GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonomous Institute, Government of Maharashtra)

Teaching and Examination Scheme (P22)

with effect from AY 2022-23

Programme: Diploma in Rubber Technology (Sandwich Pattern) **Term / Semester - V**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
							Theory			PR	OR	TW	Total
		L	P	TU	Total		TH	TS1	TS2				
ME19R310	Metrology and Quality Control	4	2		6	6	60	20	20	25*		25	**150**
MG22501	Industrial Org. .and Management	3	0	-	3	3	60	20	20				**100**
RT22501	Rubber Products Manufacturing	4	4		8	8	60	20	20	25*		25	**150**
RT22502	Reverse Engg. And Analysis of Rubber Products	5	-	-	5	5	60	20	20			25	**125**
RT22503	Mould Design	3	3		6	6					50	50	**100**
RT22504	Project and Seminar		10		10	10					50	50	**100**
	Total	**19**	**19**		**38**	**38**	**240**	**80**	**80**	**50**	**100**	**175**	**725**
Student Centered Activity (SCA)					**03**								
Total Contact Hours					**41**								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

*** Indicates assessment by External Examiner else internal assessment, # indicates self, on- line learning Mode, @ indicates on line examination**

Note: Duration of Examination--TS1&TS2 -1hour, TH- 2:30 hours, PR/OR – 3 hours per batch, SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours

Self, online learning Mode through MOOCS /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Coordinator,
Curriculum Development,
Department of Rubber Technology

In-Charge
Curriculum Development Cell

Head of Department
Department of Rubber Technology

Principal

Program: **Diploma in Rubber Technology** (Sandwich Pattern)										
Course Code: **MG22501**				Course Title: **Industrial Organization and Management**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs.)	TS1 (1Hr.)	TS2 (1 Hr.)	PR	OR	TW	Total
3	**-**	**--**	**3**	**60**	**20**	**20**	**-**	**-**	**-**	**100**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests,
PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:
Our diploma pass outs are normally placed at the supervisory level when they go to industries where they are expected to handle labour, material and machinery to get the targeted output. This requires knowledge of managing different resources of the organizations effectively. This course deals with different aspects of management, which helps technician to manage the changed environment in the industry.

Course Outcomes: Student should be able to

CO1	Get acquainted with the industrial environment.
CO2	Know the different levels and process of management.
CO3	Describe the organizational structure.
CO4	Manage different industrial resources efficiently.
CO5	Apply various rules and regulations concerned with business.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Overview of Business** 1.1 Definition of Business 1.2 Types of Business, service, manufacturing and Trade 1.3 Globalization Importance, Advantages and Disadvantages 1.4 Intellectual Property rights: Objectives, Meaning of Patent, Copy right and Trade marks **Course Outcome: CO1 Teaching Hours: 6 hrs Marks: 04 (R- 4, U-, A-)**
2	**Management Process** 2.1 What is management? Various definitions, concepts of management 2.2 Levels of management Difference between Administration and Management, Concept of Scientific management 2.3 Fourteen principles of management 2.4 Basic functions of Management: Planning, Organizing, Staffing, Directing and Controlling **Course Outcome: CO2 Teaching Hours: 8 hrs Marks: 6 (R- 2 U-, A-4)**
3	**Organizational Management :** 3.1 Organization: Definition and Steps in forming organization 3.2 Types of Organization : Line and Staff , Functional and Project 3.3 Forms of ownership: Proprietorship, Partnership, Joint stock Company, Co-operative Society, Government Sector **Course Outcome: CO3 Teaching Hours: 8 hrs Marks: 8 (R- 2, U-2, A-4)**
4	**Human Resource Management** 4.1 Personal Management: Definition and Functions 4.2 Staffing Introduction to Human Resource planning and recruitment procedure 4.3 Personnel: Training and Development 4.3.1 Types of Training 4.3.2 Skill Enhancement **Course Outcome: CO4 Teaching Hours: 8 hrs Marks: 8 (R- 2, U-2, A-4)**
5	**Industrial Safety and Legislation** 5.1 Causes of Accident 5.2 Safety Precautions 5.3 Introduction to 5.3.1 factory Act 1948

