

TAMIL NADU PUBLIC SERVICE COMMISSION

SYLLABUS FOR CERAMIC TECHNOLOGY

SUBJECT: GLASS AND ENAMEL

DIPLOMA STANDARD

Code No.190

1. INTRODUCTION TO ENAMELING:

Definition – History – Classification of enamel – vitreous enamel – Porcelain enamel Applications.

2. RAW MATERIALS CLASSIFICATION:

FLUXES:

Feldspar – Soda Feldspar – Pottash Feldspar, Calcium and Magnesium compounds , Borax, Boric acid , calcium phosphate, Lithium, White Lead, Red Lead Properties and function in enamel.

REFRACTORY MATERIALS:

Alumina, Silica etc – properties and function in enamel.

COLOURING MATERIALS:

Cobalt oxide, Chromium oxides, Nickel oxides, Copper oxides, Vanadium penta oxides, Iron oxides – Properties and function.

OPACIFIER :

Titanium di oxide, Antimony tri oxide, zirconium silicates, Tin oxides - Properties and function.

OTHERS:

Additives and Binders, Deflocculant, flocculent - Properties and function.

2. METAL PREPARATION AND CLASSIFICATION OF ENAMEL FOR METALS:

Formation of rust, Blasting ,Theory of chemical cleaning – Pickling equipments – pickling of Hcl and H₂ So₄, Special treatments – Neutralizing, Nickel dipping and their reaction.

Sheet iron enamel, Cast iron enamel, Steel enamel.

3. ENAMEL COMPOSITION AND CALCULATION:

Calculation of percentage composition from empirical formula, equivalent weight and formula batch weight, definition related to calculations.

4. PREPARATION METHOD OF ENAMEL – TYPES OF COATING:

Dry process, Wet process.

Ground coat enamel, White cover coat enamel, Coloured enamel, Jewellery and Aluminium enamels etc.

5. APPLICATION METHODS, FURNACE FOR ENAMELING AND ENAMELING DEFECTS & REMEDIES:

Dipping, Painting, Brushing, Spraying and decoration.

Enamel furnace, Crucible, Smelter- rotary and continuous – Frit furnace – Muffle furnace – firing and control etc.

Crazing, Crawling, Pinholes, Blistering, Chipping, Copper heading, Eggshells, Fish scale, hair lining, Warping, Tearing, Specking, Reboiling rusting

6. INTRODUCTION TO GLASS:

Definition – History – Application, Zachariasen's rules of glass formation.

7. RAW MATERIALS:

Glass former- Intermediate and modifiers, other ingredients- oxidising and reducing agents , refining agent, recoloration, colouring oxides – description – function and their effect on glass.

8. MELTING PROCESS

Process leading to glass formation – Volatilization – Effect of pre sintering- refining- source of gas bubbles- Physico – chemical reactions taking in glass batch- viscosity of glass, annealing, Strain in glass –softening point of glass – Strain point – annealing curve. Durability of glass – Homogenization and devitrification –Tempering Annealing -Condition of glass- melting – pot furnace – Tank furnace – Lehr etc – description and its function.

9. FORMING PROCESS

Hand operation – Laboratory ware and Bulb making, Tube making – Danner process Up draw process, down draw process, pressing – Hand press, Flat glass- Pitts berg process, Foucault process, Float process – Merit and demerits.

10. SPECIAL GLASS

Heat resisting glass- fibre glass, glass wool, Optical glass- Glass for electrical and electronic industries – Borosilicate glasses – Silica glass,

PROPERTIES:

Mechanical – Chemical – Thermal – Electrical and Optical.

DEFECT AND REMEDIES:

Defect during melting – defect during processing – its control and remedies.

1. Hand book of glass manufacture by tooley F.V. Vol I & II. Ogden Publishing Company, New York.
2. Glass ceramics by Nomillian P.W.Academic press
3. Porcelain enamels by Andrew A.P the general publishers, champion Illinois-U.S.A
4. Glass, Hutchinsons, scientific and Technical publications, London.
