GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Ceramic Materials
(Code: 3325201)

Diploma Programmes in which this course is offered	Semester in which offered
Diploma in Ceramic Technology	**Second Semester**

1. RATIONALE

Diploma Ceramic Engineers are expected to work most in Ceramic Industries. They deal with production of Ceramic Products. Since, they should be familiar of different Ceramic Raw Materials used in variety of products such as tableware or crockery decorative ware, sanitary and industrial ware. This course gives brief knowledge of different ceramic materials used for various purposes.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different sills so that student is able to acquire following competency:

i. **Select appropriate ceramic materials on the basis of their application**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	200
4	0	4	8	70	30	40	60	

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

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit-I Classification & composition of ceramic materials	1a. Explain classification of ceramic materials 1b. List composition of different ceramic materials	1.1. Classification of ceramic materials 1.1. Structural ceramics 1.2. Refractories 1.3. Pottery 1.4. Insulation material 1.5. Others – Glass, Cement, Lime, Plastics 1.2. Composition of ceramic materials
Unit –II Clay Minerals	2a. Define the scope of clay minerals 2b. Explain the Physical properties of clay minerals	2.1 Introduction to clay minerals -Kaolinite, Illite Montmorillonite, Chlorite, Vermiculite, Serpentine, Ball clay etc. 2.2 Physical properties of clay minerals such as Plasticity, Shrinkage, Swelling capacity, Iron Exchange, Drying strength etc.
Unit-III Introduction to pottery	3a. Explain the distinctive properties & uses of Terracota, Earthenware, Stoneware, Porcelainware	3.1 Introduction to Terracota, Earthenware, Stoneware, Porcelainware
Unit– IV Winning of Clay	4a. Explain the Methods for winning ceramic materials from earth. 4b. Explain the method of mining 4c. Describe the Clay storage	4.1 Methods for winning ceramic materials from earth. 4.2 Method of mining such as open pit, underground etc. 4.3 Use of mining machinery. 4.4 Clay storage, Benification and conveying machinery.
Unit– V White Ware Materials	5a. Explain the White burning clays & their properties 5b. Explain the properties of Opacifiers and colorants	5.1 White burning clays such as China clay, kaolin, ball clay, fire clay – introduction & properties. 5.2 Stony matter such as feldspar, quartz, zinc oxide, lead oxide, zirconium silicate. 5.3 Opacifiers, colorants and glaze oxides, zirconium oxides, talc, pyrophyllite, neptheline syenite etc.
Unit– VI Clays for structural Product	6a. Explain the raw material s required for structural Products	6.1 Red burning clays, Silts, Black cotton soil.
Unit– VII Refractory Materials	7a. List the different raw materials required for manufacturing refractory materials 7b. Explain the properties of refractory materials	7.1 Fire clay bauxite, diaspore, sillimanite and andalusite. 7.2 Mullite, alumina, zirconia, zircon, high temperature oxides, carbonates nitrides.
Unit–VIII	8a. List the different glass	8.1 Silica sand, sand stone, lime, calcite,

Unit	Major Learning Outcomes	Topics and Sub-topics
Glass Materials	materials 8b. Explain the properties of Glass materials	dolomite, feldspar. 8.2 Soda ash, sodium nitrate, red lead colourants and other minor ingredient.
Unit– IX Enamel	9a. Differentiate between the Ferrous and non ferrous materials used in enamel making. 9b. Explain the properties & applications of materials used for making enamel	9.1 Ferrous and nonferrous materials used in enamel making. 9.2 Materials used for enamel frit making with their properties and use.
Unit– X Mould materials	10a. Explain the properties of Plaster of Paris	10.1 Gypsum, types of gypsum, properties and uses 10.2 Plaster of Paris, types of pop, properties and uses
Unit– XI Abrasives	11a. Explain the raw materials used for making abrasives 11b. List the naturally occurring emery and silica used as abrasives.	11.1 Raw materials used for making abrasives like bauxite, corundum and Carborundum. 11.2 Naturally occurring emery and silica used as abrasives.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Classification & composition of ceramic materials	4	02	02	00	04
II	Clay Mineralogy	4	02	02	00	04
III	Introduction to pottery	4	02	02	00	04
IV	Winning of Clay	6	02	02	04	08
V	White Ware Materials	8	02	03	03	08
VI	Clays for structural Product	5	02	02	02	06
VII	Refractory Materials	7	02	03	03	08
VIII	Glass Materials	7	02	03	03	08
IX	Enamel	5	02	02	04	08
X	Mould Materials	3	02	02	02	06
XI	Abrasive	3	02	02	02	06
	Total	**56**	**18**	**28**	**24**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different skills so that students are able to acquire above mentioned competency

S. No.	Unit No.	Practical/Exercises	Approx Hours Required
1	I	Identify minerals based on their physical properties like colour, steak, fracture, Luster, etc. (based on the guidelines provided)	06
2	II	Identify Physical properties of clay minerals such as Plasticity, Shrinkage, Swelling capacity, Iron Exchange, Drying strength etc (based on the guidelines provided)	08
3	III	Identify locations of occurrences of ceramic raw materials in Gujarat State.	06
4	V	Distinguish china clay, ball clay and fire clay based on their physical properties.	08
5	VI	Identify mullite, Zirconia, alumina and Quartz based on physical properties such as colour, fracture, hardness, sp.gr, chemical composition ,melting point etc.	10
6	VIII	Determine physical properties of plaster of Paris such as setting time, moisture content, temperature rise, compressive strength etc. based on the guidelines provided	12
7	IX	Study and report the physical properties of abrasives such as hardness, sp.gr., density, composition, texture, colour etc. (based on the guidelines provided)	08
		Total	**56**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

7.1 Students will prepare File/journal for the above mentioned Experiments.

7.2 Student may be asked to collect photographs from internet which is related to field application of various topics.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No	Author	Title of Books	Publication
1	Cristophere.w.Sinton	Raw Materials for Glass and Ceramics	John Wiley & Sons
2	C.Barry Carter,M.Grant Norton	Ceramics Materials Science and Technology	Springer Science + Business media, LLC
3	C.A.Schacht	Refractory Hand books	CRC PRess

B. List of Major Equipment/ Instrument

1. Vicat Needle Apparatus
2. Infrared moisture balance

3. Redwood viscometer
4. Hot Oven (0 to 200 degree centigrade capacity)
5. Universal Testing Machine
6. Crucible furnace
7. knoop and Vickers Hardness scale
8. Digital balance (0 to 200gm) with accuracy 1mg

C. List of Software/Learning Websites

1. http://www.cbchrystal.com/Mineral_grade.php?Mineral_name
2. http://en.wikipedia.org/wiki/Ceramic

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. Bhart B. Patel**, Dept. of Ceramic Technolog

Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawlley**, Professor Dept. of Applied Sciences,