#### GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM COURSE TITLE: DRYING & FIRING (Code: 3345201)

Diploma Programme in which this course is offered	Semester in which offered
Ceramic Technology	4th semester

#### 1. RATIONALE

A ceramic engineer has to plan and supervise drying and firing process of Ceramic products. Drying and firing course contains theory of drying, classification of dryers, stages of firing, setting of ceramic ware in kiln and Effect of heat on ceramic wares. Hence the course has been design to develop skills required for drying and firing.

#### 2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop different types of skills so that students are able to acquire following competency

#### • Plan and supervise the drying and firing of ceramic wares for quality product.

#### **3.** COURSE OUTCOME

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Explain processes of drying and factors affecting them.
- ii. Describe procedure for rectifying different type of dryers.
- iii. Explain the effects of heating on ceramics
- iv. Describe the process of setting the kilns and setting the fire

#### 4. TEACHING AND EXAMINATION SCHEME

Tea	Teaching Scheme   Total Credits   Examination Scheme			cheme				
(	(In Hou	rs)	(L+T+P)	Theory Marks		Practical Marks		Total Marks
L	Т	Р	С	ESE	PA	ESE	PA	
3	0	0	3	70	30	0	0	100

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

# 5. COURSE DETAILS

Unit(Course Outcomes in cognitive domain )Unit - I1.a. Explain governing factors for drying.1.1 Introduction to drying and factors governing the drying.Ib. Explain various stages of drying1.1 Introduction to drying and factors governing the drying.1b. Explain various stages of drying1.1 Introduction to drying and factors governing the drying.1c. Describe Drying efficiency, Rate of Drying 1d. Explain different processes of drying.1.3 Drying systems and details of various stages of drying aration, heating ventilations and absorption.Unit - II Classification of Dryers2a. Define the dryers 2b. Classify different types of dryers.2.1 Introduction 2.2 Intermittent dryers, Semi continuous dryers istel in 2.3. 2d. List the defects during drying.2.1 Introduction 2.2 Intermittent dryers, Semi continuous dryers, infrared drying, high frequency drying, Humidity dryer, Horizontal dryer and Vertical dryerUnit - III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit - IV Stages of Firing Stages of Firing of ceramic Wares in Kilns4a. Describe various defects.4.1 Study of various stages of firing. 4.2 Study of twarous stages of firing.Stages of Firing in Kilns5a. Define Setting ochemical reactions during fring.5.1 Introduction of setting 5.2 Various methods of setting of wares.Unit - V Setting of in Kilns5a. Define Setting of wares.5.1 Introduction of setting 5.2 Various methods of setting of wares. </th <th></th> <th>Major Learning Outcomes</th> <th colspan="4">Topics and Sub-topics</th>		Major Learning Outcomes	Topics and Sub-topics			
domain )domain )Unit - IIa. Explain governing factors for drying.1.1 Introduction to drying and factors governing the drying.DryingIb. Explain various stages of drying efficiency, Rate of Drying shrinkage, Drying efficiency, Rate of Drying id. Explain different processes of drying.1.1 Introduction to drying and factors governing the drying.Unit - II2a. Describe Drying efficiency, Rate of Drying efficiency, Rate of Drying of dryers.1.3 Drying systems and details of various stages of drying.Unit - II2a. Define the dryers of dryers.2.1 Introduction2b. Classify different types of dryers.2.1 Introduction2c. List the defects during drying.2.3 Construction and functions of tunnel dryers, infrared drying, high frequency dryers, infrared drying, high frequency drying, Humidity dryer, Horizontal dryer and Vertical dryer2c. List the steps to Rectify the defects during processes, operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit - IV Wares4a. Describe various stages of firing.3.1 Effect of heat on physical properties of ceramic articles.Unit - IV Stagges of Firing Stagges of Firing of ceramic Wares4.1 Study of various stages of firing 4.2 Study of various stages of firing.Unit - V Setting of Ceramic Wares in Kilns5a. Define Setting objective various defects.5.1 Introduction of setting of vares.Setting of in Kilns5b. Distinguish setting with different5.1 Setting of cockery's wares. Setting of vares.Setting	Unit	(Course Outcomes in cognitive				
Unit – I Theory of DryingIa. Explain governing factors for drying.1.1 Introduction to drying and factors governing the drying.DryingIb. Explain various stages of drying1.2 Drying systems and details of various stages of drying.Intit – II Classification of Dryers2a. Define the dryers of dryers.1.4 Process of drying such as evaporation, aeration, heating ventilations and absorption.Unit – II Classification of Dryers2a. Define the dryers of dryers.2.1 Introduction2b. Classify different types of dryers.2.2. Describe the working of various types of dryers listed in 2.3.2.1 Introduction2c. Describe the working of various types of dryers listed in 2.3.2.3 Construction and functions of tunnel drying.2c. List the defects during during ing processes , operations, texture. of ceramic articles.3.1 Effect of heat on forearamic wares during processes , operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Vnit – IV Stages of Firing Setting of Ceramic Wares in Kilhs4a. Describe various stages of firing.4.1 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glazes direr firing.Unit – V Setting of in Kilhs5a. Define Setting b. Describe various methods of setting of wares.5.1 Introduction of setting 5.2 Various methods of setting of wares.Setting of in Kilhs5b. Discribe various methods of setting of wares.5.1 Introduction of setting 5.2 Various methods of setting of wares.		domain )				
