

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

TEACHING SCHEME (w. e. f. 10th Jan,' 11)

SEMESTER- VI

Sr. No.	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS.
			THEORY	TUTORIAL	PRACTICAL	
1	360501	Projects	0	0	8	8
2	360502	Fertilizer Technology	3	0	2	5
3	360503	Chemical Engineering Plant Economics	4	2	0	6
4	360504	Chemical Process Equipment Design	3	4	0	7
5		Elective	3	0	2	5
		TOTAL	13	6	12	31

Select **ANY ONE** from the following subject

Sr. No.	Subject Code	Elective Subject
1	360505	Pulp & Paper Technology
2	360506	Sugar & Food Technology
3	360507	Polymer Technology

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

SEMESTER- VI

Subject Code : 360501

Subject Name: PROJECTS

Sr. No.	Subject Content	Hrs.
1	1.0 Manufacturing of any One Products From the Following Industries: 1.1 Petrochemicals 1.2 Fertilizers 1.3 Pesticides 1.4 Pharmaceuticals 1.5 Acids 1.6 Alkalis 1.7 Natural product industries 1.8 Dyes and Dyes intermediates 1.9 Miscellaneous	12
2	2.0 Project Report Contents: 2.1 Introduction and history of product 2.2 Present status including list of industries 2.3 Properties and applications of products 2.4 Properties of raw materials 2.5 Various processes of manufacturing 2.6 Most suitable process in detail(description) with flow sheet 2.7 Major equipments required 2.8 Major instruments required 2.9 Utilities required 2.10 Layout and location of plant 2.11 Site selection parameters 2.12 Economic evaluation 2.13 Important aspects of safety 2.14 Effluent treatment related to product 2.15 Conclusion 2.16 References	100
	TOTAL	112

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

SEMESTER- VI

Subject Code : 360502

Subject Name: FERTILIZER TECHNOLOGY

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction: 1.1 Need for fertilizers. 1.1.1 Essential Elements 1.2 Classification of fertilizers. 1.2.1 Direct 1.2.2 Indirect 1.2.3 Complete 1.2.4 Incomplete 1.2.5 Artificial 1.2.6 Natural 1.2.7 Straight & Mixed fertilizers 1.3 Growth and development of fertilizer industry in Gujarat & India.	3
2	2.0 Nitrogenous Fertilizers: 2.1 Roll of Nitrogenous properties of Nitrogen. 2.2 Chemical & physical properties of Nitrogen. 2.3 Uses of Nitrogen. 2.4 Compounds of Nitrogen. 2.4.1 Ammonia, Nitric acid, Urea, Ammonium nitrate, Ammonium chloride, Ammonium sulphate, ammonium phosphate, DAP.	4
3	3.0 Ammonia: 3.1 Chemical and physical properties of ammonia 3.2 Uses of Ammonia 3.3 Manufacturing of synthesis gas 3.3.1 Different methods for synthesis gas production. (a) Non catalytic partial oxidation (b) Catalytic partial oxidation (c) Steam Hydrocarbon reforming. 3.3.2 Purification of synthesis gas 3.4 Ammonia Manufacturing 3.4.1 Different Methods	7

