

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2022(COGC-2022)

Semester-IV

CourseTitle: White ware

(Course Code: 4345204)

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

1. RATIONALE

A diploma ceramic engineer have to deal with manufacturing of white ware articles, they have to work with formulation, calculation of body and glaze mixture, drying and firing, properties of raw materials and finished products. It is also foundation for next curriculum "Advance White Ware". Hence the course has been design to develop these competencies and its associated cognitive, practical and effective domain learning out comes.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Plan and supervise production of white ware products of desired quality.

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- Define white ware, classification of white ware products.
- Describe the raw materials used in manufacturing of white ware products.
- Describe the processing of white ware products.
- Describe the decoration techniques for white ware body and glaze.
- Identify the defects in white ware body and glaze.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				Total Marks
CI	T	P		Theory Marks		Practical Marks		
			C	CA	ESE	CA	ESE	
3	-	4	5	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, CA - Continuous Assessment; ESE -End Semester Examination.

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Collect different types of white ware products and identify based on their physical appearance.	I	4
2	Perform crushing and grinding operation for given raw materials.	III	4
3	Determine the moisture content of given raw material.	II	2
4	Determine the drying shrinkage of given clay sample.	II	4
5	Determine the water of plasticity of given clay sample.	II	2
6	Determine the loss on ignition test of given raw materials.	II	4
7	Prepare white ware body of given composition by hand molding method.	III	4
8	Prepare white ware body of given composition by pressing method.	III	4
9	Prepare white ware body of given composition by extrusion method.	III	4
10	Prepare white ware body of given composition by slip casting method.	III	4
11	Prepare glaze for different white ware products.	IV	4
12	Apply different glaze application methods on white ware products.	IV	4
13	List out various body defects in white ware products.	V	2
14	List out various glaze defects in white ware products.	V	2
15	Industrial visit of white ware manufacturing unit. 1. Prepare flow chart of Product preparation 2. Identify different suitable raw materials for Product. 3. Explain process used for Body and glaze making. 4. Explain shaping process for articles. 5. Explain Drying and Firing process for articles. 6. Explain process for glaze application. Identify different defects from products.	I-V	8
Minimum Practical Exercises required #			56 hrs

Note

- i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Perform the practical	20
3	Follow safe practices measures	10
4	Record observations correctly	20
5	Interpret the result and conclude	30
Total		100

6. MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

This major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	Pr.No.
1	Pot mill, Sieve shaker with sieve set	2-12
2	Digital weight balance	2-12
3	Hot air oven	1,2
4	Muffle Furnace	3
5	Potter's wheel	3
6	Pressing machine	3
7	Pug mill/extruder	3

7. AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned Cos and PrOs. More could be added to fulfill the development of this competency.

- Work as a leader/a team member.
- Follow ethical practices.
- Practice environmental friendly methods and processes.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year

- ii. 'Organization Level' in 2nd year.
- iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the students by the teachers. (Higher level UOs automatically include lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application level)	Topics and Sub-topics
Unit – I Introduction	1a. Define White ware. 1b. Explain the history and development of white ware industries in India. 1c. Describe the classification of white ware products. 1d. Explain the applications of white ware products.	1a. Definition of white ware. 1b. History, current and future scope of white ware industries in India, List of white ware manufacturing industries. 1c. Brief classification and there characteristics of tiles, crockery ware, sanitary ware, electrical and chemical porcelain. 1d. Applications of white ware products in different fields like home, industrial and for decoration purpose.
Unit – II Raw materials	2a. List out different raw materials used in white ware industry. 2b. List out different additives used in white ware industry. 2c. Calculate batch composition of white ware bodies. 2d. Calculate batch composition of glaze.	2a. Details regarding various materials used in white ware body and glaze making like plastic materials, non-plastic materials. 2b. Details regarding various additives used in white ware body and glaze making. 2c. Method of batch calculations of different white ware bodies i.e. batch composition, molecular formula of raw materials. 2d. Method of batch calculations of different glazes i.e. batch composition, molecular formula of raw materials.
Unit– III Processing	3a. Explain the process of crushing and grinding of raw materials. 3b. Explain the process of shaping and finishing of white ware bodies. 3c. Explain the drying and firing of white ware bodies.	3a. Methods of crushing and grinding of raw materials like wet and dry method, construction and functions of various machines such as jaw crusher, roller crusher, disintegrators and pulverizes etc. Theory of Grinding in Ball Mill. 3b. Forming methods such as Throwing, jiggering & Jollying, extrusion, casting etc. Detail study of blungers, agitators, and magnetic separators, vibrating sieves, diaphragm pumps, filter press and pug mill. 3c. study of drying and firing of white

