GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Ceramic Technology

Course / Subject Code: DI03052061

Course/Subject Name: Fuels & Furnaces

w.e.f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	**NA**
Rationale:	Fuels & furnace course introduces basic knowledge about solid, liquid and gaseous fuels, their origin, classification, preparation procedure and characterization in terms of physicochemical properties. It also covers fundamentals of combustion along with combustion appliances. Drying and Firing process is a heart of ceramic manufacturing process. Diploma ceramic students should have knowledge of Fuels, Burners and Furnaces to understand firing technique of ceramic industry.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Distinguish various types of furnace & kilns.	A
02	Explain various types of fuels.	U
03	Explain uses of different types of fuels and combustion appliances.	U
04	Explain various types of burners & its uses.	U
05	Distinguish temperature measurement equipment	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	0	0	100

Course Content:

Unit No.	Content	No.of Hours	% of Weightage
Unit–I Introduction	1.1State History of kiln and furnaces, Kilns & furnaces used in the ancient age. 1.2 Explain principle of firing, Principles of combustion. 1.3 Explain importance of kiln & furnaces. 1.4 Importance of fuels in ceramic industry	07	14%
Unit – II Classification Of Fuels	2.1 Give classification of fuels, Various types of fuels, Solid, Liquid, Gaseous, Electricity. 2.2 Explain manufacturing process of synthetic fuels, Producer Gas, Synthetic Natural Gas, coal gas, Petroleum coke	**07**	**17%**
Unit – III Properties Of Fuels	3.1 Explain properties of different fuels like Solid fuels, liquid fuels, and gaseous fuels. 3.2 Calculate calorific value of fuels and Method of determining calorific value of fuels. 3.3 Identify suitable fuels for ceramic industry.	**07**	**17%**
Unit – IV Classification of Kilns for Ceramic Industry	4.1 Give classification of kilns & Furnaces. 4.2 Construction and function of traditional kilns liker up draft kilns and down draft kilns. 4.3 Construction and function of modern kilns roller kiln, tunnel kiln.	**08**	**17%**
Unit – V Glass and Enameling Furnaces	5.1Explain construction and function pot furnace, tank furnaces, muffle furnace, frit furnace 5.2 heat recovering furnaces like recuperative and regenerative type of furnaces	**08**	**17%**
Unit – VI Kiln Accessories	6.1 Brief explanation about fire box, chimney, crown, damper, saggers, muffles & kiln furniture, Burners. 6.2 Heat measuring equipments like thermo couple pyrometers, pyroscopes, optical pyrometer, resistance pyrometer and radiation pyrometer	08	**18%**

Suggested Specification Table with Marks (Theory):

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	07	4	4	2	10
II	Classification Of Fuels	07	5	5	2	12
III	Properties Of Fuels	07	5	5	2	12
IV	Classification Of Kilns For Ceramic Industry	08	5	5	2	12
V	Glass And Enameling Furnaces	08	5	5	2	12
VI	Kiln Accessories	08	5	5	2	12
Total		**45**	**29**	**29**	**12**	**70**

Distribution of Theory Marks(in%)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
42%	**41%**	**17%**	-	-	-

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	Refractory Technology: Fundamentals and Applications	Ritwik Sarkar	**Publisher: CRC Press** **ISBN-13: 9781498754255**
2	Fundamentals of Refractory Technology	James P. Bennett & Jeffrey D. Smith	**Publisher:** Wiley / The American Ceramic Society **ISBN-13:** 9781574981339

3	Refractories	M.L. Mishra	Oxford & IBH Publishing Co., New Delhi
4	Elements of Fuels Furnaces & Refractories	O.P.Gupta Khanna	9788120351578
5	Industrial ceramics	springer	Singer and singer

(b) Open source software and website:

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://www.worldrefractories.org/about-refractories
6. https://www.refractorymetal.org/types-of-refractory-materials-applications/

Suggested Project List:

AsuggestivelistofProjectsisgivenhere.ThishastomatchthecompetencyandtheCOs.Similarmicro- projects could be added by the concerned course teacher:

PROJECT1:) Comparative study of fuel combustion in different kilns/furnaces.

PROJECT 2: Calculate calorific value of different fuels.

PROJECT 3: Make a report or PPT on different types of fuels used in ceramic industries.

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) Under take micro-projects in team/individually.

b) Encourage Students for creating and designing new products using waste materials.

c) Studentsareencouragedtoregisterthemselvesinvarious**MOOCs**suchas:**Swayam, edx, Coursera, Udemy**etc to further enhance their learning.

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