	3.4.1.1 The Claude process. 3.4.1.2 Foster-dhala casale process. 3.4.1.3 The M. W. Kellogg process. 3.4.1.4 Foster-Montacatani Process 3.4.2 Different types of converters 3.4.2.1 Udha converter 3.4.2.2 Fouser Montacatani converter 3.4.2.3 Cloude converter 3.4.2.4 Mordern converter 3.4.3 Major Engineering Problems. 3.4.4 Storage, Handling and Transportation of NH ₃ .	
4	4.0 Nitric Acid: 4.1 Chemical & physical properties of nitric acid. 4.2 Uses of Nitric acid. 4.3 Manufacturing of nitric acid. 4.3.1 Different processes. 4.3.1.1 Atmospheric pressure ammonia oxidation 4.3.1.2 Pressure ammonia oxidation 4.3.1.3 Inter mediate pressure ammonia oxidation 4.4 Concentration of Nitric acid. 4.4.1 Concentration by Mg(NO ₃) ₂ 4.5 Factors affecting the production of nitric acid. 4.6 Major engineering problems.	4
5	5.0 Urea: 5.1 History. 5.2 Physical and chemical properties of Urea. 5.3 Uses of Urea. 5.4 Manufacturing of Urea. 5.4.1 Different processes 5.4.1.1 The once through process. 5.4.1.2 Ammonia partial recycle. 5.4.1.3 Solution 5.4.1.4 Total recycle process. 5.5 Finishing of urea by atmospheric orystallization. 5.6 Factors affecting urea production. 5.7 Major Engg. Problems.	7
6	6.0 Miscellaneous: 6.1.1 Ammonium nitrate Manufacturing by prilling process. 6.1.2 Ammonium nitrate Manufacturing by ammonia carbonate. and gypsum.	3

	6.1.3 Ammonium sulphate Manufacturing by ammonia carbonate and gypsum 6.1.4 Ammonium chloride Manufacturing dual-sol process.	
7	7.0 Phosphatic Fertilizer: 7.1 Role of phosphorus in Agriculture. 7.2 Physical and chemical properties of phosphorus. 7.3 Uses of phosphorus. 7.4 Storage, handling and transportation of phosphorus. 7.5 Compounds of phosphorous Phosphoric acid, single super phosphate, Triple super, Phosphate, Ammonium phosphate.	3
8	8.0 Phosphoric Acid: 8.1 Physical and chemical properties. 8.2 Uses of phosphoric acid. 8.3 Manufacturing 8.3.1 Wet Process. 8.3.2 Electric-Arc furnace process. 8.4 Major Engg. Problems	4
9	9.0 Super Phosphates: 9.1 Types 9.1.1 Normal super phosphate Manufacturing 9.1.2 Triple super phosphate Manufacturing by DEN process	2
10	10.0 Ammonium Phosphates: 10.1 Types 10.1.1 Normal Ammonium phosphate Manufacturing 10.1.2 Diammonium phosphate Manufacturing.	1
11	11.0 Potassic Fertilizer: 11.1 Role of potassium in Agriculture. 11.2 Physical and chemical properties of potash. 11.3 Compounds of potash. Potassium chloride, potassium nitrate, potassium sulphate Potassium carbonate, potassium ammonium phosphate. 11.4 Manufacturing of potassium chloride from sylinite. 11.5 Preparation of potassium nitrate, potassium sulfate, potassium carbonate, potassium ammonium phosphate.	4
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Estimation of Nitrogen content in Ammonium chloride by back titration.
2. Estimation of Nitrogen content in ammonium sulfate by back titration.
3. Estimation of Nitrogen in ammonium chloride by sublimation method
4. Estimation of Nitrogen in ammonium sulfate by sublimation method
5. Estimation ratio of Ammonia to phosphoric acid in DAP
6. Estimation % of Nitrogen in DAP by Kjeldhal's method
7. Estimation % of Nitrogen in Ammonium chloride by back titration distillation method
8. Estimation % of Nitrogen in ammonium sulfate by back titration distillation method.
9. To find biuret content in Urea sample by colour comparison
10. To study Urea manufacture by recently developed process

References Books:

- | | |
|--|-----------------------|
| 1. Outline of Chemical Technology | By M.Gopala Rao |
| 2. Fertilizer Nitrogen, its chemistry and technology | By Vincent sanachelli |
| 3. Chemtech - II | By D.Venketes warln. |
| 4. A Text book of chem. Technology Vol. I | By G. N. Pandey |
| 5. Chemical Process Industry | By Shreve |

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN CHEMICAL ENGINEERING
SEMESTER- VI

