation is constructed
- ◆ Facilitator makes corrections and modification after discussion with students group
- ◆ A typical formulation is given below.

	Wet weight
60% Creamed latex	167
10% KOH	4

50% Sulpher dispersion	3
50% ZDC dispersion	2
50% Zno dispersion	0.5
50% Sp emulsion	2
33% TiO ₂ dispersion	6
60% Chira clay	12

Co lour as deserved.

Cure 70 minutes at 100°C in hot water.

- ◆ Compounding of latex (See activity 2.1)
- ◆ Give maturation time (24-48 hrs)

Dipping

- ◆ Wooden formers cleared and dipping process should be carried out (See activity 3.1)

Drying & Vulcanization

Dry in air over/ sunlight at a temperature of 70-80oC and a bead is forded.

- ◆ Dusting and stripping
- ◆ Cure 1 hour in hot water
- ◆ A flow chart is prepared
- ◆ Facilitator evaluates record chart & finger cap.

Consolidation

- ◆ No. of dippings
- ◆ Beading
- ◆ Sun light drying
- ◆ Oven-temperature control.

Product.

- ◆ Finger cap
- ◆ Flow chart
- ◆ Record

3.3 Balloon

3.3.1 Activity Work Practice

- ◆ Students are divided in to groups
- ◆ Formula is developed by students with the proper guidance of facilitator.
- ◆ Dispersers prepared already are weighed and incorporated to NR latex (See activity 3.1)
- Coacervent should also be kept for use

- ◆ Typical formula is as follows.

Wet. Wt

60% NR latex	-	167
10% KOH Solution	-	4
20% Potassium Coprolite solution	-	2
50% Sulphur dispersion	-	1
50% ZDC dispersion	-	1.5
50% Zno dispersion	-	0.5
50% Sp Exclusion	-	2

Colour as required

- ◆ Maturation her a period of 16 hrs.
- ◆ Sieving through 80 – 100 mesh

Dipping

- ◆ Porcelain , Glass or Aluminum formers can be used
- ◆ Dipping with proper dwell time
- ◆ Dried is air oven at a temp of 60-70oC.
- ◆ Give beading
- ◆ Vulcanized in hot air at 120°C for 25 minutes.

Jazzing

This process is applied to balloons to get a variegated colour effect ie. is dip balloons in a water bath containing colored rubber solution.

Spraying

LowT.S colored latex can be sprayed to balloons.

- ◆ Balloons are stripped from the farmers by usingtalc.
- ◆ All groups do the work
- ◆ Pupils prepare a record.
- ◆ Facilitator evaluates them
- ◆ Participation, balloon and record.

Consolidation

- ◆ Former
- ◆ Stainless steel seive 80-100 nosh

- ◆ Dipping tank
- ◆ No. of dipping
- ◆ Calcium nitrate solution is alcohol
- ◆ Jazzing
- ◆ Spraying

Products:- Balloon record.

3.4 Latex foam

Activity 3.4.1 Field visit / OJT

- ◆ Selection of foam unit
- ◆ Receipt of prior prevision
- ◆ Facilitater gives some hints about the production of latex foam
- ◆ Divide students in to small group
- ◆ Daily plan is prepared with the help of factory officials (for OJT)
- ◆ Interaction between students and factory experts.
- ◆ Discussion summarizing, preparation of units ups
- ◆ Realize the process, manufacturing techniques
- ◆ Quality testing packing & Dispatch
- ◆ Prepare visit report/ training report.

