**COURSE TITLE : NATURAL RUBBER PRODUCTION**
**COURSE CODE : 3087**
**COURSE CATEGORY : B**
**PERIODS/WEEK : 5**
**PERIODS/SEMESTER : 90**
**CREDITS : 4**

## TIME SCHEDULE

| MODULE | TOPIC | PERIODS |
|---|---|---|
| I | 1.1 History, sources &, importance of Natural Rubber (NR) | 20 |
| II | 2.1 Preservation and Concentration of Latex | 23 |
| III | 3.1 Processing of NR into dry marketable forms | 22 |
| IV | 4.1 Specialty Rubbers &Reclaim Rubber | 25 |
| | **TOTAL** | **90** |

## OBJECTIVES

### MODULE – I

**1.1.0 Understand the importance, collecting and processing of NR latex**

1.1.1 State the importance of NR as a raw material
1.1.2 List out the major sources of NR – Botanical name of trees, Heveabrasiliensis, ficus elastica etc
1.1.3 Collect the statistics regarding the annual production and consumption of NR in India and world for the last few years
1.1.4 State the present position of India among other NR producing countries
1.1.5 Discuss the various methods of propagating Heavea Brasiliensis tree
1.1.6 Discuss the different clones
1.1.7 Define tapping
1.1.8 Discuss the standard of tappability for seedling and budded trees
1.1.9 Name the different tapping knives in use
1.1.10 State the meaning of the terms – taping task, tapping rest
1.1.11 List the different tapping systems in use and their intensity
1.1.12 Discuss ladder, slaughter and puncture tapping
1.1.13 Specify the purpose of intensive tapping
1.1.14 List the factors affecting tapping efficiency
1.1.15 Explain the purpose of rain guarding
1.1.16 Explain the nature, action and method of application of yield stimulants
1.1.17 Discuss the future prospects of replacing NR by appropriate synthetic rubbers
1.1.18 Discuss the uniqueness of NR
1.1.19 Discuss the possibilities of blending NR with other rubbers
1.1.20 State the applications of NR

### MODULE – II

**2.1.0 Understand the preservation and concentration of NR latex**

2.1.1 Define latex

2.1.2 Explain the colloidal nature of latex
2.1.3 Describe the composition of NR latex
2.1.4 Explain the function of various fractions on colloidal nature of latex
2.1.5 Discuss the micro organisms in latex, their names, activity and role in destabilization of latex
2.1.6 State the necessity for preservation of latex
2.1.7 State the requisites of an ideal preservative
2.1.8 Define the terms preservative, short term preservatives and long term preservatives
2.1.9 Discuss the coagulation and method of coagulation of latex
2.1.10 Explain pre-coagulation and use of various anticoagulants
2.1.11 Describe De level Centrifuge with a diagram
2.1.12 Explain with examples, various secondary preservatives – their function and dosages
2.1.13 Understand the various secondary preservative systems – components and their dosages and mention (LATZ) type latex low ammonia tetra ethylene thiuram disulphide (TMTD) Zinc Oxide (ZnO).
2.1.14 Explain the materials of construction and types of utensils to be used for collection and transportation of NR latex
2.1.15 State the need for concentration of latex
2.1.16 List the various concentration methods
2.1.17 Explain the principle of creaming of latex
2.1.18 Explain the various creaming agents used (Tamarind seed powder, Sodium alginate, Ammonium alginate etc.) – definition, examples, their actions, possible mechanisms, their preparation, dosage and method of incorporation
2.1.19 Discuss the purpose of soap and its usage in creaming
2.1.20 Describe the creaming process with flow chart
2.1.21 State the working principle of De-Laval centrifugal machine with neat sketch
2.1.22 Discuss the machinery used for centrifuging of latex with diagram
2.1.23 Explain the process of centrifuging of latex with flow chart
2.1.24 Give the meaning of efficiency of centrifuging
2.1.25 State the factors affecting centrifuging
2.1.26 Summaries the advantages of centrifuging over other concentration processes
2.1.27 State the Bureau of Indian Standards (BIS) specification (ISI) for Latex concentrate
2.1.28 State the purpose of fixing specifications for NR Latex
2.1.29 Discuss the various methods employed for enhancing quality of centrifuged latex
2.1.30 Discuss double centrifuged latex
2.1.31 State the importance of centrifuged latex as an industrial raw material
2.1.32 Discuss emerging trends in centrifuged latex market with reference to tailor made specifications of end user both Indian and foreign.
2.1.33 Explain skim latex and skim rubber
2.1.34 Mention the uses of skim rubber
2.1.35 Discuss other methods of latex concentration such as evaporation, electro decantation etc.