Subject Code : 360503

Subject Name: CHEMICAL ENGINEERING PLANT ECONOMICS

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction: 1.1 Role of Chemical Engineer 1.2 Chemical Engineering Design 1.3 Need for plant design 1.4 Process design 1.5 Plant design and its relation to sales. 1.6 Basis for good design	4
2	2.0 Development of Project: 2.1 Objectives of a plant project 2.2 Process evolution stages and their importance 2.3 Checklist for pilot plant investigation 2.4 Plant design factors 2.4.1 Technical factors 2.4.2 Economic factors 2.4.3 Legal phases 2.5 Sources of information	5
3	3.0 Process Design: 3.1 Selection of a process 3.2 Continuous v/s Batch processing 3.3 Shift and Operating schedules 3.4 Types of flow diagrams 3.4.1 Block type flow diagram 3.4.2 Material balance flow diagram 3.4.3 Energy balance flow diagram 3.4.4 Engineering flow diagrams	5
4	4.0 Selection of Process Equipment and Materials: 4.1 Plan for selection of materials for equipment 4.2 Selection of process equipment	8

	4.3 Specification sheet for equipment 4.4 Standard v/s special equipment 4.5 Selection of equipment such as 4.5.1 Size reduction equipment 4.5.2 Material handling equipment 4.5.3 Heat transfer equipment 4.5.4 Mass transfer equipment 4.5.5 Selection of pumps 4.5.6 Selection of dryers	
5	5.0 Plant Layout: 5.1 Methods for plant layout 5.1.1 Unit area concept 5.1.2 Two-dimensional layout 5.1.3 Scale models 5.2 Principles of plant layout	5
6	6.0 Location of Chemical Plant: 6.1 Site location 6.2 Factors to be considered in plant location 6.2.1 Primary factors 6.2.2 Specific factors	2
7	7.0 Economic Evaluation of Project: 7.1 Capital Investments 7.1.1 Fixed capital investment 7.1.2 Working capital investment 7.2 Equipment cost estimation 7.3 Cost Indices and problems on C.I. 7.4 Depreciation 7.5 Causes of depreciation 7.6 Various methods for determining depreciations 7.7 Problems on depreciation 7.8 Evaluation of various depreciation methods 7.9 Total product cost 7.10 Utilities 7.11 Maintenance and repair cost 7.12 Economic analysis 7.13 Net and gross earnings 7.14 Profitability analysis 7.15 Percent return on investment 7.16 Pay-out time period 7.17 Present worth	12

	7.18 Turn-over ratio 7.19 Break-even chart 7.20 Problems to find out break-even capacity	
8	8.0 Optimum Design: 8.1 General procedure for determining, optimum condition 8.2 Procedure with one variable (Analytical and graphical) 8.3 Procedure with two variables (Analytical and graphical) 8.4 Optimum economic Design for 8.4.1 Insulation thickness 8.4.2 Pipe diameter 8.5 Optimum Operation Design.	8
9	9.0 Process Auxillaries: 9.1 Piping 9.2 Piping design problems 9.3 Pipe strength and wall thickness 9.4 Ferrous and non-ferrous pipe 9.5 Non-metallic piping and tubing 9.6 Piping layout rules 9.7 Types of insulation available 9.8 Factors governing insulation	7
	TOTAL	56

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Prepare block type flow diagram
2. Prepare Material balance flow diagram
3. Prepare Energy balance flow diagram
4. Draw Process flow diagram
5. Prepare specification sheet for
 - a- Heat exchanger
 - b- Distillation column
- 6 Draw plant layout for typical chemical industry with unit area concept
- 7 Problems based on cost indices using

- (i) Different time intervals
 - (ii) Same time, different capacity
 - (iii) Combination of (1) & (2)
8. Problems on depreciation based on
- (i) Straight line method
 - (ii) Declining balance method
 - (iii) Sum-of-the years digits method
 - (iv) Sinking fund method
9. Problems for finding out break-even point
10. Problems to determine optimum value
- (i) With one variable
(Graphical & analytical)
 - (ii) With two variables
(Analytical only)

