

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: GLASS-II
(Code: 3345202)**

Diploma Programme in which this course is offered	Semester in which offered
Ceramic Technology	4 th semester

1. RATIONALE

A ceramic engineer should have the knowledge about different types of glasses, batch calculation, manufacturing processes, properties, tests, glass defects and decoration techniques. Hence the course has been design to develop these competencies and its associated cognitive, practical and effective domain learning out comes.

2. COMPETENCY

The course should be taught and curriculum should implemented with the aim to develop required skills so that students are able to acquire following competency leading to the achievement of the following competency.

- **Plan and supervise production of glass wares.**

3. COURSE OUTCOME

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.

- Explain scope of glass industries
- Explain decoration methods of glass wares.
- Describe procedure for production of glass wares
- Identify defects in glass wares.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction	1a. Explain scope of glass industries 1b. Explain different types of glass. 1c. Describe properties & application of glass.	1.1 Scope of glass industry in India and abroad. 1.2 Types of Glass and their chemical composition. 1.3 Properties and uses of glass.
Unit – II Glass Batch Calculation	2a. List out properties of raw materials 2b. Prepare Batch 2c. Calculate batch composition.	2.1 Molecular formula and molecular weight of Raw Materials 2.2 Preparation of batch from Composition. 2.3 Prepare Batch composition from Batch.
Unit – III Manufacturing Process of Optical Glass	3a. Explain Optical properties of glass. 3b. List out raw materials. 3c. Describe melting process. 3d. Explain different types of furnaces. 3e. Apply Precautions 3f. Explain homogeneity of glass.	3.1 Characteristics of optical glass. 3.2 Raw materials used for making of optical glass 3.3 Melting of optical glass. 3.4 Furnaces for melting Optical Glass 3.5 Precautions required during melting and manufacturing of optical glass 3.6 Quality control techniques.
Unit – IV Properties of Glass	4a. Explain different properties of glass. 4b. Perform different tests.	4.1 Physical properties , Thermal and optical properties, mechanical properties of glass. Electrical properties of glass. 4.2 Test to determine the various properties of glass
Unit –V Viscosity and Annealing of Glass	5a. Explain role of Viscosity 5b. Perform the annealing method. 5c. Apply precautions. 5d. Describe effect of viscosity on annealing.	5.1 Viscosity in glass manufacturing and Effect of heat on glass viscosity 5.2 Annealing of glass and Methods of annealing. 5.3 Precautions during annealing of glass 5.4 Relation between annealing and viscosity of glass
Unit –VI Decoration of Glassware	6a. Explain decoration methods. 6b. Apply sand blasting method. 6c. Describe etching. 6d. Distinguish silvering and enamel decoration.	6.1 Method of decoration of glass wares. 6.2 Method of sand blasting and its suitability. 6.3 Process of etching on glass with their uses and suitability. 6.4 Method of silvering and enamel decoration of glass.
Unit –VII Defects in Glass	7a. Explain various defects. 7b. Describe the various reasons of defects. 7c. Describe devitrification.	7.1 Defects occur in glass. 7.2 Reasons of defects such as stones, cords, blisters and seeds and their remedies 7.3 Devitrification in glass

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	3	5	0	0	5
II	Glass batch calculation	6	1	5	4	10
III	Manufacturing process of optical glass	6	2	5	6	13
IV	Properties of glass	8	2	6	4	12
V	Viscosity and annealing of glass	6	2	5	3	10
VI	Decoration of glass wares	7	2	4	4	10
VII	Defects in glass	6	2	4	4	10
Total Hrs		42	16	29	25	70

Legends: R = Remember; U = Understand; A = Apply and above levels (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 LIST OF 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 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/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1	II	Prepare a glass batch of the given chemical composition	4
2	II	Prepare potash lead glass batch.	2
3	II	Prepare a yellow colour glass batch	2
4	II	Prepare a borosilicate glass batch.	2
5	II	Prepare an amber colour glass batch.	2
6	II	Prepare an opal glass batch.	2

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
7	II	Prepare a crystal glass batch.	2
8	III	Melting process of glass batch in furnace.	6
9	IV	Determine density of glass	4
10	IV	Determine stress and strain in glass	2
11	IV	Decorate glass by etching process.	4
12	IV	Decorate glass by sand blasting process.	4
13	VI	Perform enamelling on glass.	4
14	VII	Identify various defects in glass samples.	4
Total hours (perform practical worth total 28 hours so that most units are covered)			44

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Visit to a nearest Glass industries.
- ii. Group discussion on Industrial Visit.
- iii. Collect samples of different Glass products.
- iv. List out different properties of glass.
- v. Library survey on different types of glass defects and decoration process.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Show video/animation films/photographs of Glassware production and their defects.

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Books	Author	Publication
1	Glass Engineering Hand Book	E.B.Shand	McGraw-Hill book co.,
2	Glass manufactures Vol. I & Vol. II	F.V.Tooley	New York, N.Y., Ashlee Pub. Co.,
3	Morden Glass Practice	Samuel R. Schole	Amazone web site

B. List of Major Equipment/Materials

- i. Different glass making Raw Materials and additives.
- ii. Different glass samples for study of glass defects.
- iii. Tools sets for glass making.
- iv. Digital Weight Balance, Electric Oven
- v. Electric sieve shaker machines with sieves
- vi. Electric muffle kiln
- vii. Lab type annealing Lehr
- viii. Polariscope for checking annealing of glass.
- ix. Fire Gun

C List of Software/Learning Websites

- i. <http://ebookbrowse.com/glass-manufacturing-book-pdf-d18091452>
- ii. <http://www.cgcri.res.in/index.php>
- iii. <http://www.infoplease.com/encyclopedia/society/glass-composition-properties-glass.html>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prot. B.B.Patel** , Lecturer L.E.College, Morbi
- **Prot. H.B.Dedania**, Retired Lecturer L.E.College, Morbi
- **Prot. S.Prasaad**, Retired Lecturer L.E.College, Morbi

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur**. Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh**, Assistant Professor, Department of Applied Sciences