Consolidation

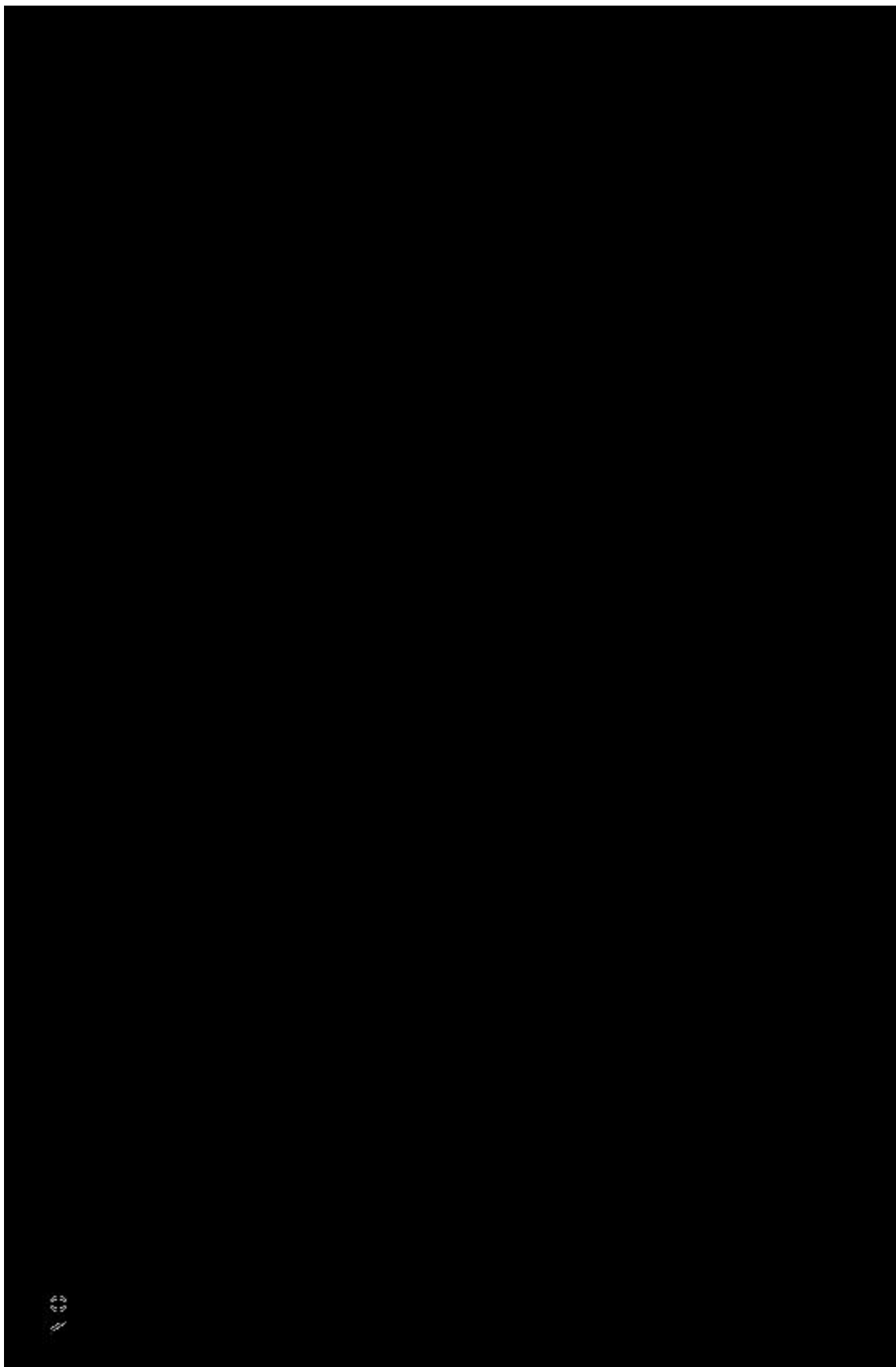
- ◆ Factory set-up
- ◆ De-ammoniates
- ◆ Initial compounding
- ◆ Maturation (24 hrs)
- ◆ Final compounding
- ◆ Foaming
- ◆ Hobart mixer
- ◆ Foam stabilizer
- ◆ Gelling
- ◆ Moulding & curing
- ◆ Post curing