	5.3.2 ESI Act 5.3.3 Workmen Compensation ACT, 5.3.4 Industrial Dispute ACT 5.3.5 Goods and Service Tax **Course Outcome: CO5 Teaching Hours: 6 hrs Marks: 10 (R- 2, U-4, A-4)**
6	**Financial Management** 6.1 Objectives and Functions 6.2 Capital Generation 6.2.1 Types and sources of Capital 6.3 Budget and Accounts 6.3.1 Types of Budgets 6.3.2 Production Budget 6.3.3 Labour Budget 6.3.4 Introduction to Profit and loss account and Balance Sheet 6.3.5 Elements of Costing **Course Outcome: CO5 Teaching Hours: 8 hrs Marks: 8 (R- 2, U-2, A-4)**
7	**Materials Management** 7.1 Inventory management : Definition of inventory and inventory control Objectives of Inventory control 7.2 ABC analysis Graphical representation 7.3 Economic Older Quantity 7.3.1 Graphical representation and Calculation of E.O.Q. 7.4 Purchasing 7.4.1 Objectives of Purchasing 7.4.2 Functions of Purchase Department 7.4.3 Steps in Purchasing **Course Outcome: CO6 Teaching Hours: 8 hrs Marks: 8 (R- 2, U-2, A-4)**
8	**Project Management** 8.1 Project Management : Definition and meaning of Project 8.2 Introduction to C.P.M. and P.E.R.T. . Preparation of Network, calculation of Project duration and floats 8.3 Concept of Break Even Analysis 8.4 Introduction to KAIZEN , 5 "S" **Course Outcome: CO6 Teaching Hours: 8 hrs Marks: 8 (R- 2, U-2, A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Overview of Business**	4			4
2	**Management Process**	2		4	6
3	**Organizational Management**	2	2	4	8
4	**Human Resource Management**	2	2	4	8
5	**Industrial Safety and Legislation**	2	4	4	10
6	**Financial Management**	2	2	4	8
7	**Materials Management**	2	2	4	8
8	**Project Management**	2	2	4	8
	Total	18	14	28	60

CO Vs PSO matrix:

Course Outcome No.	Course Outcome (CO's)	PSO1	PSO2
CO1	Get acquainted with the industrial environment	2	-
CO2	Know the different levels and process of management.	2	1
CO3	Describe the organizational structure.	2	2
CO5	. Manage different industrial resources efficiently	2	2
CO5	Apply various rules and regulations concerned with business.	-	2

CO Vs PO and CO Vs PSO Mapping (Rubber Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	3	3	3	2	2	3	2
CO2	2	3	2	2	2	2	2	3	3
CO3	2	2	3	3	2	2	3	3	2
CO4	2	3	3	2	3	3	2	2	2
CO5	3	3	2	2	3	2	2	3	3
CO6	3	2	2	2	2	2	2	2	2

References Books:

Sr. No.	**Title**	**Author**	**Publisher,**
1	Industrial Engg. and Management	Dr. O.P. Khanna	Dhanpai Rai & sons New Delhi
2	Business Administration and Management	Dr. s.c. Saxena	Sahitya Bhavan ,Agra
3	Industrial Management	Rustom S. Davar	Khanna Publication, Delhi
4	Industrial Management	Jhamb & Bokil	Everest Publication,Pune
5	Organisation and Management	R.D. Agarwal	Tata M'graw Hill

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Ravindra Barde	Industry Expert	Sidhhi Elasto Pvt. LTD
2	Mr. Dharmesh Dhanani	Industry Expert	Elphiepoly
3	Mr. Sunil Kumar Shrivastava	Lecturer in Rubber Technology	Arizona Techzeal
4	Mr. Sahil Ranoliya	Lecturer in Rubber Technology	AIRIA
5	Mr. Sahil Soliya	Lecturer in Rubber Technology	AIRIA

