

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: MANAGEMENT OF ENERGY AND ENVIRONMENT IN WET
PROCESSING
(COURSE CODE: 3362802)

Diploma Program in which this course is offered	Semester in which offered
Textile Processing Technology	Sixth

1. RATIONALE

This course provides the knowledge regarding basic energy conservation and environment management as applicable to textile process industry. Since textile process industries generate effluent, it is required to treat it before discharging into environment. This course therefore also provides the clear concept of effluent treatment and pollution load and its control for various types of textile wet processing. This course also creates awareness about newly invented membrane technology to enable them to apply on various separation processes for water used in textiles.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire the following competency required by the industry:

- **Undertake effluent processing from textile wet processes to conserve water and energy.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

- Strategies for energy savings and environment protection as per country laws.
- Reduce consumption of fuels and steam as per norms.
- Undertake water testing.
- Undertake Effluent testing.
- Apply eco-friendly and energy efficient processes.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
			C	ESE	PA	ESE	PA	
5	-	2	7	70	30	20	30	150

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit; ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In the Cognitive Domain)	Topics and Sub-topics
Unit – I Energy and Environment Management	1a. Justify the need for energy conservation and its management. 1b. Describe different types of energy. 1c. Explain environment management: water pollution, air pollution and noise pollution.	1.1 Energy management in wet processing: Sources and Classification of energy sources 1.2 Environment Protection act 1986 and Environment management in wet processing 1.3 Sources of water, its storage and distribution, Properties of water, various impurities in water and their effects on wet processing. 1.4 Management of pollution control
Unit– II Water Analysis, Purification and Utilisation	2a. Describe quality of water for wet processing. 2b. Describe various purification process for water. 2c. Explain control of water in textile mill and its re-use.	2.1 Analysis of impure water its 2.2 Water Purification : Precipitation, Ion exchange, Reverse Osmosis 2.3 Water utilization in various textile wet Processes: Bleaching, Dyeing, Printing and Finishing 2.4 Conservation of Water and its re-use
Unit– III Steam Generation and Utilisation	3a. Explain properties of different types fuels 3b. Describe the features of different types of boilers 3c. Describe the steam distribution and utilization	3.1 Fuels and their properties, 3.2 Properties of steam 3.3 Boilers: Lancashire, Water Tube, 3.4 Heating systems: Thermic fluid heating system, direct gas firing 3.5 heating system 3.6 Heat Recovery: Steam distribution, insulation and its material 3.7 Steam utilization textile wet processes:(Bleaching, Dyeing, Printing and finishing
Unit– IV Effluents and its Treatment	4a. Describe characteristics of effluents in textile industry. 4b. Describe Filtration Technology 4c. Explain process, chemistry and technology for effluent treatment	4.1 Characteristics of effluents and composite effluents from various sections of wet Processing. 4.2 Analysis of industrial rffluent and tolerance limits. 4.3 Filtration Technology: Micro filtration, Ultra Filtration, Nano Filtration, Reverse Osmosis 4.4 Stages of Effluent treatment plant: Physical Treatment, Chemical treatment and Biological Treatment.

Unit	Major Learning Outcomes (In the Cognitive Domain)	Topics and Sub-topics
Unit – V Developments in Energy Efficient and Eco- Friendly Processes	5a. Describe various energy efficient processes 5b. Explain Eco friendly processes 5c. Describe the various Eco labels	5.1 Concept of clean technology for Textile Processing, Types of ecology for textiles 5.2 Steps of clean production : 3R technology 5.3 Single stage preparatory process of cotton 5.4 Eco labels and their applications

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (Theory)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I.	Energy and Environment Management	08	2	2	4	08
II.	Water Analysis, Purification and Utilisation	20	6	8	6	20
III.	Steam Generation and Utilization	20	6	8	6	20
IV.	Effluents and its Treatment	14	4	6	4	14
V.	Developments in Energy Efficient and Eco-Friendly Processes	08	2	4	2	08
	Total	70	20	28	22	70

Legends: R = Remember, U = Understand, A= Apply and above Level (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

