GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Ceramic Technology

Subject Code: DI04052041

Subject Name: Drying and Firing

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

Prerequisite:	Ceramic raw material knowledge is required to understand effect of heat on ceramic products.
Rationale:	The course drying and firing refers to various heat treatment processes for ceramic products by using different drying and firing techniques. This course is introduced to provide knowledge of drying and firing process for diploma ceramic engineers who want to further specialize in the field of ceramics. Drying and firing course contains Process of Drying, Types of dryers, Process of firing, Process of firing, Kiln efficiency and firing defects. Hence the course has been design to develop skills required for drying and firing

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply suitable processes for drying ceramic article.	A
02	Classify dryers based on operation.	U,A
03	Select suitable firing technique for different ceramic products.	A
04	Examine effect of heat on ceramic article.	U,A
05	Select suitable technique to improve kiln efficiency.	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
				Theory		Tutorial/ Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE (V)	
3	0	0	3	70	30	00	00	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit–I Process of Drying	1.1 Definition of drying. 1.2 Explain the Importance of drying in ceramic industry 1.3 Explain the Factors affecting drying process. 1.4 Explain the Stages of drying process in ceramic body. 1.5 Explain the types of drying techniques like Natural drying, Advanced drying methods etc.	08	18%
Unit – II Types of dryers and Drying defects	2.1 Give the classification of dryers. 2.2 Explain the working of Hot floor dryer, chamber dryer etc. 2.3 Explain the working of spray dryer, tunnel dryer, mangle dryer, rotary dryer etc. 2.4 Explain drying defects such as cracks, warpage and shrinkage etc. with their remedies.	08	18%
Unit – III Process of firing	3.1 Explain the importance of firing in ceramic industries. 3.2 Explain the Firing techniques for tile body in detail. 3.3 Explain the Firing techniques for sanitary ware in detail. 3.4 Explain theFiring techniques for crockery ware in detail.	10	22%
Unit – IV Effect of heat on ceramic bodies.	4.1 Explain the physical and chemical changes occur in clay. 4.2 Explain the phase transformation of silica with diagram. 4.3 Explain the physical and chemical changes occur in clay bodies with diagram. 4.4 Explain sintering and vitrification process.	10	22%
Unit – V Kiln efficiency and firing defects.	5.1 Explain the techniques to avoid wastage of heat during firing. 5.2 Explain the types of defects occur in ceramic body. Like firing shrinkage, cracks, pin holes, black spot, warpage etc. 5.3 Explain the types of defects occur in glazes. like blister, pin holes, dunting, crazing, chipping, fish scaling, black spots etc, 5.4 Explain the remedies to overcome firing defects.	09	20%

Suggested Specification Table with Marks (Theory):

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Process of drying	08	2	3	5	10
II	Types of dryers	08	2	3	5	10
III	Process of firing	10	2	6	10	18
IV	Effect of heat on ceramic bodies	10	2	6	10	18
V	Kiln efficiency and firing defects	09	2	5	7	14
Total		**45**	**10**	**23**	**37**	**70**

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
14%	**33%**	**53%**	**-**	**-**	**-**

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	Industrial Ceramics	Felix Singer , Sonja S. Singer	Springer Dordrecht 978-94-017-5257-2
2	Fuels furnaces and refractory	O.P.Gupta	Khanna publisher 978-81-7409-088-1
3	A Hand Book of Modern Pottery Manufacture	H.N.Bose	Ceramic Publishing House,Bhagalpur

SUGGESTED LEARNING WEBSITES

1. https://en.wikipedia.org/wiki/Refractory
2. https://www.cumi-murugappa.com/refractories/ind_carbon.html
3. http://www.firebricks.co.in/
4. https://www.corrosionpedia.com/2/1426/corrosion-101/refractory-metalsproperties-types-and-applications
5. https://ceramicartsnetwork.org/pottery-making-illustrated/pottery-making-illustrated-article/Heat-Effects-on-Glaze
   https://www.worldrefractories.org/about-refractories
6. https://www.refractorymetal.org/types-of-refractory-materials-applications/
7. https://www.joyye.com/info-detail/temperature-effects-on-ceramic-tableware-quality

Suggested Project List:

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:

1. Make a report on modern drying methods.
2. Make a report on advanced firing methods.
3. Make a report on waste heat management.
4. List out types of dryers used to drying various ceramic products.
5. Make a list of advance drying techniques.

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 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) Visit any nearer industry and study for drying of ceramic products.
b) Visit any nearer industry and study for firing of ceramic products.
c) Find out different methods to prevent wastage of heat
d) Visit to ceramic industry and study cost control and fuel efficiency
e) Students are encouraged to register themselves in various **MOOCs** such as: **Swayam, edx, Coursera, Udemy** etc to further enhance their learning.

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