Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CT)/SEM-5/CT-506/2009-10

2009

CERAMIC COATING

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives of the following : $8 \times 1\frac{1}{4} = 10$

   i) The thermal expansion co-efficient (CTE) should be so adjusted that during cooling there is expansion on enamel layer and tension in the metal layer. This condition can be achieved when

      a) CTE of enamel is slightly lower than that of the metal

      b) CTE of enamel is slightly higher than that of the metal

      c) CTE of enamel and metal is equal

      d) None of these.

   ii) Acid resistance property of the enamel glass can be increased by

      a) increasing the silica content

      b) increasing the CaO content

      c) increasing ZnO and MgO content

      d) none of these.

iii) Alkali resistance property of enamel can be enhanced by

a) adding ZrO_2 (15% - 18%)

b) eliminating Al_2O_3

c) replacing part of Na_2O by Li_2O

d) none of these.

iv) The enamel slip prepared for steel is not suitable for aluminium metal as

a) they have different CTE values

b) they have quite different melting point

c) they show different oxidation resistance

d) metal pretreatment process is different.

v) The main cause of fish scaling defect of enamel is due to

a) the presence of molecular H_2

b) the presence of oxidising atmosphere

c) the mismatch of CTE between metal and the enamel glass

d) presence of inhibitor in the pickling tank.

vi) Ni-deposition in the pretreatment shop is essential for

a) zero carbon steel b) aluminium metal

c) high carbon steel d) low carbon steel.

vii) Direct-on enamelling is preferred to increase

a) thermal shock resistance property

b) corrosion resistance property

c) opacification

d) aesthetic beauty of the enamel.

viii) Basic differences between enamel glass & ordinary glass are

a) high amount of alkali in enamel glass
b) high amount of alumina in enamel glass
c) high fusion temperature of the enamel glass
d) number of constituent oxides are greater than '7' in enamel glass.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Mention the objectives of the pretreatment of metal sheet before enamelling. Why thermal degreasing is preferred to chemical degreasing ? Thermal degreasing in reducing atmosphere is advantageous. — Why ? 2 + 2 + 1
3. What is glass ceramic coating ? How glass ceramic coating is prepared ? 2 + 3
4. How CVD process differ from PVD ?
5. State the important factors to be considered before enamelling a metal. How does enamel differ from glaze ? $2\frac{1}{2} + 2\frac{1}{2}$
6. State the causes and remedies of the following enamel defects : $2 \times 2\frac{1}{2}$

   a) Cu-heading b) fish-scaling.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. What are the important vapour deposition techniques used for ceramic coating ? Mention the important advantages of this process over conventional coating process. Briefly describe the conventional CVD process with sketch. Write the important deposition reactions with examples in CVD process. What are the advantages and disadvantages of CVD process ? Mention the important applications of this process. 1 + 3 + 3 + 3 + 3 + 2

8. Why fritting is essential for enamel slip preparation ? What is ageing of step ? How is it done ? State the main raw materials used for enamel slip. What are the functions of clay and electrolyte in enamel slip ? What properties are to be measured for enamel slip ? $2\frac{1}{2} + 1 + 1\frac{1}{2} + 4 + 1\frac{1}{2} \times 2 + 3$

9. What are the objectives of acid pickling ? Briefly mention the advantages and disadvantages of HCl and H_2SO_4 as pickling acid. Why inhibitors are used ? Briefly describe the mechanism of inhibitors in pickling. Where Ni-deposition is essential and why ? $3 + 4 + 1 + 3\frac{1}{2} + 3\frac{1}{2}$

10. Mention the essential condition for good bonding of enamel with metal surface. Describe the bonding mechanism between Cu-metal and enamel. Briefly state two hypotheses of bonding mechanism of ground coat and steel surface. Briefly narrate the reaction occur during firing of coating on steel surface $3 + 3 + 3 \times 2 + 3$

11. Write short notes on any *three* of the following : 3×5

    a) Classification of common metals used for enamelling

    b) Application of vitreous coated appliances

    c) Sand blasting

    d) Ni-deposition techniques

    e) Physical vapour deposition (PVD).