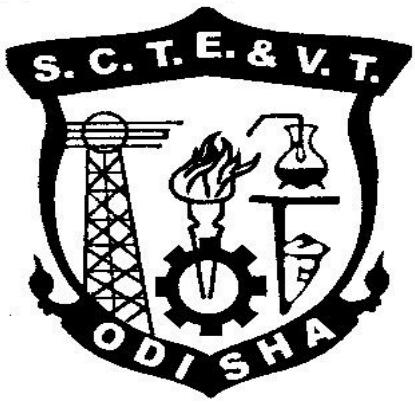
| STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING,ODISHA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TEACHING AND EVALUTION SCHEME FOR 6th SEMISTER (BRANCH NAME- CERAMIC) (Wef 2019-20) | | | | | | | | | |
| Subject Number | Subject Code | Subject | Periods/ week | | Evaluation Scheme | | | | |
| | | | L | T | P | Internal Assessment/Seasonal | End Sem Exams | Exams (Hours) | Total |
| | | **Theory** | | | | | | | |
| Th1 | | Advance Ceramic | 4 | 1 | | 20 | 80 | 3 | 100 |
| Th2 | | Ceramic Coating & Composites | 4 | | | 20 | 80 | 3 | 100 |
| Th3 | | Cement Technology | 4 | | | 20 | 80 | 3 | 100 |
| Th4 | | Elective 1- Refractory Application<br>Elective2- Electrical and Electronics Ceramic | 4 | | | 20 | 80 | 3 | 100 |
| | | **Total** | 16 | | | 80 | 320 | - | 400 |
| | | **Practical** | | | | | | | |
| Pr.1 | | Ceramic Kiln And Product Drawing | - | - | 6 | 50 | 50 | 3 | 100 |
| Pr.2 | | Ceramic Testing-IV | - | - | 4 | 25 | 50 | 3 | 75 |
| Pr.3 | | Project Phase-II | - | - | 7 | 50 | 100 | 3 | 150 |
| Pr. 4 | | Life Skill | - | - | 2 | 25 | - | - | 25 |
| | | Student Centered Activities(SCA) | | - | 3 | - | - | - | |
| | | **Total** | | | 22 | 150 | 200 | | 350 |
| | | **Grand Total** | 16 | 1 | 22 | 230 | 520 | | 750 |
| Abbreviations: L- Lecturer, T- Tutorial P-Practical. Each class is of minimum 55 minutes duration | | | | | | | | | |
| Minimum Pass Mark in each Theory subject is 35% & in each Practical subject is 50 % & in Aggregate Is 40% | | | | | | | | | |
| **SCA Shall Comprise of Extension Lectures/ Personality Development / Environmental issues/ Quiz /Hobbies/Field visits / Cultural activities /Lil studies / Classes on MOOCS/SWAYAM /Idea Tinkering and Innovation Lab Practice etc. Seminar and SCA Shall be conducted in asection** | | | | | | | | | |
| **There shall be 1 Internal Assessment done for each of Theory subject. Seasonal Marks shall be total of the performance of individual difference job / experiments in a subject throughout the semester** | | | | | | | | | |

# CURRICULLUM OF 6TH SEMESTER

# For

# DIPLOMA IN CERAMIC TECHNOLOGY

# (Effective FROM 2020-21 Sessions)




## STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWA

# ADVANCE CERAMIC
# (Theory – 1)

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 4p/week | Internal Assessment | 20 |
| Tutorial | - | - | - |
| Maximum Marks | 100 | End Semester Examination | 80 |

**Rationale:** Advance Ceramic materials and products are used in various technical fields such as in electronics and computers, in space shuttle and defense, in medical equipments and automobile engines. So a ceramic diploma student must know the application and properties of advance ceramic.