Theory of Dryingfor drying.governing the drying.1b. Explain various stages of drying1b. Explain various stages of drying1c. Describe Drying efficiency, Rate of Drying 1d. Explain different processes of drying.1.3 Drying shrinkage, Drying efficiency and Rate of drying.Unit - II Classification of Dryers2a. Define the dryers 2b. Classify different types of dryers.2.1 Introduction 2b. Classify different types of dryers.2.1 Introduction absorption.Unit - III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit - IV Stages of Firing4a. Describe various defects.4.1 Study of various stages of firing. 44. Study of various stages of firing.Unit - IV Stages of Firing i Kilhs5a. Define Setting of setting of ceramic articles.5.1 Introduction of setting of eramic articles.Unit - V Setting of in Kilhs5a. Define Setting of wares.5.1 Introduction of setting of creamic articlesSetting of in Kilhs5b. Discribe various wares.5.1 Introduction of setting of creamic articlesSetting of in Kilhs5b. Discribe various methods of setting of wares.5.1 Introduction of setting of creamic articlesSetting of in Kilhs5b. Discribe various methods of setting of wares.5.4 Setters and saggers use in biscuit &	Unit – I	1a. Explain governing factors	1.1 Introduction to drying and factors			
Drying1b. Explain various stages of drying1.2 Drying systems and details of various stages of drying1c. Describe Drying efficiency, Rate of Drying id. Explain different processes of drying.1.3 Drying shrinkage, Drying efficiency and Rate of drying.Unit – II Classification of Dryers2a. Define the dryers 2b. Classify different types of dryers.2.1 Introduction 2.2 Intermittent dryers, Semi continuous dryers, state of drying, 2.2. List the defects during drying.2.1 Introduction 2.2. Intermittent dryers, semi continuous dryers, infrared drying, high frequency drying, high frequency drying, humidity dryer, Horizontal dryer and Vertical dryerUnit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV Stages of Firing4a. Describe various stages of Firing 4b. Explain thermo- chemical reactions during fring.3.1 Effect of heat on physical properties of ceramic articles.Unit –V Setting of Ceramic Wares in Kilhs5a. Define Setting 5b. Describe various methods of setting 5c. Distinguish setting with different5.1 Introduction of setting 5.2 Various methods of setting of vares.Setters of in Kilhs5.2 Distinguish setting with different5.4 Setters and sagesr used in biscuit & vares.	Theory of	for drying.	governing the drying.			
dryingstages of dryinglc. Describe Drying efficiency, Rate of Drying id. Explain different processes of drying.1.3 Drying shrinkage, Drying efficiency and Rate of drying.Unit – II2a. Define the dryers 2b. Classify different types of dryers.2.1 IntroductionDryers2b. Classify different types of dryers.2.1 Introduction2c. Describe the working of various types of drying.2.1 Introduction2d. List the defects during dryers listed in 2.3.2.3 Construction and functions of tunnel dryers, infrared drying, high frequency dryers listed in 2.4.2d. List the defects due to drying.2.4 Defects during processes, of ceramic wares during processes, of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – III3a. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV4a. Describe various defects.4.1 Study of various stages of firing 4b. Explain thermo- chemical reactions during firing.4b. Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glaze during firing.4c. List out various defects.5.1 Introduction of setting 5.3 Setting of coramic Wares5b. Describe various with different5.4 Setting of coramic wares.5c. Distinguish setting with different5.4 Setting of mares.	Drying	1b. Explain various stages of	1.2 Drying systems and details of various			
Ic. Describe Drying efficiency, Rate of Drying ld. Explain different processes of drying.1.3 Drying shrinkage, Drying efficiency and Rate of drying.Unit – II Classification of Dryers2a. Define the dryers of dryers.2.1 Introduction2.a Define the dryers of dryers.2.1 Introduction2.b Classify different types of dryers.2.1 Introduction2.c. Describe the working of various types of dryers listed in 2.3.2.3 Construction and functions of tunnel dryers, infrared drying, high frequency dryers, infrared drying, high frequency drying.2.c. List the defects during drying.2.4 Defects during drying and their rectification.2.6. List the steps to Rectify the defects on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.3.b Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on Physical properties of ceramic articles.3.b Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.3.b Explain effect of heat on physical properties of ceramic articles.4.1 Study of various stages of firing stages of firing.4.2< List out various defects.4.1 Study of various stages of firing.4.3 Define Setting of ceramic articles5.1 Introduction of setting of vares.5.4 Setting of ceramic Wares in Kilns5.4 Setting of vares.5.4 Setting of vares.5.4 Setters and saggers used in biscuit &		drying	stages of drying			