Coordinator,
Curriculum Development,
Department of Rubber Technology

Head of Department
Department of Rubber Technology

I/C, Curriculum Development Cell

Principal

Program: **Diploma in Rubber Technology** (Sandwich Pattern)										
Course Code**: RT22503**				Course Title: **Mould Design**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs.)	TS1 (1Hr.)	TS2 (1 Hr.)	PR	OR	TW	Total
3	**3**	**--**	**6**	**-**	**-**	**-**	**-**	**50**	**50**	**100**

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Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:
Subject gives insight to Rubber Technician for a design of different types if dies used in rubber moulding and extrusion. Rubber Technologist should be able understand various aspect of die design like shrinkage, values, material of construction and designing fir different moulding techniques,

Course Outcomes: Student should be able to

CO1	Interpretation of flow properties of rubber material and its behaviour.
CO2	Select mould design and verification of arrangements of Kernels.
CO3	Details of specification of moulded items and its testing.
CO4	Selection of Extrusion process and die design to meet product specification.
CO5	Classification of moulded products and allowance.
CO6	Compute Retention time and Cost estimation.

Course Content Details:

Unit No	Topics / Sub-topics
1	Introduction to Rubber Material. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 04 (R- 2, U-2, A-)**
2	Behavior of Rubber in Mould (Flow Properties) **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
3	Explanation of curing, mould shrinkage its calculation, core, cavity, moulding cycle time (Also splitting of moulding cycle in its element) **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
4	Introduction of rubber moulding Machines and Processes (compression, transfer, injection**)** **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 04 (R- 2, U-2, A-)**
5	Introduction to detail study of mould construction fir different moulding process. This will include Feeding of Raw materials to mould Component ejection system. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-, A-4)**
6	Detail designing of mould components core, cavity, moving parts etc. Design of guide pin bushes. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
7	Compression moulds: Design of positive mould Single cavity and multi cavity mould Flash allowance, shrinkage allowance and draft allowance. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
8	Transfer moulds : Design of Transfer pot and punch. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
9	Extrusion die design: Design aspects of pipe die, Land Length, angle of entry , Profile die-Elementary study. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 04 (R- , U-2, A-2)**

10	Fabrication : A material or mould fabrication Types of steels to be used for mould marking. Heat treatments for mould components of mould (core, cavity, guide, bushes, pins etc) surface treatment. Machines and machining processes required for mould making . Lathe , drilling, shaping pantograph, spark erosion . Advantages and limitations of machining processes with reference to tolerance and surface finish, time, cost etc. Selection of processes . Mould polishing and chrome plating. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- , U-2, A-4)**
11	Calculations to find out the mould design and mould making cost. Costing of mould. Preparation of mould manufacturing quotations. **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Rubber Material	02	02		04
2	Behaviour of Rubber in mould	02	02	02	06
3	Explanation of curing, mould shrinkage its calculation	02	02	02	06
4	Introduction of Rubber moulding Machines and Processes	02	02		04
5	Introduction to detail study of mould construction for different moulding process	02		04	06
6	Detail designing of mould components	02	02	02	06
7	Compression moulds	02	02	02	06
8	Transfer moulds	02	02	02	06
9	Extrusion die design		02	02	04
10	Fabrication		02	04	06
11	Calculation to find out the mould design and mould making cost	02	02	02	06
	Total	18	20	22	60

List of experiments/Assignments:

Sr. No.	Unit	Experiments/Assignments	Approx. Hours
1	1	From the Shrinkage factors given for the rubbers calculate the cavity dimensions for the given products (eg. Cylinder, tube and sheet moulded items only) for various rubbers. The idea to be provided.	04
2	1.2	Calculate the projected cavity area. (for horizontal projection and vertical projection) and the total volume for the given products (moulded items only)	04
3	1.2.3	Calculation of the hydraulic pressure for the given moulds for given press of Ram Dia and Platen size.	04
4	4	Mould is to be designed for the Injection moulding for the given article. The platen size of the press is 18*18 inch. Arrange the cavities in such a manner that the arrangement is symmetrical and calculate the total runner length for the design.	04
5	5	Calculate the speed of extrusion in metres and grams for given profile and given extruder capacity.	02
6	6	Any other assignment as decided by the faculty.	04
		Drawings	
8	8	Detail drawing of a rubber to metal bonded products like Engine mounting/ oil seal.	02
9	9	Drawing of a hard-build component like hose or expansion bellow.	02
10	9.10	Drawing of a single cavity compression mould for a simple Rubber Article.	02
11	11	Drawing of a mould for a metal to rubber bonded products.	02
12	12	Drawing of mould for rubber bellow.	02
		Total	32