**(Fundamental idea only)**

**Objectives**: After completion of course student will be able to

1. Know about latest development of ceramic in various areas.
2. Know uses of electrical and electronic ceramic for engineering purpose.
3. Know various abrasive products and there uses
4. know ceramic material systems and ceramic composites and their application
5. Know bio-ceramic products and their application.
6. Understand application of special ceramics.

| Sl. No. | Major Topics | Periods |
|---|---|---|
| 1 | Introduction to advance ceramic | 05 |
| 2 | High Temperature material | 10 |
| 3 | Electric Ceramics | 10 |
| 4 | Magnetic Ceramic | 10 |
| 5 | Mechano- Ceramic | 10 |
| 6 | Engine Ceramic | 05 |
| 7 | Bio Ceramic. | 05 |
| 8 | Ceramic for energy system & conservation | 05 |

**COURSE CONTENTS :**

**1.0 INTRODUCTION TO ADVANCE CERAMIC**

- 1.1 Introduction of advance ceramic
- 1.2 Characteristics of Advance ceramic
- 1.3 Important and application of advance Ceramic
- 1.4 Raw materials for advance ceramic.
- 1.5 Difference between conventional ceramic and Advance ceramic.
- 1.6 General preparation &Fabrication of advance ceramic.

**2.0 HIGH TEMPERATURE CERAMICS**

- 2.1 Introduction of High Temperature Ceramics.
- 2.2 Explain the properties and application of the
- 2.3 Oxide Ceramics.
- 2.4 Explain the properties and uses of carbide, boride, and nitride ceramic.
- 2.5 Advance ceramic materials & Components for high temperature use.
- 2.6 Ceramic heating elements.

**3.0 ELECTRICAL CERAMICS**

3.1 Define Dielectric ceramics, Properties & application.

3.2 Ferro Electric and pyroelectric ceramics, piezoelectric ceramic products , their properties & application.

3.3 Low loss ceramic & their application.

3.4 High and low tension electrical porcelain their manufacturing and application.

**4.0 MAGNETIC CERAMIC**

4.1 Introduction to magnetic ceramic

4.2 Spinel ferrite

4.3 Hexagonal ferrite

4.4 Preparation of ferrite

4.5 Difference between hard ferrite and soft ferrite .

4.6 Application of ferrite.

**5.0 MECHANO-CERAMICS**

5.1 Abrasive materials and abrasive grain.

5.2 Manufacturing of abrasive grain and its application

5.3 Ceramic grinding and cutting wheel. Manufacturing and application.

**6.0 ENGINE CERAMIC**

6.1 Introduction to engine ceramic

6.2 Ceramic for automobile.

6.3 Characteristics of engine ceramic products.

6.4 Spark plug and its manufacturing.

**7.0 BIO - CERAMICS.**

7.1 Define Bio Ceramics &explain types of bio ceramic.

7.2 Special ceramic for Biological use & their characteristics.

7.3 Bio materials, bio- glass & bio-composites for medical application.

7.4 Ceramic implants.

7.5 Ceramic for artificial teeth.

Syllabus Coverage up to Internal Assessments: Topics: - 1, 2, 3& 4

## BOOKS FOR REFERENCE:

Learning Resources :

| SI.NO | Title of the book | Name of the Authors | Name of the publishers |
|---|---|---|---|
| 1 | Industrial Ceramics | Singer & Singer | Oxford and IBH |
| 2 | Special ceramic | popper British Ceramic Research Association | Heywood & Co London |
| 3 | Ceramics for advance technology | J E Hove | Jhon Willey & Sons New York |
| 4 | Oxide Ceramics | E.Ryshkewitch | Achademic Press New York |
| 5 | Hand book of Ceramic | S Kumar | Kumar Associates Kolkata |
| 6 | Structural Ceramics | J B Watchman | Academic Press, Boston, USA |
| 7 | Electro Ceramics | A J Maulson | British Institute of ceramic, UK |
| 8 | Introduction to ceramics | W. D. Kingery | John Wiley and sons,New York |
| 9 | Introduction to technical ceramic | B E Waye | Maclaren and sons,London |

# CERAMICS COATING AND COMPOSITES
# (Theory - 2)

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 4p/week | Internal Assessment | 20 |
| Tutorial | - | - | - |
| Maximum Marks | 100 | End Semester Examination | 80 |

**Rationale:** There is no substitute of ceramic coating .The coating may be glass or refractory. Ceramic coating withstands high temperature and applied over metals and non metals surface and used for various fields in electronics, electrical & refractory components in various fields. Ceramic composite materials are unique materials exhibiting metal & nonmetal, metal & glass and glass & ceramic properties used as advance technical material in various technical fields. It is highly essential for a ceramic student to know about ceramic coating and ceramic composites.

