



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Ceramic Technology

Subject Code: DI04052011

Subject Name: Glass-2

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

Prerequisite:	Glass-1 subject knowledge is required before to learn Glass-2 subject. Glass-1 subject teach raw materials, batch preparation, glass furnaces and glass article making processes which are very useful to understand Glass-2 subject.
Rationale:	Glass-2 subjects containing glass batch calculation, glass properties, glass tests, glass defects and decoration techniques which are important to maintain quality during glass production. As glass technologist subject knowledge of these topics is very important. It also contains preparation process of optical glass. Hence the course has been design to develop these competencies and its associated cognitive, practical and effective domain learning out comes.

Course Outcome:

After Completion of the Course Student will able to:

No	Course Outcomes	RBT Level
01	Calculate glass composition and glass batch.	A
02	Select suitable raw materials and manufacturing technique for optical glass.	A
03	Identify various properties of glass.	U
04	Perform various tests, annealing process and decoration techniques for glass articles.	A
05	Identify various defects in glass article.	U

**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 Glass Batch Calculation	1.1 Molecular formula and molecular weight of raw materials. 1.2 Prepare batch from Composition. 1.3 Prepare composition from glass Batch.	05	11%
Unit – II Optical Glass	2.1. Characteristics of optical glass. 2.2. Raw materials used for making optical glass. 2.3. Melting of optical glass. 2.4. Furnace for melting optical glass. 2.5. Precautions required during melting and manufacturing of optical glass.	10	22%
Unit – III Glass Properties	3.1 Physical properties:- Mechanical properties, Thermal properties, Electrical properties and optical properties 3.2 Determine density of glass. 3.3 Determine Refractive index of glass.	10	22%
Unit –IV Viscosity and Glass Annealing	4.1 Importance of viscosity in glass industries. 4.2 Method of annealing of glass article. 4.3 Precautions required during annealing of glass. 4.4 Relation between annealing and viscosity	07	16%
Unit– V Decoration Methods	5.1 Various glass decoration methods. 5.2 Sand blasting method, Etching method, silvering and enamel decoration method etc.	08	18%
Unit– VI Glass Defects	6.1. Various types of glass defects. 6.2. Reasons and remedies of glass defects like stone, bubbles, blisters, seeds, devitrification etc.	05	11%



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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	Glass Batch Calculation	5	0	2	8	10
II	Optical Glass	10	2	4	6	12
III	Glass Properties	10	3	6	6	15
IV	Viscosity and Glass Annealing	7	2	5	3	10
V	Decoration of Glass Article	8	2	6	7	15
VI	Glass Defects	5	2	2	4	8
Total		45	11	25	34	70

Distribution of Theory Marks(in%)					
R Level	U Level	A Level	N Level	E Level	C Level
16%	36%	48%	-	-	-

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. Mc Lellan, 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://www.schott.com/en-in/products/optical-glass-p1000267>
2. <https://www.swiftglass.com/blog/what-is-optical-glass/>
3. <https://www.swiftglass.com/blog/glass-materials-properties>
4. <https://abrisatechnologies.com/fabrication-facts/glass-physical-properties/>
5. https://www.lehigh.edu/imi/teched/GlassProcess/Lectures/Lecture09_Hubert_Annealing%20and%20Tempering.pdf
6. <https://fosg.in/decoration-on-glass/>
7. <https://www.emhartglass.com/sites/default/files/publications/2020-09/BR0060%20-%20Container%20defect%20causes%20and%20remedies.pdf>

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Prepare glass batch from given composition.	I	2
2	Calculate glass composition from given Batch.	I	2
3	Identify various quality control steps required during preparation of optical glass.	II	4
4	Determination Refractive index of glass sample.	II & III	4
5	Determination density of glass sample by Archimedes' principle	III	4
6	Determination thermal shock resistance property of glass samples.	III	4
7	Determination chemical resistance property of glass samples.	III	4
8	Determination alkali resistance property of glass sample.	III	4
9	Identify stress in different glass sample by Polari scope.	IV	2
10	Decoration of glass article by etching method.	V	4
11	Decoration of glass article by sand blasting method.	V	4
12	Decoration of glass article by Engraving method.	V	4
13	Decoration of glass article by silvering method.	V	4
14	Decoration of glass article by coating Enamel.	V	4
15	Decoration of glass by transfer paper.	V	4
16	Identify defects in glass sample.	IV	2
17	Visit to a glass industry and prepare a report.	I to V	8
	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	Digital weight balance	5,7,8
2	Refractometer	4
3	Water bath, tong	6
4	Polaris cope	9
5	Sand blasting nozzle with portable compressor	10
6	Glass engraving pen for decoration	12
7	Spray gun for glass article decoration	14

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) **Optical Glass industries in World:** Identify the different optical glass industries located in different parts of World and prepare the report. (**Duration: 8-10 hours**)
- 2) **Glass Properties:** prepare a chart or report for different types of glass properties.
- 3) **Glass Decoration techniques:** prepare charts for glass decoration techniques.
- 4) **Glass Defects:** prepare charts for different glass defects or collect defected glass samples and identify it.
- 5) **Advance application of glass:** - Collect information from internet and prepare a report on advance applications of glass.

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 which may be useful for their placement interviews:

- a) Undertake micro-projects in team/individually.
- b) Prepare list of some optical glass articles.



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- c) Prepare list of properties of glass.
- d) Give seminar on any relevant topic.
- e) Undertake a market survey for optical glass article.
- f) Prepare showcase portfolios.
- g) Collect defected glass samples and identify various defects of glass.
- h) Students are encouraged to register themselves in various **MOOCs** such as: **Swayam, edx, Coursera, Udemy** etc to further enhance their learning.
