Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CHE)/SEM-5/CHE-503/2011-12

2011

CHEMICAL PROCESS TECHNOLOGY - I

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 for any *ten* of the following : $10 \times 1 = 10$

i) In modified Solvay process (Dual process) for soda ash production, NH_3 is recovered as

a) Pure NH_3

b) Co-product $NH_4 HCO_3$

c) Co-product $NH_4 Cl$

d) None of these.

ii) Primary concentration of NaOH obtained from Mercury cell is

a) 10 – 14% b) 45 – 50%

c) 30 – 35% d) none of these.

iii) Contaminated arsenic is removed from molten sulphur by the treatment of

a) Caustic soda b) Caustic potash

c) Milk of lime d) none of these.

iv) In DCDA process of $H_2\ SO_4$ manufacturing unit, maximum conversion to SO_3 from SO_2 can be achieved up to

a) 50·5% b) 70·7%

c) 85·5% d) 99·7%.

v) What material is mixed with finally produced red phosphorus to stabilize it ?

a) CaO b) MgO

c) $Al_2\ O_3$ d) SiO_2 .

vi) How much residence time is required to ensure 98% conversion in the reactor for manufacturing of phosphoric acid from rock phosphate and $H_2 SO_4$ as raw materials ?

a) 1 – 3 hrs. b) 4 – 6 hrs.

c) 7 – 10 hrs. d) None of these.

vii) Glazing is an important operation for

a) glass products b) ceramic bricks

c) whitewares d) plastic products.

viii) Rate of hardening of cement can be improved by varying the proportions of

a) $C_4 AF : C_3 A$ b) $C_3 S : C_2 S$

c) $C_4 AF : C_2 S$ d) $C_3 A : C_3 S$.

ix) Percentage of $P_2 O_5$ present in triple superphosphate is

a) 16 – 20% b) 21 – 32%

c) 33 – 41% d) 42 – 50%.

x) Which phosphate-salt of calcium is water soluble ?

a) $Ca_3\ PO_4$ b) $Ca_2\ H_2\ PO_4$

c) $CaH_4\ PO_4$ d) $CaHPO_4$.

xi) Ground-wood pulp is used for the production of

a) newsprint b) book paper

c) bond paper d) wrapping paper.

xii) Which component is used in paints to prevent cracking of paint-skin ?

a) Binder b) Thinner

c) Drier d) Plasticizer.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. In the light of the reaction

$SO_2\ (g)\ + \frac{1}{2}\ O_2\ (g)\ = SO_3\ (g)$; $\Delta H = -23$ kcal at 25°C.,

Explain the statement :

"In two-stage catalytic converter, it is advisable to run the reaction at higher temperature in the first stage and at lower temperature in the second stage."

3. What are the different raw materials used in pulp and paper industry ?

4. a) What are the advantages and disadvantages of dual process over Solvay process for manufacture of soda ash ?

   b) Why higher temperature (40°C – 50°C) is maintained at middle than at bottom and top (20°C – 25°C) of carbonating tower ? 3 + 2

5. Describe the physico-chemical principle involved in the production of ammonia by Haber process.

6. What are the engineering problems associated in membrane and mercury cells for production of chlorine and caustic soda by electrolytic process ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Describe with neat flow diagram the production technology of urea by Montecatini total recycle process. How can you limit formation of Biuret in such process ? 13 + 2

8. a) Discuss the role of heat exchangers and acid coolers in the sulphuric acid manufacturing plant.

   b) With the help of a flow sheet diagram, describe the method of manufacture of sulphuric acid by contact process. 5 + 10

9. a) Describe with a neat flow sheet diagram the manufacture of phosphoric acid by wet process using strong sulphuric acid.

   b) "Why are oxides of nitrogen, hydrogen, sulphur and carbon kept strictly below 5 ppm in the intlet gas to ammonia reactor." Explain. 10 + 5

10. Describe the manufacturing process of soda ash by Solvay process with a neat process flow diagram and mark the modification done in the modified Solvay process.

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

a) Recovery of chemicals in Kraft process

b) Manufacturing process of uranium, a nuclear fuel

c) Annealing process of glass materials

d) Prilling process for the manufacture of ammonium nitrate

e) Role of particle size of pigments and suspension stability of paints.