Reference Books:

- 1. Chemical Engg. Plant design by Vilbrant and Dryden MGH
- 2. Plant design & Economics for chemical engineers by Peters D. Timmerhaus

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN CHEMICAL ENGINEERING
SEMESTER- VI

Subject Code : 360504

Subject Name: CHEMICAL PROCESS EQUIPMENT DESIGN

Sr. No.	Subject Content	Hrs.
1	1.0 Basic Considerations in Process Equipment Design: 1.1 Introduction 1.2 The general design procedure 1.3 Fabrication Techniques 1.4 Equipment classification 1.5 Power for rotational motion	2
2	2.0 Stress & Stress Analysis: 2.1 Introduction 2.2 Definition & types of stresses 2.3 Stresses due to static loads 2.4 Strains 2.5 Elastic constants 2.6 Thermal stresses 2.7 Stresses caused by bending 2.8 Deflection 2.9 Stresses caused by torsion 2.10 Stresses in flat plates 2.11 Stresses in cylinders and spheres 2.12 Stress concentration 2.13 Dynamic stresses 2.14 Impact stresses 2.15 Compound stresses	5
3	3.0 Design Consideration: 3.1 Introduction 3.2 Material selection 3.3 Corrosion prevention 3.4 Stresses created due to static and dynamic loads 3.5 Combined stresses and theories of failure 3.6 Fatigue 3.7 Brittle fracture 3.8 Creep 3.9 Temperature effects	7

	3.10 Radiation effects 3.11 Effects of fabrication methods Economic considerations	
4	4.0 Pressure Vessels: 4.1 Introduction 4.2 Operating conditions 4.2.1 Normal conditions 4.2.2 Transient conditions 4.3 Pressure vessel code 4.4 Selection of material 4.5 Vessels operating at low temperature 4.6 Vessels operating at elevated temperature 4.7 Design conditions and stresses 4.7.1 Design stress 4.7.2 Design criteria 4.7.3 Corrosion allowance 4.8 Design of shell and its components 4.8.1 Cylindrical and spherical shell and numerical for shell thickness. 4.8.2 Head or covers (theory only)	7
5	5.0 Reaction Vessels: 5.0 Introduction 5.1 Material of construction 5.2 Classification of reaction vessel 5.3 Heating system 5.3.1 Jackets 5.3.2 Coils 5.4 Design considerations 5.4.1 Jacket Design & simple numerical for thickness.	4
6	6.0 Heat Exchanger: 6.1 Introduction 6.2 Basic design procedure and theory 6.3 Overall heat transfer co efficient 6.4 Shell and tube exchangers: Construction details 6.4.1 Heat exchangers standards and codes 6.4.2 Tubes 6.4.3 Shell 6.4.4 Tube sheet layout. (Tube count) 6.4.5 Shell types (Passes) 6.4.6 Baffles 6.5 Shell and tube exchangers: General design considerations	7

	6.6 Shell side heat transfer and pressure drop 6.6.1 Flow pattern 6.6.2 Kern's method	
7	7.0 Supports for Vessels: 7.1 Introduction 7.2 Bracket or lug supports 7.3 Leg supports 7.4 Skirt supports 7.5 Saddle supports Numerical for Bracket support thickness.	3
8	8.0 Agitators: 8.1 Introduction 8.2 Power requirement for agitation 8.3 Design of agitation system components	2
9	9.0 Distillation Column: 9.1 Introduction 9.2 Basic features of columns. 9.3 Determination of shell thickness at different height	2
10	10. Fundamentals of Computer Aided Design: 10.1 Introduction 10.2 Electronic computer 10.3 Problem solving procedure 10.4 Problem: Shaft design for a vertical agitator. 10.5 Problem : Selection of head.	3
	TOTAL	42

Tutorials:

1. General design considerations.
2. Numerical based on different stresses and strains calculations.
3. Theory of failure.
4. Design of pressure vessel.
5. Design of reaction vessel.
6. Design of heat exchanger.
7. Numerical of supports.
8. Computer aided design of chemical process equipments.