shrinkage, Drying efficiency, Rate of Drying Id. Explain different processes of drying.Rate of drying.Unit – II Classification of Dryers2a. Define the dryers 2b. Classify different types of dryers.2.1 Introduction2.2. Describe the working of various types of drying.2.1 Introduction2.3 Construction and functions of tunnel drying.2.3 Construction and functions of tunnel dryers.2.4 Defects during drying.2.3 Construction and functions of tunnel dryers, infrared drying, high frequency dryers isted in 2.3.2.4 Defects during drying.2.4 Defects during drying and their rectification.2.5 Describe various during processes , operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV Wares4a. Describe various defects.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV Stages of Firing4b. Explain thermo- chemical reactions during fring.4.1 Study of various stages of firing. 4.2 Study of thermo-chemical reactions in bodies and glaze during firing.Unit – V Setting of Ceramic Wares in Kilns5c. Distinguish setting wwith different5.1 Introduction of setting 5.2 Various methods of setting of setting with different5.4 Setters and saggers used in biscuit &		1c. Describe Drying	1.3 Drying shrinkage, Drying efficiency and			
efficiency, Rate of Drying Id. Explain different processes of drying.1.4 Process of drying such as evaporation, aeration, heating ventilations and absorption.Unit – II Classification of Dryers2a. Define the dryers 2b. Classify different types of dryers.2.1 Introduction2b. Classify different types of dryers.2.2. Describe the working of various types of dryers listed in 2.3.2.3 Construction and functions of tunnel dryers. Mangle dryers, rotary dryers, spray Dryers, infrared drying, high frequency drying.2c. List the steps to Rectify the defects during processes , o operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic wares during processes , o operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV Stages of Firing4a. Describe various during fring.4.1 Study of various stages of firing tages of firing.Unit – IV Stages of Firing5b. Describe various defects.4.1 Study of various stages of firing. tages of firing.Unit – IV Stages of Firing5b. Describe various defects.5.1 Introduction of setting tring.Unit –V Stetting of Ceramic Wares in Kilns5c. Distinguish setting with different5.1 Setters and saggers used in biscuit & Ceramic avares.		shrinkage, Drying	Rate of drying.			
Id. Explain different processes of drying.aeration, heating ventilations and absorption.Unit – II Classification of Dryers2a. Define the dryers of dryers.2.1 Introduction2.2 Describe the working of various types of dryers listed in 2.3.2.1 Introduction24. List the defects during drying.2.2. Intermittent dryers, rotary dryers, spray Dryers, infrared drying, high frequency drying Humidity dryer, Horizontal dryer and Vertical dryer26. List the defects due to drying.2.4. Defects during dryers.27. List the steps to Rectify the defects due to drying.3.1 Effect of heat on physical properties of ceramic wares during drying, firing and Effect of Heat on Ceramic30. Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.3b. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.31. Explain effect of heat on physical properties of ceramic articles.3.1 Study of various stages of firing.34. Explain effect of heat on physical properties of ceramic articles.4.1 Study of various stages of firing.34. Explain effect of heat on physical properties of ceramic articles.4.1 Study of various stages of firing.4b. Explain thermo- chemical reactions during firing.5.1 Introduction of setting 5.2 Various methods of setting of wares.52. Distinguish setting in Kilns5.2 Defene Setting of wares.5.1 Introduction of setting 5.4 Setters and saggers used in biscuit &		efficiency, Rate of Drying	1.4 Process of drying such as evaporation,			
Unit - II Classification of Dryers2a. Define the dryers of dryers.2a. Define the dryers of dryers.2a. Define the dryers of dryers.Dryers2b. Classify different types of various types of dryers listed in 2.3.2.1 Introduction dryers.2.2 Intermittent dryers, Semi continuous dryers.Dryers2c. Describe the working of various types of dryers listed in 2.3.2.3 Construction and functions of tunnel dryers. Mangle dryers, rotary dryers, spray Dryers, infrared drying, high frequency drying, Humidity dryer, Horizontal dryer and Vertical dryer2d. List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit - III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit - IV Stages of Firing Stages of Firing in Kilns4a. Describe various defects.4.1 Study of various stages of firing. 4.2 Study of thermo-chemical reactions in bodies and glaze during firing.Unit - IV Setting of chemical reactions in Kilns5.1 Introduction of setting with different5.1 Introduction of setting 5.2 Various methods of setting of wares.Setting of in Kilns5c. Distinguish setting with different5.4 Setters and saggers used in biscuit & during firent		1d. Explain different	aeration, heating ventilations and			
Unit - II Classification of Dryers2a. Define the dryers of dryers.2.1 Introduction2b. Classify different types of dryers.2b. Classify different types of dryers.2.1 Introduction2c. Describe the working of various types of dryers listed in 2.3.2.2 Intermittent dryers, Semi continuous dryers.2d. List the defects during drying.2.2. List the defects due to drying.2.3 Construction and functions of tunnel dryers. Mangle dryers, rotary dryers , spray Dryers, infrared drying, high frequency drying, Humidity dryer, Horizontal dryer and Vertical dryerUnit - III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit - IV Stages of Firing4a. Describe various during firing.3.1 Estudy of various stages of firing. 4b. Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing. 4.3 Defects occurs in bodies and glazes after firing.UnitV Setting of Ceramic Wares in Kilns5a. Define Setting St. Distinguish setting with different5.1 Introduction of setting 5.2 Various methods of setting of vares.5.1 Introduction of setting setting of setting of wares.		processes of drying.	absorption.			