**Objectives:** After completion of the course, students will be able to:

1. Know about latest development of ceramic in various area.
2. Understand the nano ceramic application in various field.
3. Know about ceramic composite and their application
4. Know about glass ceramic properties and their uses
5. Understand fiber reinforced glass properties and uses
6. Know about cermets and its application.
7. Know about vitreous coating & their uses.

| SI No. | Major Topics | Periods |
|---|---|---|
| 1 | Ceramic composites | 10 |
| 2 | Glass ceramics | 08 |
| 3. | Fibre- reinforced glass | 10 |
| 4. | Cermets | 10 |
| 5. | Ceramic coating | 12 |
| 6. | Vitreous coating | 10 |

**COURSE CONTENT**

1. **CERAMIC COMPOSITES**
   2. Definition and classification of composites.
   3. Fibers and whiskers and their use as composites.
   4. Ceramic matrix composites, properties and application.
   5. Alumina and mullite matrix composites and application.
   6. Carbon – carbon composites.

**2.0 GLASS CERAMIC:**

2.1 Introduction and classification of composites.
2.2 Glass ceramic matrix composites.
2.3 Manufacturing of glass ceramic.
2.4 Properties& application of glass ceramic composites

**3.0 FIBER REINFORCED GLASS:**

3.1 Introduction to glass fiber & fiber glass.
3.2 Portland cement glass fiber composite.

3.3 Properties & uses of glass fiber composite.
3.4 Glass reinforced gypsum , application & properties
3.5 Glass reinforced polymer properties & application.

**4.0 CERMET:**

4.1 Introduction to cermets.
4.2 Various cermets products.
4.3 Manufacturing of cermets
4.4 Properties& uses of cermets
4.5 How cermets is different from glass, ceramic and metal?

**5.0 CERAMIC COATING**

5.1 Define ceramic coating
5.2 vapor deposition process.
5.3Sol –Gel technology
5.4Plasma spray process
5.5Advance ceramic coating methods

5.6Ceramic coating on implants

**6. VITREOUS COATING**

6.1 Introduction to Glassy coating

6.2 Various types of glassy coating
6.3 Application of vitreous enamel coating.
6.4 Properties and uses of various glassy coated products.

Syllabus Coverage up to Internal Assessments: Topics: - 1, 2&3

**BOOKS FOR REFERENCE**

Learning Resources :

| SI. NO | Title of the book | Name of the Authors | Name of the publishers |
|---|---|---|---|
| 1 | Introduction Technical Ceramic | B E Waye | Maclaren & Son's Ltd, London |
| 2 | Technology of Enamel | V VVargin, B E Waye | Maclarin& Son's Ltd London |
| 3 | Glass and Ceramics | P W Mcmillan | Academic press New York |
| 4 | Enamel | Andrews | The Garrad Press Publisher USA |
| 5 | Introduction to high temperature composite materials | B K Sarkar | Indian publication |
| 6 | Glass and glass ceramics | M H Lewis | Chappeman and Hall,London |
| 7 | Modern ceramic engineering | D W Richardson | Marcel Dckker ,Inc., New York |

# CEMENT TECHNOLOGY
# (Theory - 3)

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 4p/week | Internal Assessment | 20 |
| Tutorial | - | - | - |
| Maximum Marks | 100 | End Semester Examination | 80 |

**Rationale:** Cement is a ceramic product. It is prepared from inorganic non metallic raw material and fired at high temperature to form cement clinker in rotary or shaft kiln. A student of ceramic technology must be aware of the production process, testing and properties of various types of cement and also know the process of preparation of cement concrete products.

