

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: DRYING & FIRING
(Code: 3345201)**

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

1. RATIONALE

A ceramic engineer has to plan and supervise drying and firing process of Ceramic products. Drying and firing course contains theory of drying, classification of dryers, stages of firing, setting of ceramic ware in kiln and Effect of heat on ceramic wares. Hence the course has been design to develop skills required for drying and firing.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop different types of skills so that students are able to acquire following competency

- **Plan and supervise the drying and firing of ceramic wares for quality product.**

3. COURSE OUTCOME

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

- Explain processes of drying and factors affecting them.
- Describe procedure for rectifying different type of dryers.
- Explain the effects of heating on ceramics
- Describe the process of setting the kilns and setting the fire

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		
			C	ESE	PA	ESE	PA	
3	0	0	3	70	30	0	0	100

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 (Course Outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Theory of Drying	1a. Explain governing factors for drying. 1b. Explain various stages of drying 1c. Describe Drying shrinkage, Drying efficiency, Rate of Drying 1d. Explain different processes of drying.	1.1 Introduction to drying and factors governing the drying. 1.2 Drying systems and details of various stages of drying 1.3 Drying shrinkage, Drying efficiency and Rate of drying. 1.4 Process of drying such as evaporation, aeration, heating ventilations and absorption.
Unit – II Classification of Dryers	2a. Define the dryers 2b. Classify different types of dryers. 2c. Describe the working of various types of dryers listed in 2.3. 2d. List the defects during drying. 2e. List the steps to Rectify the defects due to drying.	2.1 Introduction 2.2 Intermittent dryers, Semi continuous dryers. 2.3 Construction and functions of tunnel dryers. Mangle dryers, rotary dryers ,spray Dryers, infrared drying, high frequency drying ,Humidity dryer, Horizontal dryer and Vertical dryer 2.4 Defects during drying and their rectification.
Unit – III Effect of Heat on Ceramic Wares	3a. Explain effect of heat on physical properties of ceramic wares during processes , operations , texture. of ceramic articles. 3b. Explain effect of heat on physical properties of ceramic articles.	3.1 Effect of heat on physical properties of ceramic wares during drying, firing and Effect of heat on Texture and shape of ceramic articles during drying. 3.2 Effect of heat on physical properties of ceramic glazes during firing.
Unit – IV Stages of Firing	4a. Describe various stages of firing. 4b. Explain thermo-chemical reactions during firing. 4c. List out various defects.	4.1 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glaze during firing. 4.3 Defects occurs in bodies and glazes after firing.
Unit –V Setting of Ceramic Wares in Kilns	5a. Define Setting 5b. Describe various methods of setting of wares. 5c. Distinguish setting with different materials 5d. Describe setters and saggars for various types of firing. 5e. Explain loading and unloading.	5.1 Introduction of setting 5.2 Various methods of setting of wares. 5.3 Setting of crockery's wares. Setting of refractory wares. Precautions required during setting of wares. 5.4 Setters and saggars used in biscuit & Glost firing of commercial wares. 5.5 Loading and unloading of wares.

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	Theory of drying	9	4	6	6	16
II	Classification of dryers	8	4	5	5	14
III	Effect of heat on ceramic wares	8	3	5	4	12
IV	Stages of firing	8	3	5	4	12
V	Setting of ceramic wares in kilns	9	4	6	6	16
Total Hrs		42	18	27	25	70

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

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

Not Applicable

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Library survey to collect and study of dryers and furnaces.
- ii. Industrial visit to observe firing operation in kiln and furnaces.
- iii. Study the different methods for temperature control.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Show Video film/animations/photographs of different types of kilns and firing process.

10. SUGGESTED LEARNING RESOURCES

A. List of Books:

S. No.	Title of Books	Author	Publication
1	Fuels furnaces and refractory	O.P.Gupta	Khanna publisher
2	Industrial Ceramic	Singer & Singer	New York : Chapman and Hall, 1987.
3	Refractories	F.H.Norton	McGraw-Hill
4.	A Hand Book of Modern Pottery Manufacture	H.N.Bose	Ceramic Publishing House,Bhagalpur

B. List of Major Equipment/Materials

- i. Mini Clay Oven
- ii. Mini Furnace
- iii. Tensiono meter
- iv. Hardness Tester
- v. Hot air Blowers

C. List of Software/Learning Websites

- i. <http://www.ceramicindustry.com/articles/drying-principles-of-drying>
- ii. <https://www.google.co.in/#q=kiln+furniture+and+accessories>
- iii. <https://www.google.co.in/#q=firing+stages+of++kiln>
- iv. Xx <http://www.prosec.es/descargas/DRYING-AND-FIRING-PROCESSE.pdf>

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

- **Prof. B. B. Patel** Lecturer L.E.College, Morbi
- **Prof. H. B. Dedania**, Retired Lecturer L.E.College, Morbi
- **Prof. 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