Reference Books:

1. Process equipment design - by M.V. Joshi V.V.Mahajani
2. Chemical engineering Vol- 6 - by J.M. Coulson and J.F. Richardson
3. Engineering mechanics - by R.S.Khurmi

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

SEMESTER- VI

Subject Code : 360505

Subject Name: PULP & PAPER TECHNOLOGY (Elective)

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction: 1.1 History of Pulp and Paper industry. 1.2 Applications of paper 1.3 Consumption pattern 1.4 Cellulose raw materials 1.5 Problems and Scope of pulp and paper industries in India	3
2	2.0 Pulp: 2.1 Various raw materials 2.2 Pulping Processes 2.3 Comparison of three types of pulps. 2.4 Kraft pulping process 2.5 Black liquor recovery process 2.6 Sulfite pulping 2.7 Semi-chemical pulping 2.8 Mechanical and thermo-mechanical pulping 2.9 Secondary fiber pulping 2.10 R.A.G. pulping 2.11 Dissolving pulp 2.12 Major Engineering problems of pulp industry	11
3	3.0 Paper: 3.1 Definition 3.2 Type of paper products 3.3 Various raw materials 3.3.1 Fibrous 3.3.2 Non-Fibrous 3.4 Wet process for Paper Manufacture 3.5 Latest developments 3.6 Economics of paper industry 3.7 Fourdrinier machine	9
4	4.0 Cellulose: 4.1 Definition 4.2 Properties of cellulose	5

	4.3 Preparation of chemical cellulose 4.4 Applications	
5	5.0 Lignin Chemicals: 5.1 Various Lignin chemicals and their applications 5.2 Properties of Di-methyl sulfides 5.3 Properties of Di-methyl Sulfoxide 5.4 Method of production 5.5 Major Engineering problems 5.6 Economics	7
6	6.0 Waste Disposal Techniques: 6.1 Pollution potentials of Indian pulp and paper industry 6.2 Characteristics of industrial Lignin water 6.3 Bio-technical approach for pollution abatement 6.4 Enzymology for Lignin waste treatment	7
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Measurement of Gauge of various types of papers
2. Qualitative analysis of sodium sulfite
3. Study of Composition of various types of paper and function and properties of each constituent
4. Study of kraft pulping process in detail with flow diagram; advantages, disadvantages and Major Engineering problems
5. Study of complete P and I diagram of paper manufacture with critical parameters
6. Study of pulp and paper industry by visit with detailed report

Reference Books:

1. Shreves' Chemical Process Industries 5th Edition by Georege T. Austin
2. Dryden's outlines of Chemical Technology 2nd Edition by M.Gopal Rao Marshall sitting
3. Pollution Management in industries by: Dr. R.K. Trivedi

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

SEMESTER- VI

Subject Code : 360506

Subject Name: SUGAR & FOOD TECHNOLOGY (Elective)

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction : 1.1 History of Sugar. 1.2 Sugar factories located in India. 1.3 Physical and chemical properties of Sucrose/sugar. 1.4. Brief idea of by products molasses, baggase and filter mud.	3
2	2.0 Sugar Production: 2.1 Milling operation. 2.2 Clarification/ Purification 2.2.1 Need 2.2.2 Carbonation process 2.2.3 Suphitation process 2.2.4 Filtration 2.3 Concentration/Saturation 2.4 Crystallization 2.5 Centrifuging 2.6 Drying 2.7 Bagging	9
3	3.0 Major Equipment for Sugar Production: 3.1 Crushers 3.2 Pressure mills 3.3 Shredders 3.4 Filter Press 3.5 Evaporators 3.6 Crystallizers 3.7 Centrifuge 3.8 Vacuum pump	7
4	4.0 Different Sugar Manufacturing : 4.1 Raw cane sugar manufacturing. 4.2 Refined cane sugar manufacturing. 4.3 Beet sugar manufacturing.	3