CO Vs PO and CO Vs PSO Mapping (Rubber Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	3	-	-	-	-	-	-
CO2	2	3	1	3	-	-	-	-	-	-
CO3	2	3	3	2	-	2	-	-	-	-
CO4	1	2	1	3	-	-	-	-	-	-
CO5	-	3	3	2	-	-	-	-	-	-
CO6	1	2	1	-	-	-	-	-	-	-

CO Vs PSO matrix

CO /POs		PSO1	PSO2	PSO3
CO1	Interpretation of flow properties of rubber material and its behaviour.	2	2	1
CO2	Details of specification of moulded items and its testing.	2	3	1
CO3	Select Mould design and verification of arrangements of Kernels.	3	2	-
CO4	Selection of Extrusion process and die design to meet product specification.	2	1	-
CO5	Classification of moulded products and allowance.	2	1	-
CO6	Compute Retention time and cost estimation.	1	1	-

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. Ravindra Barde	Industry Expert	Sidhhi Elasto Pvt. LTD
2	Mr. Dharmesh Dhanani	Industry Expert	Elphiepoly
3	Mr. Sunil Kumar Shrivastava	Lecturer in Rubber Technology	Arizona Techzeal
4	Mr. Sahil Ranoliya	Lecturer in Rubber Technology	AIRIA
5	Mr. Sahil Soliya	Lecturer in Rubber Technology	AIRIA

Coordinator,
Curriculum Development,
Department of Rubber Technology

Head of Department
Department of Rubber Technology

I/C, Curriculum Development Cell

Principal

Program: **Diploma in Rubber Technology** (Sandwich Pattern)										
Course Code: **RT22504**				Course Title: **Project Work and Seminar**						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs.)	TS1 (1Hr.)	TS2 (1 Hr.)	PR	OR*	TW	Total
-	10	--	10	-	-	-	-	50	50	100

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests,
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Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:
The Project work is carried out to understand the method of manufacturing of any single product from the raw materials to its final usable stage.

The Project work can also be selected to solve the industrial problem must be done by consulting the experts for manufacturing should be discussed amongst the experts from industries into the seminar conducted, The satisfactory remark from the experts is the success of the project.

The raw material use to manufactures that product or to solve the industrial problem must be done consulting the experts for manufacturing should be discussed amongst the experts from industries into the seminar conducted. The satisfactory remark from the experts is the success of the project.

The particular concept has been adopted for the subject because the overseas customer now a days give the problems to the Indian manufacturers along with the property pattern which has to be qualified to make a compound and the Indian manufacturer make the compound as per the property specified by the customer. In such a case or International standard methods like ASTM, BIS must be used.

Course Outcomes: Student should be able to

1)	Develop the skills to identify the problem and build up attitude to seek solution to the problem.
2)	Develop skill of preparing report for presentations.
3)	Identification of the problem solving and improved communications.

4)	Every student will prepare a project report in duplicate. One report copy should be submitted to the institute. Seminar should be evaluated through following points.
5)	Work involved in completing the project.
6)	Presentation techniques.
7)	Other work/book referred.

Course Content Details:

Unit No	Topics / Sub-topics
	How the Project work to be done? 1. Project work will basically include manufacturing a product to meet a certain product specifications. Product specification shall be either based on a problem from the industry or one designed by the guide. 2. Step-by-step time bound programme should be followed during the completion of project. The steps are: Selection of product or problems (1 Week) The product drawing if required (2 Week) The cost of Raw material of the product (1 Week) Designing a mould for the product (2 Weeks) Decide the cost of mould if made (1 Week) Manufacturing of the mould if necessary (2 Weeks) Preparation of Raw material i.e. mixing (1 Week) Testing of raw material, both physical and chemical tests (1 Week) Manufacturing of the product on the hydraulic moulding press (2 Weeks) Decide cost of the product (1 Week) Preparation of the project report (2 Weeks) **Presentation to be made at the end.**