**Objectives:**

After completion of the course, students will be able to :

1. Know lime and lime stone, their qualities, calcinations and cementing property.
2. Understand details about Portland cement.
3. Understand manufacturing of various types of cement, their qualities & uses
4. Know about cement kiln and its operation
5. Know various methods of testing qualities of cement.
6. Know various types of cement concrete products and its manufacturing process.
7. Know about the High Alumina cement & their application.

| Sl.No. | Major Topics | Periods |
|---|---|---|
| 1 | Lime and Other Hydraulic Materials | 05 |
| 2 | Portland Cement | 15 |
| 3. | Various Type of Cement | 15 |
| 4. | Testing of Cement | 10 |
| 5. | Cement Products | 10 |
| 6. | High Alumina Cement | 05 |

## COURSE CONTENTS

### 1. LIME AND OTHER HYDRAULIC MATERIALS

1.1 Define various terms related to lime and lime stone
1.2 State & explain properties of lime stone
1.3 Impurities of lime stone and its effect in cements.
1.4 Pozzolanic materials &Its utilization in cement.
1.5. Fly ash and slag for cement making

### 2.0 PORTLAND CEMENT : Discuss the following details :-

2.1 Introduction to OPC
2.2 Raw Materials for OPC, Their properties and effect on cement making.
2.3 Manufacturing Process of OPC
2.4 Rotary Kiln and its operation (RK)
2.5. Vertical shaft kiln and its operation for OPC.
2.6 Clinker formations and clinker chemistry
2.7. Hydration of cement & Setting of Cement.
2.8. Effect of acid water and sulphate water on cement

2.9. Effect of alkalis compound on OPC.
2.10. Various types of Accelerator and retarders used in cement.
2.11. Properties of cement, 43 grade and 53 grade OPC
2.12 Constituents of cement clinker, grinding of clinker
2.13 Storage of cement
2.14. Impurities in cement and their effect.

**3.0 VARIOUS TYPES OF CEMENT:**

Describe the composition, quality, property and uses of the following cement:-

3.1 Pozzolana Cement
3.2 Blast Furnace slag cement
3.3 Acid Resistant Cement
3.4 Masonry Cement
3.5 Sulphate Resisting and Super Sulphate Cement
3.6 Rapid Hardening Cement
3.7. Quick Setting Cement
3.8. High alumina Cement
3.9. White Cement
3.10 Coloured Cement
3.11 Oil well cement.
3.12 Sorel cement.
3.13 Hydrophobic cement.
3.14 Expanding Cement.
3.15 Low expansion cement

**4.0. TESTING OF CEMENT :**

Discuss the following testing methods for cement in brief.

4.1 Consistency of cement
4.2 Initial and Final setting of Cement.
4.3 Expansion of Cement
4.4 Compressive & Tensile Strength.
4.5 Fine ness of cement
4.6 Impurities in Cement
4.7 Specific gravity of cement.
4.8 Chemical analysis of cement.

**5.0. CEMENT CONCRETE PRODUCTS :**

5.1 Describe various cement concrete products used in low cost housing
5.2 Explain various types of ferro-cement products.
5.3 Describe making of mosaic tiles.
5.4 Describe making of cement concrete (RCC) pipes & Railway slipper.
5.5. Describe making of cement concrete Block
5.6. Making of FAL-G Brick

**6.0 HIGH ALUMINA CEMENT**

6.1. Introduction
6.2 Raw materials used for manufacturing of HAC.
6.3. Manufacturing process
6.4 Hydration Chemistry & properties of high alumina cement
6.5 Use of high alumina cement in refractory & other areas.

Syllabus Coverage up to Internal Assessments: Topics: - 1, 2&3

**BOOKS FOR REFERENCE:**

| Learning Resources : | | | |
|---|---|---|---|
| **Sl. NO** | **Title of the book** | **Name of the Authors** | **Name of the publishers** |
| 1 | Chemistry of Cement and Concrete | F. M..Lee | Edward Arnold Publisher London |
| 2 | Cement Lime and Plaster | C Edwin | Jhon Willy and sons New York |
| 3 | Civil engineering material | S. C.Rangawala | Charotar Publishing House, Anand |
| 4 | Technology of cement and Blended cement | H N Banerjee | Wheeler publishing Allahabad |
| 5 | Cement and concrete science Technology | S N Ghosh | ABI Books, New Delhi |

# REFRACTORIES APPLICATION
## (Theory - 4) Elective - 1

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 4p/week | Internal Assessment | 20 |
| Tutorial | | | |
| Maximum Marks | 100 | End Semester Examination | 80 |

**Rationale:** Without refractory a product cannot be prepared where heat is involved in manufacturing process. All metallurgical furnaces are lined with refractory materials. Other than metal extraction refractory is used in glass making, ceramic product making, cement making also in petrochemical and fertilizer industries. A ceramic diploma student must know the refractory application in various fields.