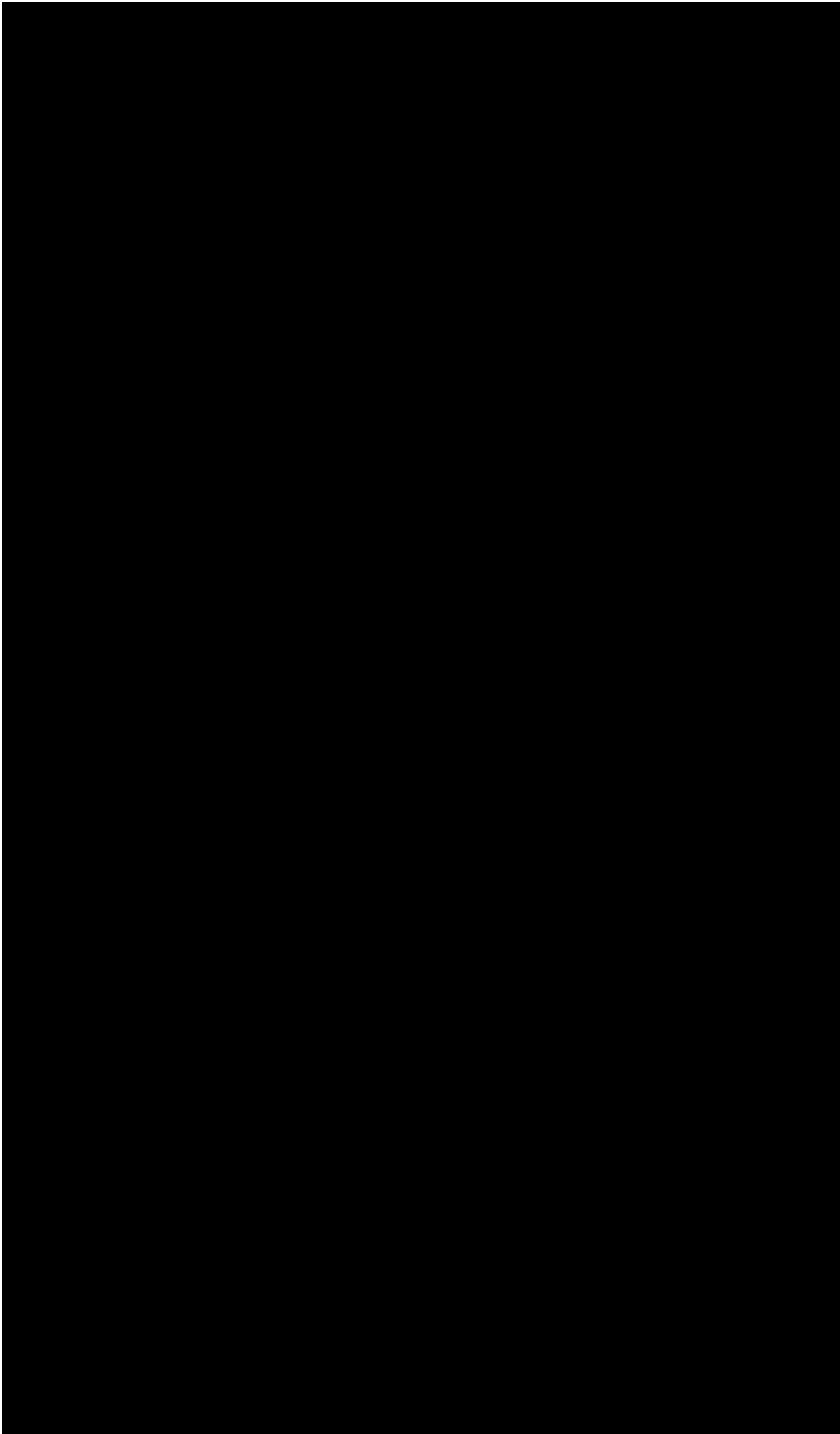
- ◆ Washing
- ◆ Drying
- ◆ Testing

Product

- ◆ Field visit report/ training report

UNIT ANALYSIS – UNIT 3 LATEX PRODUCTS





CHAPTER 4

MASTICATION AND BLENDING OF DIFFERENT ELASTOMERS

Introduction

The first step in rubber compounding is to reduce the viscosity of raw rubber, this is termed as “mastication”. Degree of mastication differs with nature of rubber. Different type of rubbers can be blended if its viscosity is made competable. To et better properties and of economic reasons, the different rubbers are to be blended together. The art and science of blending is covered in this unit.

Curriculum Objectives

- ◆ To attain the ability to do the mastication of the the raw natural rubber through work pratice.
- ◆ To achieve to ability to do blending of NR with SBR through work practice

Syllabus (45 hrs)

- ◆ Mastication and blending of different elastomers

4.1 Mastication

Activity 4.1.1 Work practice

Students are divided in to 3 or 4 groups. Rubber sheet (300gm) is taken by the each group and it is passed through mix lab mill rolls.

- ◆ Even group members should get the working practice.
- ◆ They should practice cuttings by knife
- ◆ They should check the temperature developed in the mill roll
- ◆ They are asked to observe the Physical changes take place during the work
- ◆ Students can identify, by visual means that mastication process is over or not
- ◆ Use of peptizing is also recommended.

- ◆ Students prepare a record.
- ◆ Facilitator evaluates record and active participation.

Consolidation

- ◆ Mooney viscosity
- ◆ Peptizing
- ◆ Heat development
- ◆ Plasticity

Maturation time

Product:-

- ◆ Masticated compound ,
- ◆ Record

4.2 Blending

Activity 4.2.1 Work practice

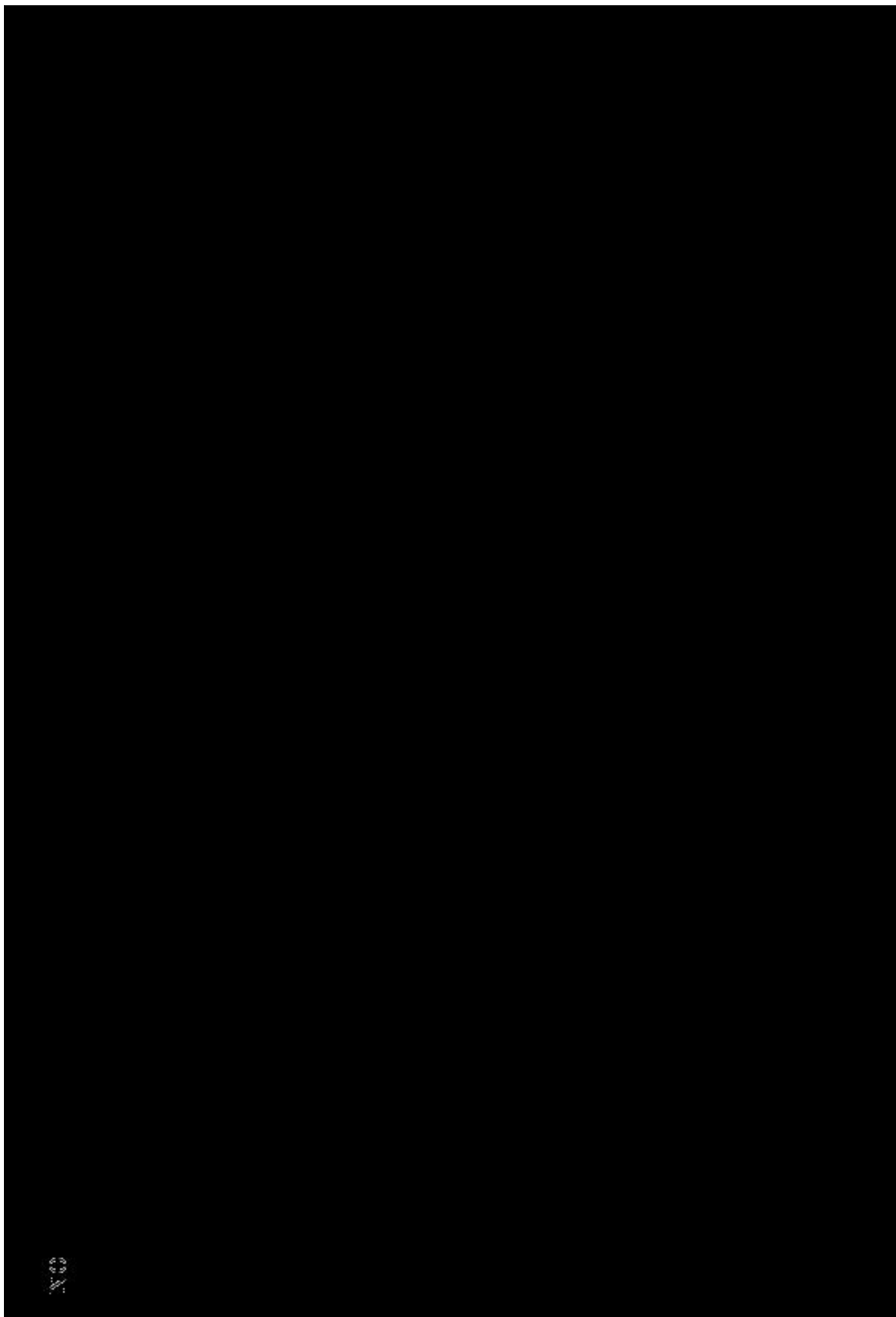
- ◆ Students are divided to group
- ◆ Each group are directed to do the blending process
- ◆ N R and SBR is blended in the ratio 1-1
- ◆ Students take the weight of NR and SBR
- ◆ They first masticate NR
- ◆ To the masticated NR, the SBR is introduced and proper cutting and band formation is ensured
- ◆ Students record the work in the record.
- ◆ Facilitator evaluates the blended rubber and record.