Coordinator,
Curriculum Development,
Department of Rubber Technology

Head of Department
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I/C, Curriculum Development Cell

Principal


GOVERNMENT POLYTECHNIC MUMBAI
GPM
ESTD. 1960
TRANSFORM KNOWLEDGE INTO WORK

Program**: Diploma in Rubber Technology** (Sandwich Pattern)										
Course Code: **RT22502**				Course Title: **Reverse Engg. And Analysis of Rubber Products**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs.)	TS1 (1Hr.)	TS2 (1 Hr.)	PR	OR	TW	Total
5	**0**	**--**	**5**	**60**	**20**	**20**	**--**	**---**	**25**	**125**

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Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:
Reverse engineering and analysis of rubber products are essential for product improvement, competitive advantage, cost optimization, quality assurance, customization, and knowledge acquisition. By leveraging these practices, manufacturers can drive innovation, enhance competitiveness, and meet the evolving needs of customers and markets effectively.

Course Outcomes: Student should be able to

CO1	Summarize the basic concepts and methods related to rubber reverse engineering
CO2	Identify the different types of rubbers and rubber related materials on the basis of their properties.
CO3	Explain the principle, construction and working of various analytical techniques.
CO4	Analyse the properties of rubber and rubber related materials on the basis of it's thermal behaviour.
CO5	Distinguish the reconstructed formulation and actual formulation of any rubber product
CO6	Learn about the Experimental Methods

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Reverse Engineering Concepts Related To Rubber:** 1.1 General Concepts and Examples, 1.2 Solvent Extraction, 1.3 Ash Content Determination, 1.4 Chemical Digestion, **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
2	**Principle Chemical Methods used in Rubber Reverse Engineering:** 2.1 Chemical Methods, Introduction, 2.2 Chemical Analysis, 2.3 Comminution of the polymer sample, 2.4 Separation of additives, 2.5 Qualitative and quantitative investigation of the additives, 2.6 Identification and quantitative analysis of isolated polymer samples **Course Outcome: CO2 Teaching Hours: 6 hrs Marks: 10 (R- 4, U-4, A-2)**
3	**Analytical Methods used in Rubber Reverse Engineering** 3.1 Chromatography: Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), Gel Permeation Chromatography (GPC) 3.2 Spectroscopy: Introduction, Infrared Spectroscopy, Determination of Acrylonitrile Content (ACN) of Acrylonitrile Butadiene Rubber (NBR), , Fourier Transform Infrared Spectroscopy(FTIR), Carbon Type Analysis (CA, CP, and CN) of the Rubber Process Oil by Fourier Transform Infrared (FTIR) 3.3 Microscopy and Image Analysis: Introduction, : Applications & Principle of Optical Microscope, Scanning Electron Microscope, Transmission Electron Microscope, Identification of Carbon Black Type, Carbon Black Identification by Transmission Electron Microscopy (TEM), Elastomer Blend Morphology by TEM, Microtomy, Staining, and TEM Analysis, TEM Image Analysis—Examples, X-ray Diffraction Techniques (WAXS, SAXS) **Course Outcome: CO3 Teaching Hours: 6 hrs Marks: 14 (R- 4, U-6, A-4)**
4	