**Objectives :**After completion of course student will be able to

1. Understand heat transfer by refractories.
2. Know the refractory requirement in fertilizer and petrochemical industries
3. Understand the uses of refractories in thermal power plant, and cement industries
4. Know the refractories use in ceramic kiln and glass furnaces.
5. Know refractories for energy conservation .

| SI No. | MAJOR TOPICS | Periods |
|---|---|---|
| 1 | Heat transfer by refractory | 10 |
| 2 | Refractories in fertilizer and petrol chemical industries | 05 |
| 3 | Refractories in cement industry | 10 |
| 4 | Refractories in Power plant | 05 |
| 5 | Refractories in Glass Industry | 10 |
| 6 | Refractories in Ceramic Kiln and Furnaces | 10 |
| 7 | Repairing & maintenance of kiln & furnaces | 10 |

### 1.0 HEAT TRANSMISSION BY REFRACTORIES

1.1 Explain the heat transfer through a porous body.
1.2 Explain heat loss, heat balance and heat recovery in kiln and furnace.
1.3 Discuss flow of heat, through walls of furnace under variable conditions
1.4 Explain heat conservation in kiln & furnace.

### 2.0 FERTILIZER AND PETROCHMICAL INDUSTRY

Explain the following terms and mention the refractories used for them.
2.1 Secondary reformer, Primary Reformer, Heaters
2.2 Rotary kiln for calcinations of coke.
2.3 Refractories for carbon black Industry.

### 3.0 REFRACTORIES IN CEMENT INDUSTRY

3.1 Describe Rotary kiln & refractories used in different zones in details.
3.2 Describe Vertical shaft kiln for mini cement plant.
3.3Describe Refractories used in vertical shaft kiln. 3.4 various shapes of refractories for rotary cement kiln construction.

### 4.0 REFRACTORIES IN POWER PLANT.

Describe the requirement of refractories of the following in brief.
4.1 Thermal power plant.

4.2 Nuclear power plant

**5.0 REFRACTORIES FOR GLASS INDUSTRY**

5.1 .Various types of furnaces used in glass melting.
5.2. Glass tank furnace refractories & their properties.
5.3 Refractories used in various section of glass tank with justification .
5.4 Refractories used in regenerator in glass tank furnace and their properties

**6.0 REFRACTORIES FOR CERAMIC KILN**

6.1 Refractories for down draft kiln construction
6.2 Refractories for tunnel kiln construction
6.3 Refractories for shuttle kiln.
6.4 Refractories for Roller hearth kiln.
6.5 Kiln furniture and their properties
6.6 Refractories for energy conservation in kilns

**7.0 REPAIRING AND MAINTENANCE OF FURNANCES**

**7.1** Blast furnace
**7.2** BOF and EAF
**7.3** Ceramic kilns and furnaces
**7.4** Hot repairing of steel making furnaces
**7.5** Hot repairing of coke oven.

Syllabus Coverage up to Internal Assessments: Topics: - 1, 2,3& 4

**BOOKS FOR REFERENCE**

Learning Resources :

| SI. NO | Title of the book | Name of the Authors | Name of the publishers |
|---|---|---|---|
| 1 | Refractories production and Properties | J.H. Chester | Iron and steel institute london |
| 2 | Refractories | M.L. Mishra | Clear type press, Allahabad |
| 3 | Refractories ,manufacture,properties and application | Chesti | Prentice Hall India Private Ltd.New Delhi |
| 4 | Refractories | Nandy | Tata McGraw Hill Publishing Co.New Delhi |
| 5 | Refractories | F. H. Norton | McGraw Hill ,London |
| 6 | Refractories and their uses | K. Shaw | Applied science publisher , U. K |
| 7 | Tecnology of monolithic refractories | Akira Nishikawa | Pilibrico Japan Co.Ltd. Japan |

