GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Chemical Engineering

Subject Code: DI04005081

Subject Name: Pulp and Paper Technology

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Professional Elective - II

Prerequisite:	Student should have knowledge regarding Unit Operations and unit processes.
Rationale:	Out of total paper produced in the country, 35% paper is produced in Gujarat. Diploma engineers are responsible for ensuring paper quality, improving the efficiency of production and reducing the environmental impact of the industrial paper making process. Engineers apply their skill while working in laboratory, production, research, sales and marketing. Engineers use chemicals such as sodium hydroxide and sodium sulphide to chemically remove lignin from wood. They ensure that paper is produced uniformly in the same color. This course is to enable the diploma engineer to some extent in accomplish the task of selecting chemicals, laboratory operations for the Pulp and Paper Technology.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe fundamentals of pulp and paper industry.	R,U
02	Explain Properties and applications of various Cellulose & Lignin Chemicals	R,U,A
03	Apply reactions and unit operations steps to manufacture various Pulp, Paper, Cellulose & Lignin Chemical	R,U
04	Analysis of influent and effluent for selection of proper waste disposal techniques	A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit – I Basics of Pulp and paper Technology	1.1 Introduction of pulp and paper industry 1.2 consumption pattern of paper 1.3 Cellulose raw material 1.4 Problems and scope of pulp and paper industries in India	5	11
Unit – II Pulp	2.1 Various raw materials 2.2 Pulping process: Sulphite pulping, Semi-chemical pulping, Mechanical and Thermo-mechanical pulping, Secondary fiber pulping, Rag pulping, Dissolving pulp 2.3 Kraft pulping process with major engineering problems. 2.4 Comparison of three types of pulps 2.5 Black liquor recovery process	14	31
Unit –III Paper	3.1 Types of paper products, Various raw materials: Fiberous and Non- Fiberous 3.2 Wet process for paper manufacture 3.3 Fourdrinier machine 3.4 Economics of paper industry 3.5 Recent improvement in paper making	10	22
Unit – IV Cellulose and Lignin Chemicals	4.1 Properties of cellulose 4.2 Preparation of chemical cellulose 4.3 lignin chemicals: Types, Properties of Di-methyl sulphides and Di- methyl sulfoxide 4.4 manufacturing process of Di-methyl sulphides and Di- methyl sulfoxide 4.5 Applications of cellulose and lignin chemicals	8	18
Unit – V Waste Disposal Techniques	5.1 Pollution potentials of Indian pulp and paper industry 5.2 Characteristics of Industrial Lignin water 5.3 Bio-technical approach for pollution	8	18
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**44**	**36**	**---------**	**_____**	**_____**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S.No.	Title of Book	Author	Publication with place, year and ISBN
1	Dryden's outlines of Chemical Technology	Rao, M.Gopal, Sitting, Marshall	Affilated East-West Press Pvt. Ltd. 3 rd Edition
2	Shreves' Chemical Process Industries	Austin, George T.	McGraw-Hill Education India Pvt. Ltd - New Delhi, 5th Edition
3	Environmental Pollution and Control in Chemical Process Industries	Bhatia, S.C.	Khanna Publishers,Second Edition 2011(ISBN: 8174091068)
4	Pollution Management in Industries	Trivedi, R.K.	Environmental Publication, Karad, India
5	Handbook of Pulping and Papermaking	Biermann, Christopher J.	Academic Press, ISBN-13: 978-0120973620

(b) Open-source software and website:

1. https://ndl.iitkgp.ac.in/
2. https://swayam.gov.in/
3. https://onlinecourses.nptel.ac.in

Suggested Practical List:

Sr. No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx. Hrs Required
1	Calculate the moisture content present in wood	2
2	Estimate the amount of lignin by kappa number test	2
3	Prepare Pulp by using different pulping methods.	2
4	Undertake qualitative analysis of sodium sulphite.	2
5	Perform pre-hydrolysis of the raw material for pulp.	2
6	Measure gauge (thickness) of various types of papers	2

7	Determine the pH for influent/effluent	2
8	Determine the COD for influent/effluent	2
9	Determine the BOD for influent/effluent	2
10	Optimize pH for maximum COD removal for black liquor	2
11	Estimate the coagulant dose at optimum pH for maximum COD removal	2
12	Determine the total solids present in influent	2
13	Determine dissolved oxygen present in influent.	2
14	Prepare chart showing different operations and processes involve in pulp and paper industry	2

Suggested Activities for Students:

1. Assignments
2. Technical Quiz/MCQ Test
3. Presentation on some course topic
4. I-net based assignments
5. Visit the paper mills, report on types of pulping methods and paper manufacturing process
6. Visit the paper mill; Make a report on effluent treatment plant.

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