Classification of Dryers2b.Classify different types of dryers.2.2Intermittent dryers.2.2Intermittent dryers.Semi continuous dryers.2c.Describe the working of various types of dryers listed in 2.3. 2d.2.2Intermittent dryers.2.3Construction and functions of tunnel dryers.2d.List the defects during drying.2.4Lost the defects during drying.2.4Defects during drying and their rectification.Unit – III Effect of Heat on Ceramic Wares3a.Explain effect of heat on physical properties of ceramic articles.3.1Effect of heat on physical properties of ceramic articles.3.1Effect of heat on physical properties of ceramic articles during drying, firing and Effect of heat on physical properties of ceramic articles.3.1Effect of heat on physical properties of ceramic articles during drying.Unit – IV Stages of Firing4a.Describe various stages of firing.4.1Study of various stages of firing 4.24.1Stages of Firing in Kilns5a.Define Setting of setting of wares.5.1Introduction of setting setting of wares.5.1Unit –V Setting of in Kilns5a.Define Setting of setting of wares.5.1Introduction of setting setting of wares.5.15.4Setters and saggers used in biscuit & during firenent5.4Setters and saggers used in biscuit &	Unit – II	2a. Define the dryers	2.1 Introduction			
Dryersof dryers.dryers.2c. Describe the working of various types of dryers listed in 2.3.2.3 Construction and functions of tunnel dryers, name drying, spray Dryers, infrared drying, high frequency drying ,Humidity dryer, Horizontal dryer and Vertical dryer2d. List the defects during drying.2e. List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic articles.31. Effect of heat on physical properties of ceramic articles.3b. Explain effect of heat on physical properties of ceramic articles.32. Effect of heat on physical properties of ceramic articles.3b. Explain effect of heat on physical properties of ceramic articles.31. Study of various stages of firing.4b. Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing.4c. List out various defects.5.1 Introduction of setting firing.5b. Describe various defects.5.1 Introduction of setting of wares.5c. Distinguish setting in Kilns5.2 Various methods of setting of wares.5.4 Setters and saggers used in biscuit & with different5.4 Setters and saggers used in biscuit & during setting of wares.	<b>Classification of</b>	2b. Classify different types	2.2 Intermittent dryers, Semi continuous			
2c.Describe the working of various types of dryers listed in 2.3. 2d.2.3 Construction and functions of tunnel dryers. Margle dryers, rotary dryers, spray Dryers, infrared drying, high frequency Dryers, infrared drying, high frequency drying. Humidity dryer, Horizontal dryer and Vertical dryerUnit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat of ceramic articles. 3b. Explain effect of heat on physical properties of ceramic articles. 3b. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles during drying. 3.2 Effect of heat on physical properties of ceramic articles. 3b. Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles during firing. 4.2 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glaze during firing. 4.3 Defects occurs in bodies and glazes after firing.Unit – V Setting of Ceramic Wares in Kilns5a. Define Setting vares.5.1 Introduction of setting of refractory wares. 5.2 Various methods of setting of wares.5.1 Introduction of setting of refractory wares. 5.4 Setters and saggers used in biscuit & construction and functions of tunnel dryers. Mangle dryers. Action the in the interval dryer	Drvers	of dryers.	dryers.			
of various types of dryers listed in 2.3.dryers. Mangle dryers, rotary dryers, spray Dryers, infrared drying, high frequency drying, Humidity dryer drying, Humidity dryer2d. List the defects during drying.2e. List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat of ceramic articles.3.1 Effect of heat on physical properties of ceramic wares during processes, operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV4a.Describe various defects.4.1 Study of various stages of firing.4b.Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing.4b.Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing.4b.Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing.4b.Explain thermo- chemical reactions during firing.5.1 Introduction of setting firing.5b.Describe various methods of setting of wares.5.1 Introduction of setting of wares.5c.Distinguish setting with different5.4 Setters and saggers used in biscuit &	5	2c. Describe the working	2.3 Construction and functions of tunnel			
dryers listed in 2.3.Dryers, infrared drying, high frequency drying, lumidity dryer, Horizontal dryer and Vertical dryer2d.List the defects during drying.2e.List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit – III3a.Explain effect of heat on physical properties of ceramic wares during processes , operations , texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Wares3b.Explain effect of heat on physical properties of ceramic articles.3.2 Effect of heat on physical properties of ceramic articles.Unit – IV4a.Describe various stages of firing.4.1 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glaze during firing.Stages of Firing5b.Define Setting wares.5.1 Introduction of setting 5.2 Various methods of setting of wares.Init –V Setting of in Kilns5c.Distinguish setting with different5.4 Setters and sageers used in biscuit &		of various types of	dryers. Mangle dryers, rotary dryers ,spray			