5	5.0 Food Technology 5.1 History of Food Industry. 5.2 Importance of Food Industry. 5.3 Types of Food Industry. 5.4. Food processing techniques. 5.5. Food processing equipments. 5.6. Food storage. 5.7. Areas for development	4
6	6.0 Dairy Products: 6.1. Milk composition. 6.2. Methods of preparation of pasteurized milk 6.3. Preparation of milk powder 6.4. Brief study of cream and butter 6.5. Classification and composition of cheese 6.6. Preparation of cheese	5
7	7.0 Baking Industry: 7.1 Introduction to baking 7.2 Raw materials used in baking industries 7.3 Making of bread 7.4 Various equipment used in baking industries 7.5 Manufacturing process	5
8	8.0 Miscellaneous Products: 8.1 Preparation of non – alcoholic carbonated beverages. 8.2 Beverage syrup manufacturing. 8.3 Bottling of Carbonated Beverages. 8.4 Manufacturing of wine. 8.5 Manufacturing of Beer. 8.2.1.Processing Techniques 8.2.2. Production 8.6 Biotechnology & its application in food industry	6
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Polarimeter – Determination of “POL”
2. To find solid content in juice by brix hydrometer
3. Analysis of bagasse
4. To make grading of sugar
5. To measure pH of given sugar solution
6. To find out content in milk sample
7. Analysis of Sugar
8. Bread making in laboratory
9. Preparation of Cheese
10. Study of equipments used in sugar factory.
11. Study of equipments used in food industry.
12. Preparation of non – alcoholic carbonated beverages.

Reference Books:

- | | |
|--|---------------|
| 1. Outline of Chemical Technology | Gopal Rao. |
| 2. A Textbook of Chemical technology Vol-1 | G.N. Pandey |
| 3. Chemical process Industries | Shreve |
| 4. Hand book of cane sugar engineering | Elsevier |
| 5. Cane sugar Handbook | R.B.L. Mathur |

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN CHEMICAL ENGINEERING

SEMESTER- VI

Subject Code : 360507

Subject Name: POLYMER TECHNOLOGY (Elective)

Sr. No.	Subject Content	Hrs.
1	1.0 Introduction : 1.1 Importance. 1.2 Techniques of polymerization. 1.3 Classification of polymer	3
2	2.0 Plastics: 2.1 Classification of plastics. 2.2 Polyethylene: 2.2.1 Physical and chemical properties. 2.2.2 Applications. 2.2.3 Manufacturing (a) High pressure ICI process for LDPE (b) Ziegler low pressure process for HDPE (c) Phillips process for HDPE 2.3 Polyvinyl chloride: 2.3.1 Physical and chemical properties 2.3.2 Applications 2.3.3 Manufacturing 2.3.3.1 By Suspension polymerization 2.3.3.2 By Emulsion Polymerization 2.3.4 Major equipment details. 2.4 Polystyrene: 2.4.1 Physical and chemical properties. 2.4.2 Applications 2.4.3 Manufacturing 2.4.3.1 Continuous Bulk polymerization. 2.5 ABS : 2.5.1 Physical and chemical properties. 2.5.2 Applications 2.5.3 Manufacturing 2.6 Polytetrafluoro Ethylene (PTTE /Teflon) : 2.6.1 Physical and chemical properties. 2.6.2 Applications. 2.6.3 Manufacturing.	14

