GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Ceramic Technology

Course / Subject Code: DI01052011

Course / Subject Name: Ceramic Materials

w. e. f. Academic Year:	2024-25
Semester:	1st
Category of the Course:	ESC-02

Prerequisite:	**NA**
Rationale:	It is an introductory subject to be given to students opting for ceramic engineering. It will expose the students to various areas to be covered in this course and various field jobs where they will find employment. This knowledge is essentially required for supervisors. The students will also be exposed to various categories of ceramics.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe the properties and uses of clay materials.	R
02	Identify the sources of silica and its importance in tri axial body.	U
03	Describe the different types of fluxes used in ceramic manufacturing.	R
04	Describe the different forms of alumina and synthetic raw materials.	R
05	Describe the methods of Dispose of ceramic waste	U

**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 / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit – I Clay	1.1 Explain the formation of clays. 1.1.1 Definition of clay, Formula of clay, weathering of rocks. 1.2 Explain the classification of clays 1.2.1 Primary and secondary clays with examples. 1.3 Describe winning method of clays. 1.3.1 Methods of winning ceramic materials from earth, open pit, underground mining and machineries and Clay storage. 1.4 Explain the purification methods of clays. 1.4.1 Purification of clay – mechanical and chemical methods – sorting, air separation, magnetic separation.	10	20%
Unit – II Silica	2.1 Describe the occurrence of silica. 2.1.1 Occurrence of various silica raw materials like quartz, sand, sand stone, quartzite, ganister, flint and their uses in the manufacture of various ceramic articles. 2.2 Explain the properties of silica 2.2.1 Physical and chemical properties of silica. 2.3 Describe the forms of silica. 2.3.1 Effect of heat on silica. 2.4 Explain the role of silica in triaxial body. 2.4.1Role of silica in triaxial body.	08	25%
Unit – III Fluxes	3.1 Explain the occurrence of fluxes. 3.1.1 Occurrence of various fluxes,,, 3.2 Describe the various types of feldspar., 3.2.1 Types of feldspar like Potash Feldspar, Soda feldspar, Lime Feldspar, Cornish stone, nephelinesyenite. 3.3 Explain the properties of feldspar. 3.3.1 Properties of Potash Feldspar, Soda feldspar, Lime Feldspar, Cornish stone, nephelinesyenite. 3.4 Explain the role of feldspar in triaxial body. 3.4.1 Role of feldspar in triaxial body. 3.5 Explain the different types of carbonates and sulphates. 3.5.1 Different types of carbonates like Sodium carbonate, potassium carbonate, calcium carbonate and Sulphates like sodium sulphate, potassium sulphate, calcium sulphate ect.	10	20%

Unit – IV Alumina & synthetic raw material.	4.1 Explain the occurrence of alumina. 4.1.1 Occurance of various forms of alumina. 4.2 Describe the various types of alumina. 4.1.1Different types of alumina like gibbsite, Diaspora, bauxite, corundum, fused alumina and sintered alumina, tubular alumina. 4.2 Explain the properties of alumina. 4.3 Describe alumino silicates. 4.4.1 Alumino silicates like kyanite, Silimanite, andalusite & mullite. 4.5 Explain synthetic raw materials. 4.4.1 Synthetic raw materials like Carbides, Nitrides, Borides	08	25%
Unit – IV Recycling of Industrial Wastes	5.1 Justify the need of understanding recycling of industrial waste like Cullets, Grog, Fly Ash, and Blast Furnace Slag. 5.1.1 Concept of recycling waste. 5.2 5b. Establish the relationship of sustainability and recycling of industrial waste. 5.2.1 Sustainability and recycling 5.3 Suggest methods of recycling ceramic waste with examples. 5.3.1 Methods to recycle ceramic waste 5.4 5d. Suggest methods to dispose ceramic waste	**09**	10%
	TOTAL	**45**	**100%**

Suggested Specification Table with Marks (Theory):

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Clay	10	3	7	8	18
II	Silica	08	4	7	8	19
III	Fluxes	10	2	8	8	18
IV	Alumina and synthetic raw materials	08	2	4	4	10
V	Recycling of industrial waste	09	1	2	2	5
	Total	**45**	**25**	**26**	**19**	**70**

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
36%	37%	27%	-	-	-

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	Introduction to ceramics	WD Kingery	Elsevier Scientific Publishing Company, New York
2	Ceramic white wares	SudhirSen	Oxford & IBH Publishing Co., New Delhi
3	Refractories	M.L. Mishra	Oxford & IBH Publishing Co., New Delhi
4	Modern glass practice	S.G. Scholse	McGraw Hill Publishing Co. New Delhi
5	Industrial ceramics	springer	Singer and singer

(b) Open source software and website:

1. www.coursera.org
2. www.ceramics.org
3. http://en.wikipedia.org/wiki/Ceramic

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the different types of raw materials based on their physical properties.	I	04
2	Determine the water of plasticity of clay.	II	04
3	Determine Linear drying shrinkage of clay body	II	04
4	Determine firing shrinkage of given sample.	II	04
5	Determine bulk density of density of given sample.	II	02
6	Determine the Loss on ignition of given sample.	III	02
7	Determine the moisture content test of clay.	III	02

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
8	Determine the moisture content test of quarts.	III	02
9	Determine the specific gravity test of clay.	IV	02
10	Determine the specific gravity test of Quarts.	IV	04
	Total		**30 Hrs**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	**PrO.No.**
1	Sieve shaker with sieve set	1,2,
2	Digital weight balance	1-10
3	Hot air oven	3-10
4	Muffle furnace	4,6
5	Specific gravity bottle	9,10

Suggested Project List:

A suggestive list of Projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

PROJECT 1:
Ceramic industries in India: Identify the different ceramic industries located in different parts of India and prepare the report.

PROJECT 2:
Raw materials: prepare a chart of ceramic raw materials with formula and Collect different types of ceramic raw material samples from local industries.

PROJECT 3: Decorative ware: prepare any type of clay ware, decorate it and prepare a report.

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:

- Undertake micro-projects in team/individually.
- Encourage Students for creating and designing water treatment processes using waste materials.
- Students are encouraged to register themselves in various **MOOCs** such as: **Swayam, edx, Coursera, Udemy** etc to further enhance their learning.

* * * * * * *