2d.List the defects during drying.drying ,Humidity dryer, Horizontal dryer and Vertical dryer2e.List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit – III Effect of Heat on Ceramic Wares3a.Explain effect of heat on physical properties of ceramic wares during processes , operations , texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.03b.Explain effect of heat on physical properties of ceramic articles.3.1 Effect of heat on Physical properties of ceramic articles.03b.Explain effect of heat on physical properties of ceramic articles.3.2 Effect of heat on physical properties of ceramic glazes during firing.1Mathemo- chemical reactions during firing.4.1 Study of various stages of firing bodies and glaze during firing.3tages of Firing Setting of Ceramic Wares in Kilns5a.Define Setting of wares.5c.Distinguish setting with different5.4 Setters and saggers used in biscuit &		dryers listed in 2.3.	Dryers, infrared drying, high frequency			
Image: drying.and Vertical dryer2e.List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat of ceramic wares during processes , operations, texture of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.3b. Explain effect of heat on physical properties of ceramic articles.3.2 Effect of heat on physical properties of ceramic articles.3b. Explain effect of heat on physical properties of ceramic articles.3.2 Effect of heat on physical properties of ceramic glazes during firing.Unit – IV Stages of Firing Setting of Ceramic Wares4a.Describe various defects.Unit –V Setting of in Kilns5a.Define Setting of bescribe various defects.5.1 Introduction of setting of wares.5c.Distinguish setting with different5.4 Setters and saggers used in biscuit &		2d. List the defects during	drying ,Humidity dryer, Horizontal dryer			
2e. List the steps to Rectify the defects due to drying.2.4 Defects during drying and their rectification.Unit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic wares operations, texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles.Unit – IV Stages of Firing4a. Describe various during firing.3.1 Study of various stages of firing stages of firing.Unit –V Setting of Ceramic Wares in Kilns5a. Define Setting of ceramic stages of setting of uring firing.5.1 Introduction of setting stages of setting of ceramic wares.Unit –V Setting of in Kilns5a. Define Setting of setting with different5.1 Introduction of setting stages of setting of uring setting of wares.Setting of in Kilns5c. Distinguish setting with different5.4 Setters and saggers used in biscuit & uring setting of wares.		drying.	and Vertical dryer			
Unit – III3a.Explain effect of heat on physical properties of ceramic wares during processes, operations, texture. of ceramic articles.3.1Effect of heat on physical properties of ceramic wares during drying, firing and Effect of heat on Texture and shape of ceramic articles.Wares3b.Explain effect of heat on physical properties operations, texture. of ceramic articles.3.1Effect of heat on physical properties of ceramic wares during drying.Unit – IV4a.Describe various stages of firing.4.1Study of various stages of firing bodies and glaze during firing.Unit – IV4a.Describe various defects.4.1Study of various stages of firing.Unit –V5a.Define Setting of ceramic wares.5.1Introduction of setting of vares.Unit –V5a.Define Setting wares.5.1Introduction of setting of refractory wares. Precautions required during setting of wares.5.1Introduction of setting of refractory wares. Precautions required during setting of wares.		2e. List the steps to	2.4 Defects during drying and their			
Unit - III3a.Explain effect of heat on physical properties of ceramic wares during processes , operations , texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles during drying, firing and Effect of heat on Texture and shape of ceramic articles during drying.Wares		Rectify the defects	rectification.			
Unit – III Effect of Heat on Ceramic Wares3a. Explain effect of heat on physical properties of ceramic wares during processes , operations , texture. of ceramic articles.3.1 Effect of heat on physical properties of ceramic articles during drying, firing and Effect of heat on Texture and shape of ceramic articles during drying.Unit – IV Stages of Firing4a.Describe various stages of firing. 4b.4.1Study of various stages of firing. during firing.Unit – IV Stages of Firing4a.Describe various defects.4.1Study of various stages of firing. during firing.Unit –V Setting of in Kilns5a.Define Setting wares.5.1Introduction of setting of wares.Unit –V Stafes in Kilns5a.Define Setting with different5.1Introduction of setting of wares.Setting of in Kilns5c.Distinguish setting with different5.4Setters and saggers used in biscuit &		due to drying.				