# ELECTRICAL AND ELECTRONIC CERAMICS
## (Theory - 4) Elective - 2

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 4p/week | Internal Assessment | 20 |
| Tutorial | | | |
| Maximum Marks | 100 | End Semester Examination | 80 |

**Rationale :** Without Ceramic Electrical transmission cannot be made and without ceramic electronic components cannot be made. It is highly essential for a Ceramic Diploma student

**Objectives :**

After completion of this course, students will be able to

1. know various s Oxide Ceramics, non-oxide ceramics and ceramics Composites.
2. know the various application of the above special ceramics.
3. know the general idea on the production of above special ceramic products.

| Sl.No. | Major Topics | Periods |
|---|---|---|
| 1 | Electronic ceramics | 30 |
| 2 | Electrical ceramic | 30 |

**COURSE CONTENT**

**1.0 Electronic Ceramics**

1.1 Ceramic capacitors.
1.2 Semiconductors
1.3 Ceramic Actuator.
1.4 Multilayer ceramic actuator.
1.5 Barium titanate as a ceramic material.
1.6 Important electronic ceramic material.
1.7 Properties of electronic ceramic materials.
1.8 Piezoelectric ceramic for electronic products.
1.9 Resistor , inductor, circuit, protective devices , varistor.
1.10.Ceramic magnets.
1.11.New Advance Ceramic material for electronics use

**2.0 ELECTRICAL CERAMIC**.

2.1. Low Tension, low frequency porcelain insulator
2.2. High Tension, low frequency porcelain insulator
2.3. High Tension low frequency mullite porcelain
2.4. Electrode for glass melting
2.5. Ceramic dielectrics
2.6. Spark plug insulators
2.7. High frequency ceramic insulators
2.8. High temperature insulators
2.9. Low loss steatite porcelain
2.10 Low loss cordierite bodies
2.11 Low loss zirconia porcelain

2.12. Lithia porcelain
2.13 Alumina porcelain
2.14 Super conductors
2.15. Ceramic heating element
2.16. Electric motor brushes

Syllabus Coverage up to Internal Assessments: Topics: - 1, 2&3

**BOOKS FOR REFERENCE**

| Learning Resources : | | | |
|---|---|---|---|
| **Sl. NO** | **Title of the book** | **Name of the Authors** | **Name of the publishers** |
| 1 | Electro ceramics | Edited by A.J. Manison and Other | BIC, U.R. |
| 2 | Structural Ceramics | J B Watchman | Academic Press, Boston, USA |
| 3 | Electro Ceramics | A J Maulson | British Institute of ceramic, UK |
| 4 | Industrial Ceramics | Singer & Singer | Oxford and IBH |
| 5 | Special ceramic | popper British Ceramic Research Association | Heywood & Co London |
| 6 | Introduction to technical ceramic | B E Waye | Maclaren and sons,London |

# Pr1. CERAMIC KILN AND PRODUCT DRAWING

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 6 p/week | Internal Assessment | 50 |
| Tutorial | - | - | - |
| Maximum Marks | 100 | End Semester Examination | 50 |

**Rationale:** A Ceramic student should have ideas to read the kiln and product drawing in order to prepare a product of required dimension and also get overall idea on kiln and its construction. So practice of drawing of various types of ceramic kiln and ceramic products are required.

**Objective:** After completion & this course the student will be able to

i) Sketch and draw to measurement various furnace, kin.
ii) Sketch and draw various electrical insulators, tableware, sanitary wares and mould of various products.
iii) Sketch and draw symbols of equipment used in ceramic and chemical industries.
iv) Represent a process with the help of flow charts.

**COURSE CONTENTS**

1. Draw different types of shapes used in furnace construction.
2. Furnace / Kiln drawing – Draw the following
   i. Down draft kiln.
   ii. Tunnel Kiln.
   iii. Muffle kiln.
   iv. Chamber Kiln.
3. Draw various types of
   a. Electrical insulators
   b. Tableware
   c. Sanitary-wares and mould of various products.
4. Sketch symbols of Equipment used in ceramic and chemical industries.
5. Plant lay-out of various ceramic industries.
6. Draw flow diagram of various products manufacturing.