Consolidation

- ◆ Blending of NR with SBR
- ◆ Difference in Mooney viscosity
- ◆ Compatibility
- ◆ Time of blending

Product

- ◆ NR – SBR blend
- ◆ Record



CHAPTER 5

DRY RUBBER COMPOUNDING

Introduction

Raw rubber alone cannot be used for making products. To improve its properties, different processing chemicals are to be added based on its use. In this unit students get an opportunity to handle mixing mill and its related operations. And also the sequence of addition of rubber chemicals.

Curriculum Objective.

- ◆ To acquire the ability to make dry rubber compound through work practice.

Syllabus

(48 hrs)

- ◆ Dry rubber compounding.

Dry rubber Compounding

Activity 5.1 Work Practice

- ◆ Divide the students into groups
- ◆ Each group is asked to develop compound recipes
- ◆ Facilitator scrutinized the compound formulation with prepare modifications.
- ◆ A typical dry rubber compound recipe is given below.

NR	-	00
Zno (w.s)	-	5
Stearic Acid	-	2
MBT	-	1.2
TMT	-	0.2
Process Oil	-	7
Whiting	-	35

Clay	-	125
TMQ	-	1
S	-	2.5

Cure is at 150°C 1000 psi pr

- ◆ Each group should make rubber compounds variety formulations ie elastomeric blends, change in -curing system, A/O can be entertained.

Order of Addition

NR is masticated in case of blends synthetic rubber reclaimed rubber are added later.

- ◆ Addition of Activation
- ◆ Addition of whiting agent/ special
- ◆ Addition of Accelerations
- ◆ Addition of fullers along with P. oils.
- ◆ Addition of curing agent
- ◆ Compound is homogenized
- ◆ Blank is prepared and ready for moulding operation.

Consolidation

- ◆ Band
- ◆ Bank formation
- ◆ Nip adjustment
- ◆ Cooling of rolls
- ◆ Mastication
- ◆ Blending
- ◆ Incorporation
- ◆ Refining
- ◆ Rubber compound
- ◆ Record.
- ◆ Band
- ◆ Bank formation
- ◆ Nip adjustment
- ◆ Cooling of rolls

Product

- ◆ Rubber compound
- ◆ Record.

UNIT 5 DRY RUBBER COMPOUNDING

NO	QTY	DESCRIPTION	UNIT	AMOUNT	REMARKS
1	100	SMOKED RUBBER	KG	100	
2	100	SMOKED RUBBER	KG	100	
3	100	SMOKED RUBBER	KG	100	
4	100	SMOKED RUBBER	KG	100	
5	100	SMOKED RUBBER	KG	100	
6	100	SMOKED RUBBER	KG	100	
7	100	SMOKED RUBBER	KG	100	
8	100	SMOKED RUBBER	KG	100	
9	100	SMOKED RUBBER	KG	100	
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98	100	SMOKED RUBBER	KG	100	
99	100	SMOKED RUBBER	KG	100	
100	100	SMOKED RUBBER	KG	100	

CHAPTER 6

ON THE JOB TRAINING PROGRAMME

INTRODUCTION

On the job training which is an integral part of vocational education that takes place in a real job situation under the supervision of an expert in-plant supervision aiming at the development of proficiency and self confidence.

OJT is designed to supplement in school instruction by providing the dimension of practical training in a realistic work situation.

The real exposure to the industry definitely promotes the technical know how of pupils. OJT increases production of goods and services to the employer at less cost. Since the trainees who actually do the work are not paid. This training is a mutual benefit programme for both trainee and the employer.

Curriculum Objective.

- ◆ To familiarize the real work situation and attain the skill to operate giant machineries.

Syllabus

(70hrs)

- ◆ On the Job training (OJT)

On the job training programme (ojt)

Activity 6.1 Training

School resource group should have a strategic planning for the successful implementation of OJT programme.