	Thermal Analysis of Rubber: 4.1Introduction, Some Important Technical Terms Related to Thermal Analysis, 4.2 Principle of Differential Scanning Calorimetry (DSC) Operation, Application of DSC, 4.3 Differential Thermal Analysis (DTA), Thermomechanical Analysis (TMA) and Thermodilatometry (TD), 4.4 Hydraulic assemblies, 4.5 Thermodilatometry of Rubbers, Rubber composites & blends, Thermo sets & Fibers Dynamic Mechanical Analysis (DMA), 4.6 Principle of Thermogravimetric(TG) ,Evolved Gas Detection (EGD) and Evolved Gas Analysis (EGA),, **Course Outcome: CO4 Teaching Hours: 8 hrs Marks: 10 (R- 2, U-4, A-4)**
5	**Thermal Analysis of Additives in Polymers** 5.1: Introduction 5.2 ,Protective agents, Plasticizers, Accelerators, Vulcanizing Agents, Other Additives etc, 5.3 Polymer Flammability,. 5.4 Thermal Analysis & Flammability Evaluation **Course Outcome: CO5 Teaching Hours: 10hrs Marks: 10 (R- 4, U-4, A-2)**
6	**Experimental Methods:** 6.1 Polymer synthesis, 6.2 Isolation & purification of polymers, 6.3 Polymer fractionation and determination of glass transition temp. etc. **Course Outcome: CO6 Teaching Hours: 7hrs Marks: 10 (R- 4, U-4, A-2)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Introduction to Reverse Engineering Concepts Related To Rubber:**	2	2	2	6
2	**Principle Chemical Methods used in Rubber Reverse Engineering**	4	4	2	10
3	**Analytical Methods used in Rubber Reverse Engineering**	4	6	4	14
4	**Thermal Analysis of Rubber**	2	4	4	10
5	**Thermal Analysis of Additives in Polymers**	4	4	2	10
6	**Experimental Methods:**	4	4	2	10
	Total	20	24	16	60

References/ Books:

Sr. No.	Title	Author, Edition and Year Of publication	Publisher,
1	Rubber Technology Handboo Reverse Engineering of Rubber Products: Concepts, Tools, Techniques,	Saikat Dasgupta, Mukhopadhyaya, Krishna C. Branwal, Anil Bhowmick k,	----------
2	Thermal Characterization of Polumeric Materials	Edvin A. Turi	---------.
3	Thermal Degradation of Polymer Materials	Pielichowski	----------

E-References:

- http://www.biomedcentral.com/
- http://www.sciencedirect.com/
- http://onlinelibrary.wiley.com/

CO Vs PO and CO Vs PSO Mapping (Rubber Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	3	3	3	2	2	3	2
CO2	2	3	2	2	2	2	2	3	3
CO3	2	2	3	3	2	2	3	3	2
CO4	2	3	3	2	3	3	2	2	2
CO5	3	3	2	2	3	2	2	3	3
CO6	3	2	2	2	2	2	2	2	2

Industry Consultation Committee:

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1	Mr. Ravindra Barde	Industry Expert	Sidhhi Elasto Pvt. LTD
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Head of Department

Coordinator,
Curriculum Development,
Department of Rubber Technology

Department of Rubber Technology

I/C, Curriculum Development Cell

Principal

Program: Diploma in Rubber Technology (Sandwich Pattern)										
Course Code: **RT22501**				Course Title: **Rubber Product Manufacturing**						
Compulsory / Optional: **Compulsory**										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs.)	TS1 (1Hr.)	TS2 (1 Hr.)	PR*	OR	TW	Total
4	**4**	**--**	**8**	**60**	**20**	**20**	**25**	**---**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests,
PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:
The subject of rubber product manufacturing is significant due to its economic, technological, and societal implications. By studying this subject, individuals can gain insights into the complex processes involved in producing high-quality rubber products and contribute to innovation, sustainability, and industry advancement.