**BOOKS FOR REFERENCE**

Learning Resources :

| SI. NO | Title of the book | Name of the Authors | Name of the publishers |
|---|---|---|---|
| 1 | Industrial ceramics | Singer and Signer | Oxford I B H Publishing CO |
| 2 | Refractories | Chesty | Prentice Hall India Learning Pvt. Ltd. New Delhi |
| 3 | Refractories | Nandi | Prentice hall of India Delhi |

# Pr2. CERAMIC TESTING IV

| Name of the Course : Diploma in CERAMIC TECHNOLOGY | | | |
|---|---|---|---|
| Course Code | | Semester | 6th |
| Total Period | 60 | Examination | 3 hrs |
| Theory Periods | 4 p/week | Internal Assessment | 25 |
| Tutorial | - | - | - |
| Maximum Marks | 100 | End Semester Examination | 50 |

Rationale : In order to know the quality of a ceramic raw materials and product the chemical composition of the raw materials and the products are to be determined. So, the student of Diploma Ceramic should have the knowledge on chemical analysis of Ceramic raw materials and products.

Objectives : After completion of this practical topics the student will aware of the following:

1. How to prepare samples for chemical analysis.
2. Various methods of chemical analysis for ceramic.
3. Various testings conducted for cement.
4. Overall idea on the quality of cement and ceramic raw materials.

## SECTION-A

**MINIMUM FIVE NUMBERS OF TESTINGS TO BE PRACTICED BY THE STUDENT**

**CHEMICAL ANALYSIS OF CERAMIC RAW METERIALS AND PRODUCTS.**

1. Sampling
2. Determination of loss on Ignition.
3. Opening of sample by fusion for analysis
4. Estimate of $SiO_2$.
5. Estimate of $Al_2O_3$
6. Estimate of $TiO_2$
7. Estimate of $Fe_2O_3$
8. Estimate of CaO
9. Estimate of Mgo
10. Analysis of Glaze
11. Analysis of enamel frit
12. Estimation of hardness of water using EDTA.

## TESTING OF CEMENT

1. Consistency test of cement .
2. Initial setting & final setting of cement
3. Soundness of cement.
4. Compressive strength & Tensile strength of cement.
5. Fineness of cement.

# Pr3. PROJECT Phase - II

| Name of the Course: Diploma in Ceramic Engineering | | | |
|---|---|---|---|
| Course code: | | Semester | 6th |
| Total Period: | 105 | Examination | 3 hrs |
| Lab. periods: | 7 P / week | Sessional | 50 |
| Maximum marks: | 150 | End Sem Examination | 100 |

**RATIONALE**

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Ceramic engineering and practices in real life situations, so as to participate and manage a large Ceramic engineering projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

**OBJECTIVES**

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

**Project Phase-I and Phase-II**

The Project work duration covers 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5th semester under Project Phase-I. The students were allowed to study literature, any existing

system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-II in $6^{th}$ semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

| **Sl. No.** | **Performance Criteria** |
|---|---|
| 1. | Selection of project assignment |
| 2. | Planning and execution of considerations |
| 3. | Quality of performance |
| 4. | Providing solution of the problems or production of final product |
| 5. | Sense of responsibility |
| 6. | Self expression/ communication/ Presentation skills |
| 7. | Interpersonal skills/human relations |
| 8. | Report writing skills |
| 9 | Viva voce |

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

Organization of Project Report

1. Cover page:
   It should contain the following ( in order)
   (i) Title of the Project

(ii) "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"
(iii) By Name of the Student(s)
(iv) Logo of the Institution
(v) Branch Name/Depart Name and Institution Name with Address
(vi) Academic Year

2. 1st Inner page
   Certificate:
   It should contain he following
   "This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

   Seal and signature of the Supervisor/Guide with date
3. 2nd Inner Page
   Acknowledgement by the Student(s)
4. Contents.
5. Chapter wise arrangement of Reports
6. Last Chapter: Conclusion
   It should contain
   (i) Conclusion
   (ii) Limitations
   (iii) Scope for further Improvement
7. References