Some recommendations are given below:

- ◆ Selections of reputed firm
- ◆ Request for permission

- ◆ Signing of M.O.U
- ◆ Brief discussion of process details of concerned products.
- ◆ Facilitator should accompany the students,
- ◆ Active participation and punctuality should be assumed.
- ◆ Students should prepare a detailed training report.
- ◆ Facilitator evaluates training report

Consolidation

- ◆ Factory management
- ◆ Plant lay out
- ◆ Raw material collection
- ◆ Processing
- ◆ Quality testing
- ◆ Packing & dispatch

Product

- ◆ Training report

ON THE JOB TRAINING PROGRAMME

UNIT 6

NO	Content	Skills	Activity	Material	Equipment	Time
6.1	Introduction to the subject	Observation	Work	Materials	Tools	10 min
6.2	History of rubber	Observation	Work	Materials	Tools	10 min
6.3	Properties of rubber	Observation	Work	Materials	Tools	10 min
6.4	Manufacture of rubber	Observation	Work	Materials	Tools	10 min
6.5	Uses of rubber	Observation	Work	Materials	Tools	10 min
6.6	Recycling of rubber	Observation	Work	Materials	Tools	10 min
6.7	Future of rubber	Observation	Work	Materials	Tools	10 min

CHAPTER 7

DRY RUBBER PRODUCT

Introduction

Moulding is a common operation for rubber-moulded goods. Any rubber product can be manufactured using different types of moulds. In this unit, students are trained to produce some of the products like doormat, tea mat, chapels etc. Students gets an opportunity to produce moulded goods like cellular rubbers, ebonite, sponge rubber etc which requires some special attention. They also get awareness of different presses like hydraulic press, screw press hydraulic press etc.

Curriculum Objective

- ◆ To achieve the ability to do rubber compounding and to produce mats through work practice.
- ◆ To acquire the ability to do rubber compounding to produce paper weight, washer, rubber ball through work practice.

Syllabus

(59hrs)

- ◆ Dry Rubber Products

Co. 7.1. Tea mats

Activity 7.1.1 Work Practice

- ◆ Students group design formulation for tea mat of different colors & filler loading
- ◆ Facilitator verify the formulation
- ◆ Students groups weigh the ingredients as per the formulations.
- ◆ Students prepare compounds for tea mats.
- ◆ Students groups mould tea mat using preheated mould & Screw press.
- ◆ Each group carry out the finishing operation of their product & inspected

- ◆ Students Record the operation and results.

consolidation

- ◆ Formulations, (NR, Based and NR/SR Blend)
- ◆ Compound preparation, Blending
- ◆ Colour combination
- ◆ Pre heating & lubricating of mould.
- ◆ Charging, venting, moulding
- ◆ Inspection
- ◆ Finishing operation
- ◆ Inspection

Product

- ◆ Tea mat of different colours & quality.
- ◆ Record.

Co 72 Paper weight, washer

Activity 7.2 Work Practice

- ◆ Student groups design formulation of paper weight, washer of different quality levels.
- ◆ The facilitator suggest correction in the formulation if necessary
- ◆ Student groups prepare compounds of paper weight of different colours under the supervision of facilitator
- ◆ Student groups prepare compounds for different type of washers.
- ◆ Student groups mould paper weights of different colours & quality
- ◆ Student groups moulded washers of different shapes & quality
- ◆ Inspection of products
- ◆ Finishing operation are carried out by students
- ◆ All students record the work practice

Consolidation

- ◆ Formulation of paper weight – different colour
- ◆ Formulation of washers – different applications
- ◆ Moulding operation
- ◆ Inspection – moulding defects
- ◆ Percentage wastage & loss compound cost calculation

- ◆ Finishing & trimming.

Products

- ◆ Paper weights of different colours
- ◆ Washers for different applications
- ◆ Record.

Co. 7.3 Hawaii Sole & Strap

Activity 7.3. Work practice

- ◆ Students prepare formulations of Hawaii soles & strap (by referring the theory notes) of different quality & colours.
- ◆ The facilitate correct the formulations if necessary
- ◆ Students groups make compound of Hawaii sole & strap of different quality & colours.
- ◆ Students groups mould the Hawaii sole & strap of different quality & colour using hydraulic press & mould.
- ◆ Visual inspection.
- ◆ Students groups perform the finishing operations
- ◆ Cutting & Assembling of Hawaii chapel by each groups.
- ◆ Each groups calculate the compound cost, wastage and Recorded in the work practice record.