	2.7 Phenol formaldehyde : 2.7.1 Physical and chemical properties. 2.7.2 Applications 2.7.3 Manufacturing 2.8 Urea Formaldehyde : 2.8.1 Physical & chemical properties. 2.8.2 Application 2.8.3 Manufacturing	
3	3.0 Natural & Synthetic Rubbers : 3.1 Introduction : 3.1.1 Classifications 3.1.2 Natural rubber 3.1.3 Synthetic rubber 3.2 Natural rubber : 3.2.1 Physical & chemical properties. 3.2.2 Applications 3.2.3 Manufacturing 3.3 Synthetic Rubbers: 3.3.1 Styrene-Butadiene rubbers 3.3.1.1 Physical & chemical properties. 3.3.1.2 Applications 3.3.1.3 Manufacturing 3.3.2 Poly Butadiene. 3.3.2.1 Physical & chemical properties. 3.3.2.2 Applications 3.3.2.3 Manufacturing 3.3.3 Ethylene Propylene Terpolymers. 3.3.3.1 Physical & chemical properties. 3.3.3.2 Applications 3.3.4 Polychloroprene 3.3.4.1 Physical & chemical Properties 3.3.4.2 Applications 3.3.4.3 Manufacturing 3.3.5 Silicone rubber. 3.3.5.1 Physical & chemical 3.3.5.2 Applications 3.4 Compounding of rubbers. 3.5 Processing of rubbers. 3.5.1 Mastication 3.5.2 Mixing 3.5.3 Moulding 3.5.4 Extrusion 3.5.5 Calendaring 3.5.6 Vulcanization	12

4	4.0 Fibres : 4.1 Introduction 4.2 Classification 4.2.1 Viscose Rayon fibers 4.2.2 Cellulose Acetate fibers 4.2.3 Nylon fibers 4.2.4 Polyester fibers 4.2.5 Acrylic fibers 4.2.6 Glass fibers 4.3 Viscose rayon fibers: 4.3.1 Physical & chemical properties 4.3.2 Applications 4.3.3 Manufacturing 4.4 Cellulose Acetate fibers : 4.4.1 Secondary cellulose acetate fibers 4.4.2 Physical & chemical properties 4.4.3 Applications 4.4.4 Manufacturing 4.5 Nylon Fibers: 4.5.1 Nylon 6 4.5.1.2 Physical & chemical properties 4.5.1.3 Applications 4.5.1.4 Manufacturing 4.5.2 Nylon 6,6 4.5.2.1 Physical & chemical properties 4.5.2.2 Applications 4.5.2.3 Manufacturing 4.6 Polyester fibers: 4.6.1 Physical & chemical properties 4.6.2 Applications 4.6.3 Manufacturing 4.7 Acrylic fibers: 4.7.1 Physical & chemical properties 4.7.2 Applications 4.7.3 Manufacturing 4.8 Glass fibers: 4.8.1 Physical & chemical properties 4.8.2 Applications 4.8.3 Manufacturing	13
	TOTAL	42

NOTE:-

Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

1. Measurement of the tensile/abrasion/properties of a given plastics, rubber product	4 hrs.
2. Preparation of polymer by bulk polymerization.	4 hrs.
3. Preparation of thermo-plastics PMMA.	2 hrs.
4. Preparation of thermo-plastics PS.	2 hrs.
5. Preparation of thermoset PF linear.	2 hrs.
6. Preparation of thermoset PF cross-linked.	2 hrs.
7. Preparation of thermoset UF cross-linked.	2 hrs.
8. Preparation of thermoset MF corss-linked.	2 hrs.
9. Prediction of molecular weight by viscosity.	2 hrs.
10. Vulcanization of Rubber.	4 hrs.
11. Determination of Tensile strength/Abrasion resistance of fiber	2 hrs.

Total	28

Reference Books:

- | | |
|--|---|
| 1. Chemical - IV Manual of Chemical Technology | - By D.Venketes warlu – IIT Madras |
| 2. Outlines of Chemical Technologytry | - By M. Gopal Rao |
| 3. A Text book of chem. Technology Vol. I | - By G. N. Pandey |
| 4. Chemical Process Industry | - By Shreve |
| 5. Polymer science | - V R Gowarikar, N V Viswanathan, Jayadev Sreedhar –New Age International Pvt. Ltd. |