**MODULE – III**

**3.1.0 Study the processing of NR latex into dry marketable forms**

3.1.1 Name the marketable forms of dry rubber
3.1.2 Define Ribbed smoked sheets (R.S.S.)
3.1.3 Describe the process of manufacture of RSS and air dried sheets (ADS)
3.1.4 Discuss the machinery used in the processing of latex into RSS & ADS
3.1.5 Explain the grading of sheet rubbers

3.1.6 Explain the relevance of grading of sheet rubber
3.1.7 Mention the current market status and future prospects of natural rubber
3.1.8 Define crepe rubber
3.1.9 State the starting materials for different types of crepe production, Pale Latex crepe –(PLC), Estate Brown Crepe (EBC) etc.
3.1.10 Explain the manufacture of the following crepe rubbers –(PLC) sole crepe, Estate Brown Crepe (EBC)
3.1.11 State the machinery used for crepe production
3.1.12 Mention the current status and future prospects of crepe rubber
3.1.13 Mention the visual grading of crepe rubbers and name of different grades
3.1.14 Discuss the draw backs in visual grading of sheet and crepe rubbers
3.1.15 Define technically specified block rubber- Indian Standard National Rubber (ISNR)
3.1.16 Mention how block rubbers are named in different NR producing countries
3.1.17 Write the advantages of ISNR Over sheet and crepe rubbers
3.1.18 List the names of various processes for the production of ISNR
3.1.19 Describe the Hevea – crumb processes
3.1.20 Explain the unit operation and machinery details for production of ISNR constant viscosity
3.1.21 State the technical specification for grading ISNR with parameters for ISNR 3CV,3L, 5, 10, 20 & 50 grades
3.1.22 Discuss the quality enhancement of ISNR
3.1.23 Discuss the current status and future prospects of ISNR

**MODULE – IV**

**4.1.0 Know the production, properties, advantages and applications of speciality rubbers**

4.1.1 State the objectives for producing speciality rubbers
4.1.2 Name the different types of speciality rubbers
4.1.3 Describe superior processing rubbers and their different forms
4.1.4 Describe the production of different forms of SP (superior processing) rubbers – SP, PA – 80, PA – 57, SP crepe
4.1.5 Explain what is constant viscosity and low viscosity natural rubbers (CV & LV)
4.1.6 Describe the processing of latex in CV and LV rubbers
4.1.7 Define oil extended NR (OENR)
4.1.8 Discuss the production of oil extended NR and type of oils used
4.1.9 Discuss oil latex master batching
4.1.10 Mention the advantages and disadvantages of OENR
4.1.11 Define tyre rubber
4.1.12 Explain the preparation, properties and advantages of tyre rubber
4.1.13 Define and use of powdered NR
4.1.14 Explain the production, important uses and advantages of powdered NR
4.1.15 Give the meaning of graft NR and its uses
4.1.16 State the behavior of Hevea – plus M.G (methacrylate grafted) over NR
4.1.17 Define de-proteinsed natural rubber (DPNR) and its features
4.1.18 Explain the properties, advantages and uses of DPNR
4.1.19 Define epoxidised NR and its features
4.1.20 Explain the production, properties and uses of epoxidised NR
4.1.21 Discuss latex – black master batching
4.1.22 Give the meaning of cyclised NR and its features and applications
4.1.23 Give the features of chlorinated NR and its applications