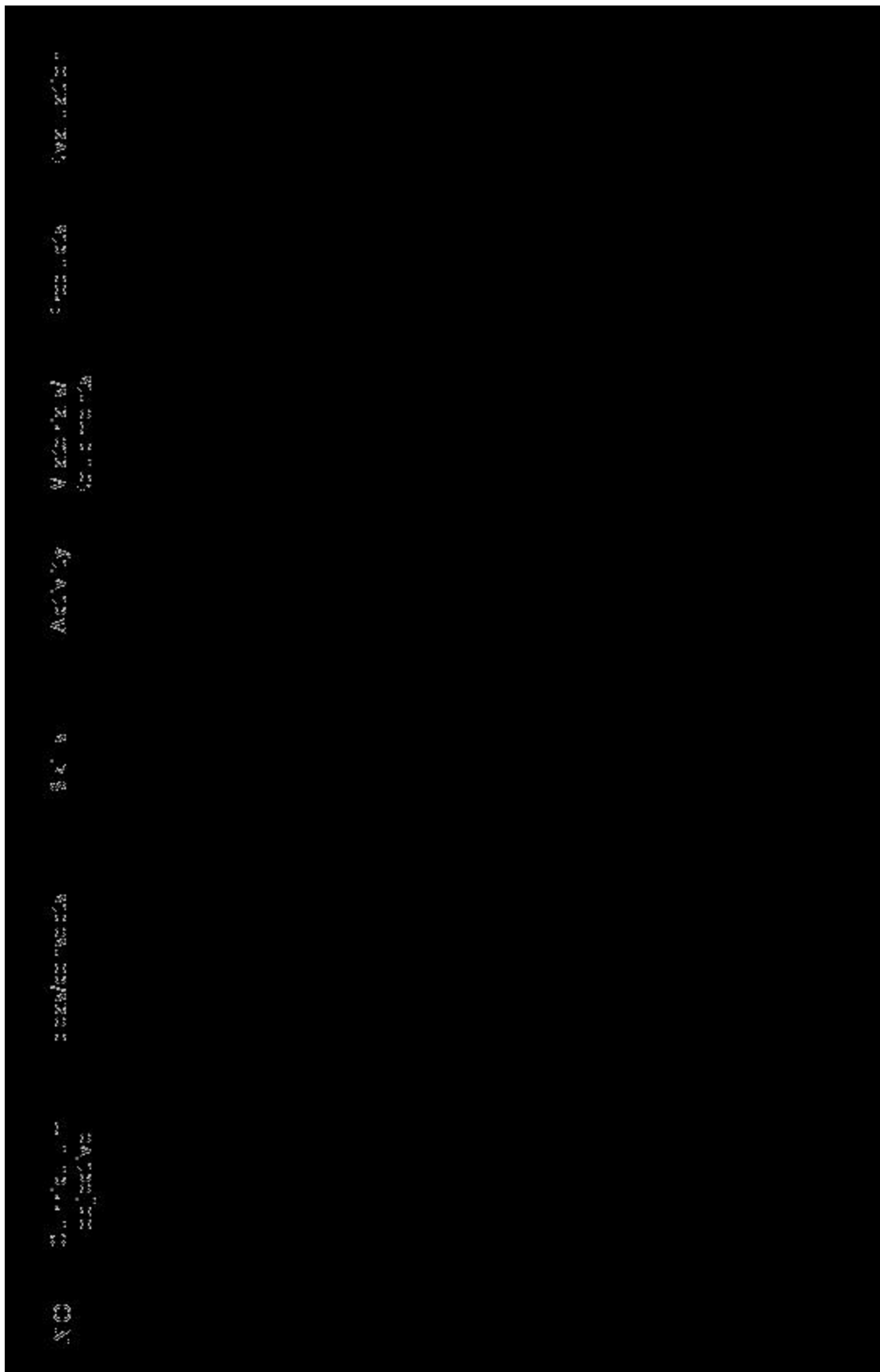
Consolidation

- ◆ Formulations
- ◆ Upper white, Lower sole, V-strap.
- ◆ Layering
- ◆ Moulding
- ◆ Defects of Hawaii sole
- ◆ Finishing operations.

Products

- ◆ Hawaii soles of different quality & colours
- ◆ Hawaii strap of different quality & colours
- ◆ Hawaii chapals of different quality & colours
- ◆ Record Book

UNIT .7. DRY RUBBER PRODUCTS



PART III

RUBBER TECHNOLOGY SAMPLE QUESTIONS

RUBBER TECHNOLOGY- 2 SAMPLE QUESTIONS (T.E)

1. A chart is shown below.

Master Batch	Final Batch
NR- 100	Master batch
Zno- 3	+
Stearicacid- 2	MBT- 1.2
Whiting- 100	TMTD- 0.2
SP- 5	Sulphar – 2.5

Write your comments about master batch and final batch.

2. Ramu went a factory and saw the compounding of doormat. While watching compounding he had a doubt why sulphar is added as the last chemical. As a rubber technology student can you clear his doubt?
3. One of your friends is working in a hose factory. Suggest the machineries and equipment for the manufacture of hose that he too can start a firm.
4. Can you suggest appropriate processing techniques for the manufactures of hospital rubber sheet, which you have noticed in hospitals? Also illustrates the working process.

Receipie for Ebonite

5. Rubber -100

Antioxidant

Ca(OH)₂

-

-

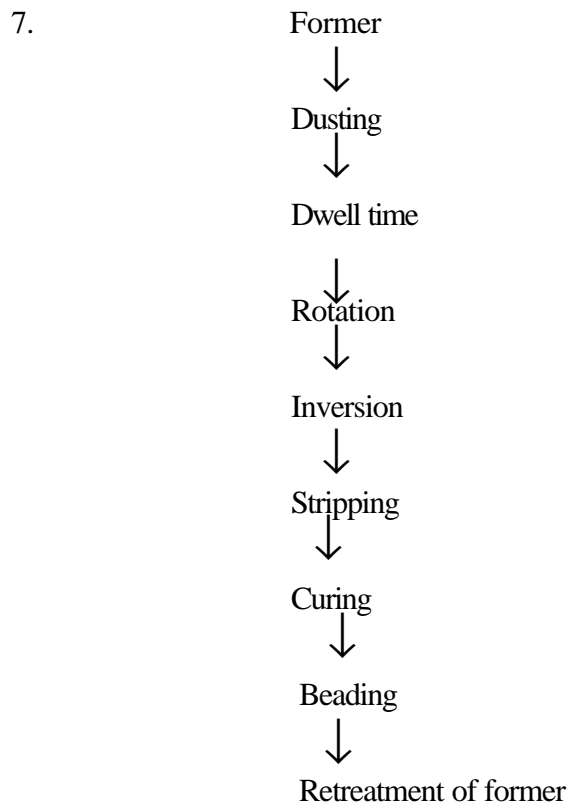
Find the missing chemicals and dosage.