Course Outcomes: Student should be able to

CO1	Understand about Cellular Rubber Products
CO2	To Know about the Rubber Gasket, Washers & Seals,
CO3	To know about manufacturing of Vibration Isolators and Mounts
CO4	Understand manufacturing of Hoses & Tubing.
CO5	Understand about the Rubber Rollers & Printing Blankets & Conveyer Belting.
CO6	Learn manufacturing of footwear.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Cellular Rubber:** 1.1 Introduction, 1.2 Difference between sponge & Expanded Rubber, 1.3 Compounding Manufacturing of sponge rubber, 1.4 Manufacture of expanded rubber **Course Outcome: CO1 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**
2	**Rubber Gasket, Washers , Seals & Rubber to metal bonded products:** 2.1 Properties of Gasket, Washers & Seal materials, . 2.2 Selection of Rubber for oil seals, 2.3 Types of seals, 2.4 Methods of manufacturing 2.5 Manufacturing of Rubber to metal bonded products **Course Outcome: CO2 Teaching Hours: 6 hrs Marks: 10 (R- 4, U-4, A-2)**
3	**Vibration Isolators and Mounts :** 3.1 Definition of Vibration & Shock, 3.2 Principles of Isolation & Principles of Damping, 3.3 Combination of Isolation and Damping, 3.4 Designing and Compounding for Vibration Isolation and Shock Absorption, 3.5 Manufacturing Technology. **Course Outcome: CO3 Teaching Hours: 6 hrs Marks: 10 (R- 4, U-4, A-2)**
4	**Hoses & Tubing :** 4.1 Hose design & construction 4.2 Manufacturing Process, 4.3 Hose fittings & Couplings, 4.4 Hydraulic assemblies, 4.5 Hose Standardization testing & specification, care & maintenance of hose 4.6 . Different types of hoses and their manufacturing process, **Course Outcome: CO4 Teaching Hours: 8 hrs Marks: 08 (R- 2, U-4, A-2)**
5	

	Rubber Rollers & Printing Blankets: 5.1 Introduction 5.2 Application 5.3 Method of Manufacturing, , 5.4 Compounding & design, 5.5 Different types of rollers. ral considerations, **Course Outcome: CO5 Teaching Hours: 10hrs Marks: 10 (R- 4, U-4, A-2)**
6	**Conveyer Belting:** 6.1 Functions of Conveyer belting, 6.2 Components 6.3 Conveyer belt design, Choice of belt width & Spread, Elevator belt design. 6.4 Compounding 6.5 Manufacturing Process **Course Outcome: CO5 Teaching Hours: 7hrs Marks: 10 (R- 4, U-4, A-2)**
7	**Footwear:** 7.1 Various Manufacturing processes, 7.2 Types of adhesives, 7.3 Preparation & testing of various adhesives like solvent based rubber, 7.4 Manufacturing of various components like soles, insoles, foot bed, counter, toe, puff, stiffeners, finishers etc. specialty. **Course Outcome: CO6 Teaching Hours: 4 hrs Marks: 06 (R- 2, U-2, A-2)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Cellular Rubber**	2	2	2	6
2	**Rubber Gasket, Washers & Seals**	4	4	2	10
3	**Vibration Isolators and Mounts**	4	4	2	10
4	**Hoses & Tubing**	2	4	2	8
5	**Rubber Rollers & Printing Blankets**	4	4	2	10
6	**Conveyer Belting**	4	4	2	10
7	**Footwear**	2	2	2	6
	Total	22	24	14	60

List of experiments/Assignments:

Sr. No.	Unit	CO	Experiments/Assignments	Approx. Hours
1	1	CO1	Preparation of a compound to meet a given hardness.	10
2	2	CO2	Preparation of a rubber moulded articles	10
3	4	CO4	Calendaring a rubber compound on a fabric and determining the coating characteristics.	10
4	2	CO2	Preparation of a rubber to metal bonded item.	10
5	4	CO4	Preparation of a rubber tube.	10
6	4	CO4	Preparation of a hose by hand building techniques..	10
			Total	**60**

References/ Books:

Sr. No.	Title	Author, Edition and Year Of publication	Publisher,
1	Rubber Technology Handbook,.•	Werner Hofmann	Hanser Publishers
2	Rubber Technology Manufacture	Blow & Hepburn.	---------.
3	Rubber Engineering	------	IRI

E-References:

- http://www.pentagonrubber.com/
- **http://www.premierrubber.net/**
- **http://www.transflexconveyors.com/**

CO Vs PO and CO Vs PSO Mapping (Rubber Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	2	3	3	3	2	2	3	2
CO2	2	3	2	2	2	2	2	3	3
CO3	2	2	3	3	2	2	3	3	2
CO4	2	3	3	2	3	3	2	2	2
CO5	3	3	2	2	3	2	2	3	3
CO6	3	2	2	2	2	2	2	2	2

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Sr. No	**Name**	**Designation**	**Institute/Organization**
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