



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Ceramic Technology

Course / Subject Code: DI03052041

Course/Subject Name: Glass-1

w.e.f. Academic Year:	2024-25
Semester:	3 rd
Category of the Course:	PCC

Prerequisite:	NA
Rationale:	Diploma ceramic students have a wide scope in glass industries. So they should familiar with Basic knowledge of Glass.Glass-1 subjects contain Definition, Batch preparation process, Melting process and forming process of glass articles. Glass-1 is essential foundation for next curriculum of Glass-2.

Course Outcome:

After Completion of the Course Student will able to:

No	Course Outcomes	RBT Level
01	Define glass, state properties and uses of glass.	R
02	Classify glass making oxides with their functions	U
03	Select suitable batch preparation process for glass.	A
04	Select suitable furnace and manufacturing process for different glass articles.	A
05	Select the suitable recycling method for glass waste.	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
L	T	PR		C	Theory		Tutorial/ Practical	
			ESE (E)		PA (M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit-I Introduction	1.1 Definition of glass. 1.2 General properties and uses of glass. 1.3 Chemical composition of glass. 1.4 Description in brief about different types of glass.	04	9%
Unit – II Raw Materials	2.1 Details regarding various materials used in glass making 2.2 Classify glass making oxides with their functions. 2.3 Glass essential raw materials like forming oxides, fluxes, Oxidizing agent, Reducing agent, Refining agent, coloring and discoloring agent etc. 2.4 Occurrences of various glass making raw materials in India. 2.5 Grading and washing of sands used in glass making	10	22%
Unit – III Batch Preparation	3.1 Methods of batch preparation. 3.2 Description of machines used for batch preparation and mixing. 3.3 Processing of raw materials before batch making 3.4 Process of handling and mixing of raw materials.	08	18%
Unit –IV Glass Furnaces.	4.1 Various types of furnaces used for glass melting. 4.2 Construction and functions of pot furnace. 4.3 Construction and functions of Tank furnace. 4.4 Construction and functions of regenerator and Recuperator. 4.5 Description regarding various parts of glass melting furnaces. 4.6 Details description regarding melting process of glass batches.	10	22%
Unit– V Manufacturing process of Glass articles	5.1 Manufacturing hollow ware articles by Mouth blowing process, semi-automatic process or automatic process. 5.2 Manufacturing process of sheet glass and plate glass. 5.3 Manufacturing scientific glass apparatus by blowing process. 5.4 Manufacturing process of container glass.	10	22%
Unit– VI Recycling of Industrial Wastes	6.1 Concept of recycling glass waste. 6.2 Sustainability and recycling of Industrial waste. 6.3 Suitable Methods to recycle Glass waste.	03	7%



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Suggested Specification Table with Marks (Theory):

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	4	2	4	4	10
II	Raw Materials	10	4	7	7	18
III	Batch Preparation	8	2	4	4	10
IV	Glass Furnaces	10	2	5	8	15
V	Manufacturing process of glass article	10	2	4	6	12
VI	Recycling of industrial waste	03	1	2	2	5
Total		45	13	26	31	70

Distribution of Theory Marks(in%)					
R Level	U Level	A Level	N Level	E Level	C Level
18%	37%	44%	-	-	-

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:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Glass Engineering Hand Book	George W. McLellan, Errol B. Shand	McGraw-Hill book co,1984 ISBN :- 9780070448230
2	Glass manufactures Vol. I & Vol. II	F.V.Tooley	Glass Industry Division, Ashlee Publishing Company, 1984, ISBN:- 9780911993202
3	Modern Glass Practice	Samuel R. Schole	CBI Publishing Co Inc.,U.S.; 7th edition (1 December 1975) SBN :- 978-0843606126



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(b) Open source software and website:

1. <https://en.wikipedia.org/wiki/Glass>
2. <https://www.britannica.com/search?query=glass+properties+and+composition>
3. <https://gozonepack.com/how-glass-is-made-a-step-by-step-process/>
4. <https://www.engineeringenotes.com/engineering/glass/how-to-manufacture-glass-glass-manufacturing-process/46790>
5. https://en.wikipedia.org/wiki/Glass_production

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Prepare list of different types of glass with their properties and examples.	I	02
2	Prepare list of various raw materials used in glass industry.	II	02
3	Perform grading, washing and drying of glass sand.	II	04
4	List out occurrences of glass making materials in India.	III	02
5	List out various machineries used in glass batch preparation.	III	02
6	Determine moisture content in raw materials	III	04
7	Examine iron content in given raw materials.	III	02
8	Identify suitable methods for Handling and Mixing of Raw materials.	III	02
9	Draw glass pot furnace and tank furnace and explain functions of each part.	IV	02
10	Prepare list of heat saving devices used in glass industries.	IV	02
11	Prepare glass article by mouth blowing process.	V	06
12	Perform melting and shaping of prepared glass batch.	V	06
13	Identify suitable manufacturing methods for Jar, sheet glass, Tube, bulb, plate glass etc.	V	04
14	Identify suitable methods to recycle broken glass.	VI	02
15	Visit to a glass industry and prepare a report.	II to IV	06
	Minimum Practical Exercises required #		30 Hrs.



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List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	Sieve shaker with sieve set	3
2	Digital weight balance	3,6,7,12
3	Bar magnet	7
4	Hot air oven	3,6,7
5	Glass Melting Furnace	11,12
6	Electric Raising Hearth furnace	11,12
7	Pastel and Mortar	12
8	Glass blowing equipment like blow pipe ,block, jacks, shears, paddles ,moulds ,benches ,yokes etc.	11

Suggested Micro- Project List:

Suggestive lists of the Projects are given here. These have to match the competency and the Cos.

Similar micro- projects could be added by the concerned course teacher:

1. **Glass industries in India:** Identify the different glass industries located in different parts of India and prepare the report. (**Duration: 8-10 hours**)
2. **Raw materials:** prepare a chart or report on glass raw materials with formula and collect different types of glass raw material samples from local industries.
3. **Glass Melting Furnaces:** prepare charts or report on glass melting furnaces and show its parts.
4. **Glass manufacturing process:** prepare charts or report on different glass manufacturing processes.
5. **Machineries used in glass industries:-**Prepare a report on various machineries used in glass industries.

Suggested Activities for Students:

Other than the classroom and laboratory learning, following are the suggested student- related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio



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which may be useful for their placement interviews:

- a) Undertake micro-projects in team/individually.
- b) Prepare list of some glass articles.
- c) Give seminar on any relevant topic.
- d) Undertake a market survey for glass article.
- e) Prepare showcase portfolios.
- f) Students are encouraged to register themselves in various **MOOCs** such as: **Swayam, edX, Coursera, FutureLearn, Udacity, Udemy** etc to further enhance their learning.