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application level)	Topics and Sub-topics
		ware bodies, biscuit firing and glost firing.
Unit– IV Finishing and Decoration.	4a. Describe finishing techniques for white ware bodies. 4b. Describe body decoration methods. 4c. Describe glaze decoration methods.	4a. Methods of finishing the wares such as trimming, Sizing and Sponging process and Turning of green articles etc. 4b. mold effect, screen printing, hand decoration etc. 4c. hand painting, screen printing, digital printing etc.
Unit– V Defects and remedies.	5a. Identify the various defects arise in white ware bodies during shaping, drying and firing. 5b. Identify the glaze defects. 5c. Explain the reason and remedies for body and glaze defects.	5. a Study of body defects like Cracks, warpage, shrinkage, pin holes, black spots, different core etc. 5. b Study of glaze defects like crazing, blisters, dunting, crawling, pin holes, chipping etc. 5. c Study of reason and remedies for body and glaze defects.

Note: The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

10. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	6	7	4	3	14
II	Raw Materials	10	4	3	7	14
III	Processing	10	3	4	7	14
IV	Finishing and Decoration	8	3	4	7	14
V	Defects and remedies	8	4	7	3	14
Total		42	21	22	27	70

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

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test

items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

11. SUGGESTED STUDENT ACTIVITIES

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 conduct following activities in group and prepare small reports (of 1 to 5 page for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

- a) Prepare list of some white ware articles.
- b) Undertake micro-projects in teams
- c) Give seminar on any relevant topic.
- d) Undertake a market survey for white ware article.
- e) Prepare showcase portfolios.
- f) Prepare charts containing details of various raw materials.

12. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) Guide student(s) in undertaking micro-projects.
- c) **'CI' in section No. 4** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
- d) About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessing during different assessment methods.
- e) With respect to **section No.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- f) Guide students on how to address issues on environment and sustainability using the knowledge of this course.
- g) Guide students for using data manuals.

13. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total work load on each students due to the micro-project should be about **14 to 16(Fourteen to sixteen) student engagement**

hours(i.e. about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

- a) Collect different raw material samples used in white ware industries.
- b) Collect different types of white ware products and label them.
- c) Prepare any one type of white ware product in laboratory and make a report.
- d) Prepare/study of white ware product in industry and make a report.

14. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	A Hand Book of Modern Pottery Manufacture	H.N.Bose	Ceramic Publishing House, Bhagalpur
2	Ceramic glazes	Kennethshaw	Amsterdam, London, New York, Elsevier
3	Element of Ceramic	F.H.Norton	Addison-Wesley Pub. Co.
4	Ceramic White Wares	Sudhir Sen	Oxford & IBH Publishing Co., New Delhi
5	Industrial Ceramics	Felix Singer , Sonja S. Singer	Springer Dordrecht 978-94-017-5257-2

15. SUGGESTED LEARNING WEBSITES

- a. <http://www.gobookee.org/elements-of-ceramics-f-h-norton/>
- b. <http://www.cheminfonet.org/art/ceramics101.pdf>
- c. http://en.wikipedia.org/wiki/Ceramic_engineering

16. PO-COMPETENCY-CO MAPPING

Semester IV	Whiteware (Course Code: 4345204)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & Environment.	PO 6 Project Management	PO 7 Life-long learning
<u>Competency</u>	Plan and supervise production of white ware products of desired quality.						
<u>Course Outcomes</u>							
CO a) Define white ware, classification of white ware products.	3	1	1	1	1	1	1
CO b) Describe the raw materials used in manufacturing of white ware products.	3	1	1	3	1	1	2
CO c) Describe the processing of white ware products.	3	2	3	3	2	2	2
CO d) Describe the decoration techniques for white ware body and glaze.	3	2	3	3	2	2	2
CO e) Identify the defects in white ware body and glaze.	2	3	3	3	1	2	1

Legend: '3' for high, '2' for medium, '1' for low or '-' for the relevant correlation of each competency, CO, with PO/ PSO

15. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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