7. SUGGESTED EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Experiment/Exercise (Outcomes in the Psychomotor Domain)	Approx. Hours Required
1	II	Determine Total Solids, Total Dissolved Solids (TDS), Suspended Solids in a given sample of water.	04
2	II	Find out alkalinity in a given sample of water.	02
3	II	Determine total hardness of a given sample of water.	02
4	II	Find out chloride content in a given sample of water.	02
5	III	Check energy consumption for conservation in Conventional Preparatory Process and Single Stage Preparatory Process of cotton.	04
6	III	Check energy consumption for conservation in dyeing of different class of dyes on cellulosic fabrics.	04
7	III	Check energy consumption for conservation and cost control in different vat dyeing methods.	04
8	III	Compare energy consumption for conservation in case of polyester heat setting and optical whitening combined process with conventional approach.	02
9	III	Check energy consumption for conservation in dyeing of cellulosic fibre/fabrics with different dyes using different MLR.	02
10	III	Check energy consumption for conservation in exhaustion method and padding methods of dyeing.	02
11	III	Check energy consumption for conservation in printing of cellulosic fabrics with reactive dyes by different methods.	02
12	IV	Find out Biochemical Oxygen Demand (BOD) of a given sample of an effluent.	04
13	IV	Determine Chemical Oxygen Demand (COD) of a given sample of an effluent.	04
Total			38
Note: Perform any of the practical exercises from above list for total of minimum 28 hours depending upon the availability of resources so that skills matching with the most of the outcomes of every unit are included.			

8. SUGGESTED STUDENT ACTIVITIES

- i. Do literature survey for different types of effluent treatment plant.
- ii. Collection and Study of different water analysis reports from different sources.
- iii. Prepare mini project on different type of boilers.
- iv. Collect data of effluent produced at end of each textile wet processes and make a Power point Presentation on it.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange industrial demonstration for effluent treatment plant and machineries as per unit IV
- ii. Arrange visit for demonstration of energy conservation in dyeing of different dyes
- iii. Organise Seminar/Quiz/Presentation on recent developments in the field of energy conservation and effluent for Textile.
- iv. Arrange guest lecturers from industry experts for contemporary practices in industries.
- v. Organise group discussion of students on recent trends and awareness about eco processing

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Author	Title of Books	Publication
1.	Jhala P. B. Vyas M. M. Subrahmanyam K.	Water and effluent in Textile Mills	Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad
2	Manivasakam N.	Water used in textile processing	Sakthi Publication, Coimbatore
3	Manivasakam N.	Treatment of textile processing effluents	Sakthi Publication, Coimbatore
4.	Gulrajani M. L. Gupta Sanjay	Energy conservation in textile wet processing	Omega Scientific Publishers, New Delhi
5.	Parajia J. S. Vyas M. M.	Fuel and steam economy, Textile Engineering Tablet-III	Textile Association Of India (TAI), India
6.	M. Ratna Prabhu . Parajia J. S. Vyas M. M. Subrahmanyam K.	Heat economy in Textile Mills	Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad
7	Prayag R. S.	Bleaching, Merserising and Dyeing of Cotton Materials	Shri J. Printers, Pune

B) Major Equipment/ Instrument with Broad Specifications

i.	Water heating bath	<ul style="list-style-type: none"> Jacketed doubled wall, inner and outer walls are made of SS Insulating material:- Glass wool Temperature range:- 5 – 99°C Thermostatic control with digital display Power requirement:- 220-230V
ii.	Laboratory Oven	<ul style="list-style-type: none"> Temperature up to 250°C Heat up time:- 45 min Digital Display Electronic Controller Internal Chamber:- SS 304 External :- Mild steel powder coated Insulation:- Glass Wool 65 mm Ventilator:- Adjustable type (Aluminium)
iii.	Padding Mangle	<ul style="list-style-type: none"> Maximum Working Width:- 300mm Material of Coating on bowl:- Synthetic rubber Rubber hardness:- 65°/70° shore hardness Bowl dimension:- 120 mm dia X 350 mm length Cloth speed:- variable speed. Max up to 10 mts/min Machine dimension:- L 850 X W 610 X H 640 Electrical Supply:- 230 V AC, Single Phase

C) Software/Learning Websites

- en.wikipedia.org/wiki/energy_conservation

- ii. en.wikipedia.org/wiki/Textile_effluent
- iii. <http://textilefashionstudy.com>
- iv. <http://textilelearner.blogspot.in>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. R D Joshi**, Lecturer, Textile Processing Dept., R C Technical Institute, Ahmedabad.
- **Prof. R G Patel**, I/C Head, Textile Processing Dept., Dr. S and S S Ghandhy College of Engg. and Tech., Surat.
- **Prof. C. R. Madhu**, Adhoc Lecturer, Textile Processing R C Technical Institute, Ahmedabad.
- **Prof. D D Vyas**, Adhoc Lecturer, Textile Processing Dept., Dr. S and S S Ghandhy College of Engg. and Tech., Surat

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. C. K. Chugh**, Professor, Department of Mechanical Engineering
- **Dr. Joshua Earnest**, Professor Department of Electrical and Electronics Engineering