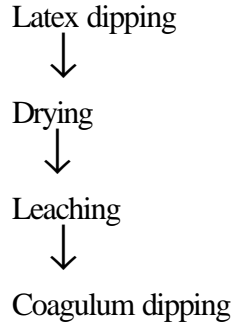
6. Raju has a door mat manufactures industry. Now he wants to a start a Tea mat unit also.

The formulation for Doormat is given below.

NR	- 70
WTR	- 60
Zno	- 4
Stearicacid	- 2
MBT	- 1.2
TMT	- 0.25
Clay	- 120
Whiting	- 50
Process oil	- 8
TMQ	- 1
Wax	- 0.5
SP	- 2.5

Based on the above formulation design a tea mat.





Arrange the above dipping process in the order of manufacture of dipped goods.

8. List some of the dipping equipment and machineries used for manufacturing for latex compound and product.
9. Sethu is planning to start a latex thread unit. Illustrate him the working principle and the necessary equipment to manufacture it.
10. Sreekumar is owing a hollow Toy factory suggest the appropriate latex processing techniques.

11. Items	Parts by wt
60% creamed latex	167.0
Vulcanized D paste (20%Soln)	1.25
50% sulphur dispersion	3.00
50% ZDC dispersion	2.00
50% Zno dispersion	0.50
50% Antioxidant dispersion	2.00
33% TiO ₂ dispersion	6.00
60% china clay dispersion	8.00

The above given formulation is for rubber band. Justify the selection of ingredients.

12. Make a report on the manufacturing, compounding and equipment used for latex foam, which you have seen during the factory visit.
13. Now day's rubberized roads are becoming popular. By using the following chemicals can you design a formulation for rubberized road? Compare it with the normal road.

Chemicals

Latex

Bitumen

Accelerators

Sulphur

14. Rajesh wants to start a chapel manufacturing unit by using the natural rubber. Can you help him to convert the raw materials rubber to a finished hawai chapel.
15. A rubber mat unit near to your school facing some production problems, i.e., uncured spots in surface. Can you find out the reasons and remedies?
16. A batch of rubber band manufactured in Ratheesh Kumar's company was returned back. The quality failure of that consignment was, it breaks when stretched. What could be the reasons? Can you change the formulation?

Formulation of Ratheesh Kumar's company

60% creamed latex	167
20% D paste	1.25
50% sulphur dispersion	8.00
50% ZDC dispersion	2.00
50% Zno dispersion	0.50
50% SP	3.00
33% TiO2 dispersion	5.00
60% clay dispersion	40.00

17. Some production problems are there in a rubber ball unit. Can you make a trouble-shooting chart?

Problems	Reasons	Solutions
1.No surface finish		
2.Ball over size after cure		
3.Low Bounce		

18. Can you suggest which type of belting is used in engine fans? Illustrates the building and curing of this belt.

19. Match the following.

Tread	Extruder	Gives strength
Carcass	Nylon	Air impermeability
Tube	Rib/Lug	Used in cars
Cycle tire	Copper wire	Gives strength
Bead	Mandrel method	Firmly holds to rim
Chafer	Steel belt	Outer most part of the tire
Side wall	Used under tread	Prevents rim chafing
Liner	Ply	Cotton fabric is used

Breaker	Calendar roll	Only rubber compound is used
Radial tire	Collapsible drum method	Protects both sides of tires

20. Can you suggest an appropriate curing method used for huge tires like tractor tire, truck tire etc.

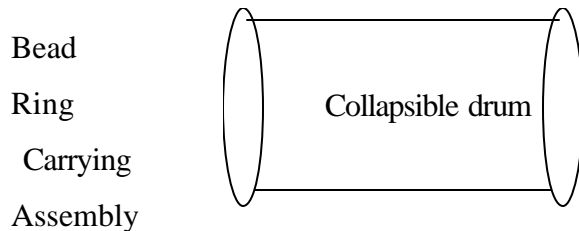
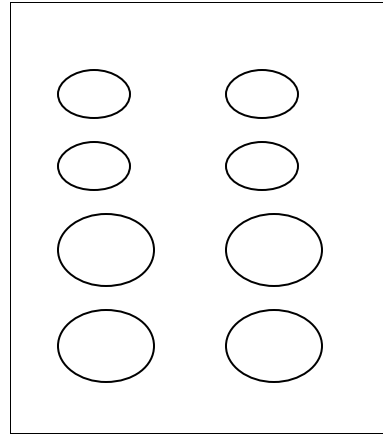
Multi component station

Carcass

Breaker

Tread

Sidewall



Based on the above picture make a write up on the tire building process.

21. Assume that you are going to buy a hawai chapel. For a good quality chapel, what all qualities you expect?

22. Match the following.

VFA	Durometer	Stability
Tensile strength	Markalhm still- apparatus	Mechanical stability
Hardness	Stirrer2 140000 rpm	UTM
Mechanical stability time	Dump-bell shape	Air blowing
Ross flexing machine	Ammonia content	Flex resistance
Alkalinity	Chappel	DAHP
Sludge content	Sieve	60%
Coagulum content	Centrifuging	Loss of weight
DRC	Din abrader	Dipped goods
Abrasion resistance	Latex-concentrated	Shore A

25. A vulcanized rubber sample when comes in cotact with organic solvent, its weight increases.

Can you say the reason? Also, find the percentage increases in volume.