Effect of Heat on Ceramic Wareson physical properties of ceramic wares during processes , operations , texture. of ceramic articles.ceramic wares during drying, firing and Effect of heat on Texture and shape of ceramic articles during drying.Wares3b. Explain effect of heat on physical properties of ceramic articles.3c Effect of heat on physical properties of ceramic glazes during firing.Unit – IV4a.Describe various stages of firing.4.1Study of various stages of firing betwird firing.Stages of Firing4b.Explain thermo- chemical reactions during firing.4.1Study of thermo-chemical reactions in bodies and glaze during firing.Unit –V5a.Define Setting defects.5.1Introduction of setting setting of wares.Unit –V5a.Define Setting of wares.5.2Various methods of setting of refractory wares. Precautions required during setting of wares.fin Kilns5c.Distinguish setting with different5.4Setters and saggers used in biscuit &	Unit – III	3a. Explain effect of heat	3.1 Effect of heat on physical properties of			
on Ceramic Waresof ceramic wares during processes , operations , texture. of ceramic articles.Effect of heat on Texture and shape of ceramic articles during drying.3.2Effect of heat on physical properties of ceramic glazes during firing.3.2Effect of heat on physical properties of ceramic glazes during firing.Unit – IV4a.Describe various stages of firing.4.1Study of various stages of firing4b.Explain thermo- chemical reactions during firing.4.1Study of thermo-chemical reactions in bodies and glaze during firing.4c.List out various defects.5.1Introduction of setting5b.Describe various defects.5.1Introduction of setting of refractory wares.5c.Distinguish setting with different5.4Setters and saggers used in biscuit &	Effect of Heat	on physical properties	ceramic wares during drying, firing and			
Waresduring processes , operations , texture. of ceramic articles.ceramic articles during drying.3b.Explain effect of heat on physical properties of ceramic articles.3.2 Effect of heat on physical properties of ceramic glazes during firing.Unit – IV4a.Describe various stages of firing.4.1 Study of various stages of firing4b.Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing.4c.List out various defects.4.3 Defects occurs in bodies and glazes after firing.Unit –V5a.Define Setting of setting of ceramic Wares5.1 Introduction of setting setting of wares.5c.Distinguish setting with different5.4 Setters and saggers used in biscuit &	on Ceramic	of ceramic wares	Effect of heat on Texture and shape of			
Operations , texture. of ceramic articles.3.2 Effect of heat on physical properties of ceramic glazes during firing.3.5Explain effect of heat on physical properties of ceramic articles.3.2 Effect of heat on physical properties of ceramic glazes during firing.Unit – IV4a. Describe various stages of firing.4.1 Study of various stages of firing4b. Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing.4b. Explain thermo- chemical reactions during firing.4.1 Study of thermo-chemical reactions in bodies and glaze during firing.4c. List out various defects.5.1 Introduction of setting5b. Describe various methods of setting of wares.5.1 Introduction of setting of refractory wares. Precautions required during setting of wares.5c. Distinguish setting with different5.4 Setters and saggers used in biscuit &	Wares	during processes,	ceramic articles during drying.			
Image: ceramic articles.ceramic articles.ceramic glazes during firing.3b. Explain effect of heat on physical properties of ceramic articles.ceramic glazes during firing.Image: Unit - IV4a. Describe various stages of firing4b. Explain thermo- chemical reactions during firing.4b. Explain thermo- chemical reactions during firing.4b. Explain thermo- chemical reactions during firing.4.3 Defects occurs in bodies and glazes after firing.Image: Unit -V5a. Define Setting defects.5.1 Introduction of setting 5.2 Various methods of setting of wares.Image: Unit -V5a. Define Setting methods of setting of wares.5.1 Introduction of setting 5.2 Various methods of setting of wares.5c. Distinguish setting with different5.4 Setters and saggers used in biscuit & Setters and saggers used in biscuit &		operations, texture. of	<b>3.2</b> Effect of heat on physical properties of			
3b. Explain effect of heat on physical properties of ceramic articles.Unit – IV4a. Describe various stages of firing.4.1 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glaze during firing.Stages of Firing4b. Explain thermo- chemical reactions during firing.4.1 Study of various stages of firing 4.2 Study of thermo-chemical reactions in bodies and glaze during firing.Unit –V5a. Define Setting of Ceramic Wares in Kilns5.1 Introduction of setting of wares.5.1 Introduction of setting of refractory wares. Precautions required during setting of wares.		ceramic articles.	ceramic glazes during firing.			
Unit – IV4a.Describe various stages of firing.4.1Study of various stages of firingStages of Firing4b.Explain thermo- chemical reactions during firing.4.1Study of thermo-chemical reactions in bodies and glaze during firing.4c.List out various defects.4.3Defects occurs in bodies and glazes after firing.Unit –V5a.Define Setting of Setting of chemical setting of setting of corramic Wares in Kilns5.1Introduction of setting of setting of wares.5c.Distinguish setting with different5.4Setters and saggers used in biscuit & during setting of wares.		3b. Explain effect of heat				
Unit – IV4a.Describe various stages of firing.4.1Study of various stages of firingStages of Firing4b.Explain thermo- chemical reactions during firing.4.2Study of thermo-chemical reactions in bodies and glaze during firing.4c.List out various defects.4.3Defects occurs in bodies and glazes after firing.Unit –V Setting of Ceramic Wares in Kilns5a.Define Setting of setting of wares.5.1Introduction of setting 5.25c.Distinguish setting with different5.4Setters and saggers used in biscuit &		on physical properties				