# Pr-4 LIFE SKILL

## (Common to All Branches)

| Practical | 2 Periods per week | Sessional | 25 Marks |
|---|---|---|---|
| Total Periods | 30 Periods | Total Marks | 25 Marks |

**Objective:** After completion of this course the student will be able to**:**

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

**DETAIL CONTENTS:**

### 1. SOCIAL SKILL

Society, Social Structure, Develop Sympathy and Empathy
Swot Analysis – Concept, How to make use of SWOT
Inter personal Relation**:** Sources of conflict, Resolution of conflict ,
Ways to enhance interpersonal relation

### 2. PROBLEM SOLVING

Steps of Problem solving**:**

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

### 3. PRESENTATION SKILL

Body language , Dress like the audience
Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,
Voice and language – Volume, Pitch, Inflection, Speed, Pause
Pronunciation, Articulation, Language, Practice of speech.
Use of AV aids such as Laptop with LCD projector, white board etc.

### 4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES

*Group Discussion:*
Introduction to group discussion, Ways to carry out group discussion,
Parameters— Contact, body language, analytical and logical thinking,

decision making
*Interview Technique :*
Dress, Posture, Gestures, facial expression, Approach
Tips for handling common questions.

**5. WORKING IN TEAM**

Understand and work within the dynamics of a groups.
Tips to work effectively in teams,
Establish good rapport, interest with others and work effectively with them to meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, Handling frustrations in group.

**6. TASK MANAGEMENT**

Introduction, Task identification, Task planning , organizing and execution, Closing the task

**PRACTICAL**

**List of Assignment:** *(Any Five to be performed including Mock Interview)*

**a. SWOT analysis:-**

Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.

a) Your past experiences,
b) Achievements,
c) Failures,
d) Feedback from others etc.

**b. Solve the True life problem assigned by the Teacher.**

**3. Working in a Team**

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.( One activity per group where Team work shall be exhibited)

**4. Mock Interview**

**5. Discuss a topic in a group and prepare minutes of discussion.**

**6. Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.**

**7. Task Management**

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

**Note**: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.

**Note**: -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

**METHODOLOGY:**

*The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.*

**Books Recommended:-**

| Sl.No | Name of Authors | Title of the Book | Name of the Publisher |
|---|---|---|---|
| 01 | E.H. Mc Grath , S.J | Basic Managerial Skills for All | PHI |
| 02 | Lowe and Phil | Creativity and problem solving | Kogan Page (I) P Ltd |
| 03 | Adair, J | Decision making & Problem Solving | Orient Longman |
| 04 | Bishop , Sue | Develop Your Assertiveness | Kogan Page India |
| 05 | Allen Pease | Body Language | Sudha Publications Pvt. Ltd. |

## MACHINE EQUIPMENTS FOR CERAMIC TESTING LABROTORY
### VI semester

| Sl. No | Name Of Equipment | Quantity |
|---|---|---|
| 01 | Vicat's Apparatus | 20 |
| 02 | Lee Chatelier Apparatus | 20 |
| 03 | Electronic Weighing Balance | 02 |
| 04 | Platinum Crucible | 02 |
| 05 | Porcelain Crucible | 50 |
| 06 | Burette with stand | 50 |
| 07 | Pipette | 50 |
| 08 | Conical flask | 50 |
| 09 | Beaker (500ml) | 50 |
| 10 | Measuring Jar(100cc) | 50 |
| 11 | Measuring Jar(500cc) | 20 |
| 12 | Measuring Jar(1liter) | 05 |
| 13 | Pestle &Motar | 20 |
| 14 | Buncen Burner | 50 |
| 15 | Gas Plant | 01 |
| 16 | Glass test tubes | 1000 |
| 17 | Tripod Stand | 50 |
| 18 | Distilled water plant | 01 |
| 19 | Electric Furnace Lab type $1600^0$c | 01 |
| 20 | Vibrating Table | 01 |
| 21 | Compressive testing machine | 01 |
| 22 | BIS Sieve (100,150,200,250,300,400 micron) | 01 each |