**4.2.0 Study the process of manufacture, properties and applications of reclaimed rubber**

4.2.1 Define reclaimed rubber
4.2.2 Give the important raw materials for reclaim production
4.2.3 Name the reclaiming agents
4.2.4 Specify functions of each reclaiming agents
4.2.5 Describe the different manufacturing methods such as reclamator , digester process and pan process
4.2.6 Specify the different steps in different reclaim processing methods
4.2.7 Compare different processes Explain the types of reclaim rubber and their specifications
4.2.8 Discuss the advantages of using reclaim rubber in products
4.2.9 Mention the processing advantages of reclaimed rubber
4.2.10 Study the other application of reclaim rubber
4.2.11 List the reclaiming units in India

## COURSE CONTENT

### MODULE – I

**History & development of natural rubber** -as an important industrial raw material.- Major sources – propagation of Hevea brasiliensis, different clones. Extraction of Latex – methods of extraction of latex – tapping, standard of tappability for seedling and budded trees. Tapping knives, tapping task, tapping rest. Different systems and their intensity, intensive tapping, ladder tapping, slaughter & puncture tapping. Factors affecting tapping efficiency. Rain guarding; yield stimulation- statistics of NR, future prospects of NR, replacement possibilities of NR, uniqueness of NR, cost evaluation of NR for the last decades. Blends of NR, applications of NR byproducts from NR plantation industry.

### MODULE – II

**Preservation and Concentration of NR latex-**Definition of Latex – composition and function of non-rubber constituents, colloidal nature of latex, micro – organisms in latex and their role in destabilization, need for preservation of latex, short and long term preservation – $NH_3$ as ideal preservative, secondary preservatives – LATZ type. Pre-coagulation and use of anticoagulants – examples.- Coagulation and methods of coagulation of Latex-

**Concentation of latex** – need for concentration of Latex-Latex concentration methods – creaming, centrifuging, evaporation and electro decantation.

**Creaming** – principle, creaming agents and soaps used, process.

**Centrifuging** – principle, machinery, operation on machinery, maintenance, control system, centrifuging process, efficiency of centrifuging factors affecting efficiency of centrifuging latex and its need; quality enhancement methods of centrifuged latex, double centrifuging, packing of centrifuged latex; importance of centrifuged latex as an industrial raw material and its present trends. Skim latex and skim rubber – recovery of skim rubber--, its applications-other latex concentration processes

### MODULE – III

**Marketable forms of dry rubber** – R.S.S., crepe block rubber- Processing of field latex into R.S.S., ADS, different grades, current market status, and future prospects. Production requirements—Green book.

**Crepe rubbers** – different grades and their processing. Application of each grades, current market status and future prospects. Production requirements
ISNR – different grades, manufacturing details, production requirements, quality enhancement, current status and future prospects.

## MODULE – IV

**Specialty rubbers** -Importance of speciality rubbers in rubber industry-- features, production methods, chemical aspects, applications and current status of the following speicality rubbers – SP rubber, CV & LV rubber, OENR, tyre rubber, powdered natural rubber, Hevea plus MG, DPNR, Latex black master batch, epoxidised NR, cyclised NR, chlorinated NR.
**Reclaim Rubber-**Reclaim rubber – definition, objectives of reclaiming-raw materials for reclaim production-reclaiming agents and their specific functions- Manufacturing of reclaim by various methods-comparison of different processes-types of reclaim rubber and their specifications, processing advantages of reclaim rubber- applications.

## REFERENCE BOOKS


1. Hand book of Natural rubber production in India – Rubber Board
2. High polymer Latices – D.C. Balkley Vol. I
3. Latex in Industry – R.J. Noble
4. Rubber Technology and manufacture – Blow
5. Rubber Technology and manufacture – Sterven Blow
6. Vander built rubber hand book - R.T. Vanderbilt Co. Ltd.