Unit – IV4a.Describe various stages of firing.Stages of Firing4b.Explain thermo- chemical reactions during firing.4.1Study of various stages of firing4b.Explain thermo- chemical reactions during firing.4.2Study of thermo-chemical reactions in bodies and glaze during firing.4c.List out various defects.4.3Defects occurs in bodies and glazes after firing.Unit –V Setting of Ceramic Wares in Kilns5a.Define Setting of wares.5.1Introduction of setting 5.25c.Distinguish setting with different5.4Setters and saggers used in biscuit & Ceramic Setting of wares.		of ceramic articles.				
Stages of Firing4b.stages of firing. Explain thermo- chemical reactions during firing.4.2Study of thermo-chemical reactions in bodies and glaze during firing.4b.Explain thermo- chemical reactions during firing.4.3Defects occurs in bodies and glazes after firing.4c.List out various defects.4.3Defects occurs in bodies and glazes after firing.4c.List out various defects.51Introduction of setting 5.25b.Describe various methods of setting of wares.5.1Introduction of setting of setting of ceramic Wares5c.Distinguish setting with different5.4Setters and saggers used in biscuit & certain of the setting of the setting of wares.	Unit – IV	4a. Describe various	4.1 Study of various stages of firing			
Stages of Firing4b.Explain thermo- chemical reactions during firing.bodies and glaze during firing.4c.List out various defects.4.3Defects occurs in bodies and glazes after firing.Unit -V Setting of Ceramic Wares in Kilns5a.Define Setting bodies and glaze during firing.5b.Describe various methods of setting of wares.5.1Introduction of setting 5.25c.Distinguish setting with different5.4Setters and saggers used in biscuit & Ceramic Wares.		stages of firing.	4.2 Study of thermo-chemical reactions in			
Unit -V Setting of Ceramic Wares in Kilns5a.Define Setting Setting of Sb.5b.Define Setting Setting of methods of setting of wares.5.1Introduction of setting S.25.1Introduction of setting S.25b.Describe various methods of setting of wares.5.1Introduction of setting S.25.2Various methods of setting of refractory wares. Precautions required during setting of wares.5c.Distinguish setting with different5.4Setters and saggers used in biscuit &	Stages of Firing	4b. Explain thermo-	bodies and glaze during firing.			
during firing.firing.4c.List out various defects.firing.Unit -V5a.Define Setting 5b.5.1Setting of Ceramic Wares in Kilns5b.Describe various methods of setting of wares.5.15c.Distinguish setting with different5.4Setters and saggers used in biscuit &		chemical reactions	4.3 Defects occurs in bodies and glazes after			
4c. List out various defects.   Unit -V 5a. Define Setting 5b. 5.1 Introduction of setting 5.2   Various methods of setting of Ceramic Wares in Kilns 5a. Define Setting 5b. 5.1 Introduction of setting 5.2   Various methods of setting of wares. 5.3 Setting of crockery's wares. Setting of wares.   5c. Distinguish setting with different 5.4 Setters and saggers used in biscuit &		during firing.	firing.			
Unit -V5a.Define Setting5.1Introduction of settingSetting of Ceramic Wares in Kilns5b.Describe various methods of setting of wares.5.1Introduction of setting 5.2Various methods of setting of wares.5.3Setting of crockery's wares. Setting of refractory wares. Precautions required during setting of wares.Setting of wares.5c.Distinguish setting with different5.4Setters and saggers used in biscuit &		4c. List out various				
Unit -V5a.Define Setting5.1Introduction of settingSetting of Ceramic Wares in Kilns5b.Describe various methods of setting of wares.5.2Various methods of setting of refractory wares. Precautions required during setting of wares.5c.Distinguish setting with different5.4Setters and saggers used in biscuit &	<b>X</b> T •4 <b>X</b> 7	defects.				
Setting of Ceramic Wares in Kilns5b. Describe various methods of setting of wares.5.2 various methods of setting of vares.5c. Distinguish setting with different5.3 Setting of crockery's wares. Setting of refractory wares. Precautions required during setting of wares.5.4 Setters and saggers used in biscuit &	Unit –V	5a. Define Setting	5.1 Introduction of setting			
Ceramic Wares in KilnsInterforms of setting of wares.5.5Setting of refractory wares.5.5Setting of refractory wares.5c.Distinguish setting with different5.4Setters and saggers used in biscuit &	Setting of	5b. Describe various	5.2 Various methods of setting of wares.			
in Kilnswates.refractory wates.5c.Distinguish setting with differentduring setting of wares.5.4Setters and saggers used in biscuit &	Ceramic Wares	methods of setting of	5.5 Setting of crockery's wares. Setting of			
with different 5.4 Setters and saggers used in biscuit &	in Kilns	wares.	during setting of works			
with different 5.4 Setters and saggers used in discuit &		JC. Distinguish setting	5.4. Sotters and soggers used in bisquit &			
motomole lost timing of commonated wares		with different materials	5.4 Setters and saggers used in Discuit &			
5d Describe setters and 55 Loading and unloading of wares.		5d Describe setters and	5.5 Loading and unloading of wares.			
Su. Describe setters and S.S. Loading and unroading of wates.		Su. Describe setters and	5.5 Loading and unloading of wates.			
saggers for various		saggers for various				
types of filling.		5. Explain loading and				
unloading		unloading				