CE Sample Questions

1. Prepare an assignment on manufacture of examination gloves.
2. Conduct a seminar on extrusion
3. Conduct a debate on road rubberisation.
4. Make a project on door mat.
5. Make a field visit report of latex form manufacturing.
6. A group discussion on rubber compounding is conducted in the class. Prepare a write up of this.
7. Conduct a panel discussion on tire component.
8. Prepare a chart of ISI specification of cenex
9. Prepare a reference note of temile properties.
10. Conduct an experiment to produce the mat.

PARTIV

PART IV
PE DETAILING
PE SAMPLE QUESTIONS

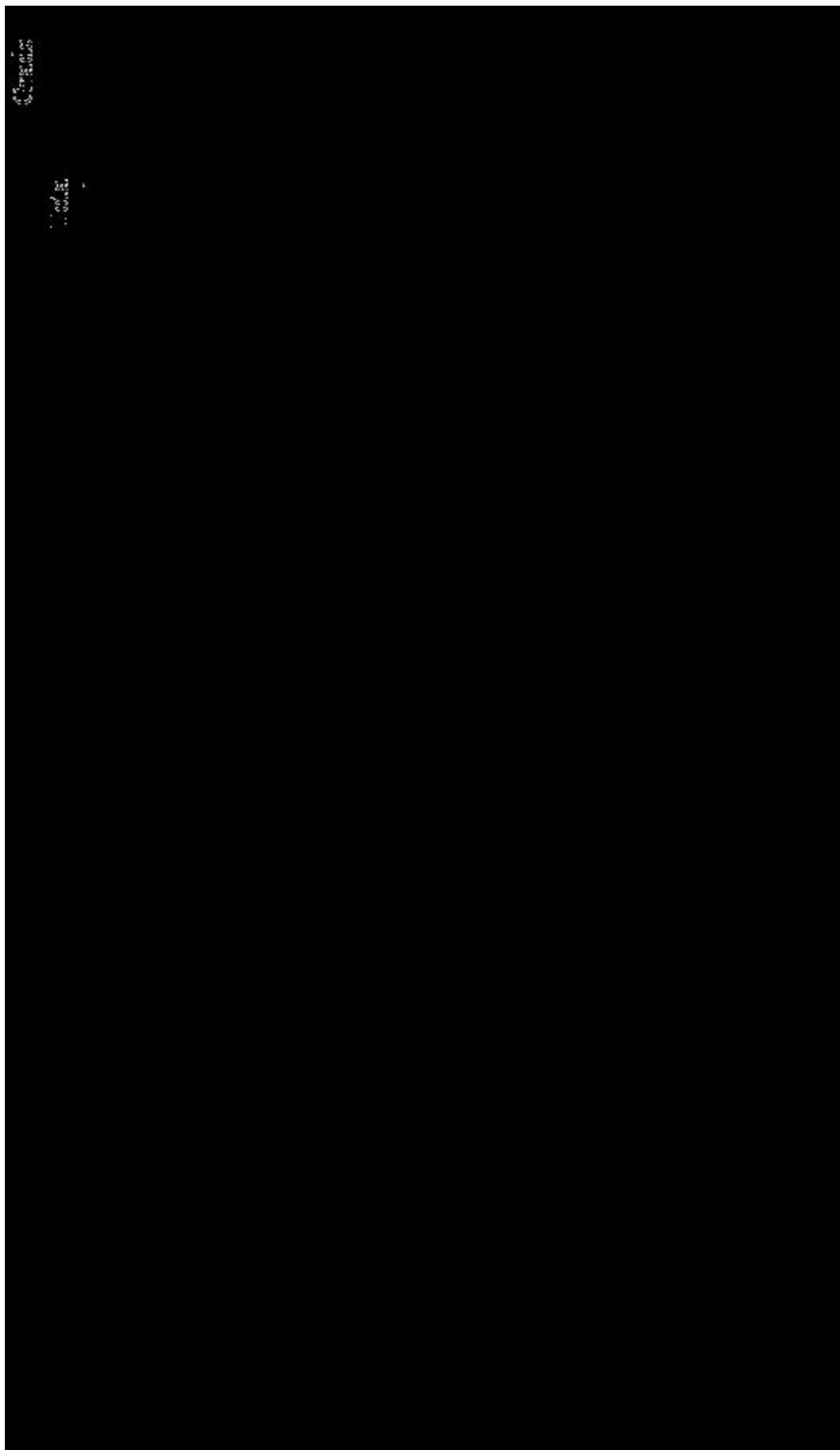
- 1. a. Develop a formulation for hawai sole.**
- b. Prepare blue color hawai sole.
2. Prepare a vulcanizate with a hardness of 60 shore – A.
3. Design a formulation for handmade gloves and make it.
4. Manufacture finger cap using the given latex compound.
5. Design a recipe for sponge rubber and prepare a sponge rubber sheet.
6. Manufacture hawai strap from the given formulation.
7. Produce door brush in your laboratory by using the given chemicals.
8. Produce fluorescent rubber band in your laboratory and calculate the production cost.
9. Produce balloons from the given latex compound.
10. Prepare 50% SP emulsion in your laboratory.
11. Construct play ball from the given formulation.
12. Make paperweight of red color.
13. Design a formulation for Tea mat of green color. Manufacture ten mats.
14. Design a recipe for ebonite sheet and make it.
15. Design a recipe for washer and make it.

PART V

APPENDIX

Name of vocational
course:

Name of student:
Residential Address:



GRADING

A +	-	90 and above
A	-	80 – 89
B +	-	70-79
B	-	60-69
C +	-	50-59
C	-	40-49
D +	-	30-39
D & E	-	Need Improvement

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