# 6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title		Distribution of Theory Marks			
		Teaching	R	U	Α	Total
		Hours	Level	Level	Level	Marks
Ι	Theory of drying	9	4	6	6	16
II	Classification of dryers	8	4	5	5	14
III	Effect of heat on	8	3	5	4	12
	ceramic wares					
IV	Stages of firing	8	3	5	4	12
V	Setting of ceramic wares	9	4	6	6	16
	in kilns					
Tota	Hrs	42	18 27 25		70	

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

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

# 7. SUGGESTED LIST OF EXERCISES/PRACTICAL

Not Applicable

# 8. SUGGESTED LIST OF STUDENT ACTIVITIES

i.Library survey to collect and study of dryers and furnaces. ii.Industrial visit to observe firing operation in kiln and furnaces. iii.Study the different methods for temperature control.

# 9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Show Video film/animations/photographs of different types of kilns and firing process.

# 10. SUGGESTED LEARNING RESOURCES

## A. List of Books:

S.	Title of Books	Author	Publication
No.			
1	Fuels furnaces and refractory	O.P.Gupta	Khanna publisher
2	Industrial Ceramic	Singer & Singer	New York : Chapman and
2	De francés de la companya de la comp	TH New Arm	
3	Refractories	F.H.Norton	McGraw-Hill
4.	A Hand Book of Modern Pottery Manufacture	H.N.Bose	Ceramic Publishing House,Bhagalpur

## **B.** List of Major Equipment/Materials

- i. Mini Clay Oven
- ii. Mini Furnace
- iii. Tensiono meter
- iv. Hardness Tester
- v. Hot air Blowers

## C. List of Software/Learning Websites

- i. http://www.ceramicindustry.com/articles/drying-principles-of-drying
- ii. https://www.google.co.in/#q=kiln+furniture+and+accessories
- iii. https://www.google.co.in/#q=firing+stages+of++kiln
- iv. Xx http://www.prosec.es/descargas/DRYING-AND-FIRING-PROCESSE.pdf

# 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

## **Faculty Members from Polytechnics**

- Prof. B. B. Patel Lecturer L.E.College, Morbi
- Prof. H. B. Dedania, Retired Lecturer L.E.College, Morbi
- Prof. S.Prasaad, Retired Lecturer L.E.College, Morbi

## **Coordinator and Faculty Members from NITTTR Bhopal**

- Dr. Abhilash Thakur, Associate Professor, Department of Applied Sciences
- Dr. Bashirullah Shaikh, Assistant Professor, Department of Applied Sciences