Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/CHE(N)/SEM-5/CHE-503/2012-13

2012

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 × 1 = 10

   i) Raw materials for Solvay process for manufacture of soda ash

      a) Salt, limestone, coke/natural gas

      b) Ammonia, salt, limestone

      c) Ammonia, limetone, coke/natural gas

      d) None of these.

ii) Sour natural gas contains

a) Free Sulphur b) SO_2

c) H_2S d) SO_3.

iii) In DCDA process of H_2SO_4 manufacturing process, how many numbers of catalyst bed used ?

a) 2 nos b) 4 nos

c) 8 nos d) 10 nos.

iv) Contaminated Fluoride in Rock phosphate is recovered in superphosphate manufacturing unit

a) Hydrogen Fluoride b) Calcium Fluoride

c) Fluoro silicic acid d) None of these.

v) 'Crazing' is considered as a type of defect may occur in the operation of ..... in white ware manufacturing

a) Mixing b) Hot pressing

c) Verification d) Glazing.

vi) Which of the following catalyst is preferably used in the manufacture of nitric acid

a) V_2O_5 b) Fe_2O_3

c) Pd d) Pt-10% Rh Gauge.

vii) Basic raw materials for production of urea are

a) N, H_2 and COCl b) NH_3 and CO

c) NH_3 and CO_2 d) None of these.

viii) Linde process of manufacture of oxygen and nitrogen from air uses

a) joule-Thompson cooling

b) adiabatic expansion

c) carnot cycle

d) none of these.

ix) Ammonium sulphate manufacture uses

a) ammonia and gypsum

b) ammonium chloride and sulfuric acid

c) ammonia, carbon di oxide and gypsum

d) ammonium nitrate and sulfuric acid.

x) The phosphorous content of triple superphosphate is expressed as a percentage of

a) P_2O_5 b) P

c) P_2O_3 d) H_3PO_4.

xi) During absorption of HCl gas in water, the gas is kept above dew point to

a) Increase the rate of absorption

b) Avoid corrosion

c) Reduce the strength of acid

d) Reduce the cooling water circulation rate.

xiI) ..... Portland cement attains the maximum strength in 28 days

a) Type-I b) Type-II

c) Type-III d) Type-V.

GROUP – B

(Short Answer Type Questions)

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

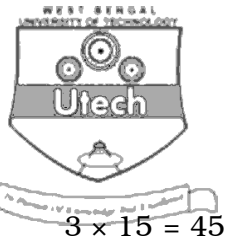
2. Briefly discuss about the role of 'over-voltage' in the electrolysis of brine solution. Make a comparative study of mercury cell and membrane cell process for NaOH and Cl_2 production with an eye of product purity and cost of production.

3. From physicochemical principles for the oxidation of SO_2 to SO_3, justify the optimum operational conditions of DCDA converter.

4. Using NaCl as raw material, briefly describe the Technology of hydrochloric acid production mentioning the speciality of roasting furnace and absorption of HCl gas.

5. Describe with a neat flow sheet diagram the manufacture of phosphoric acid by wet process using phosphate rock.

6. How is $(NH_4)_2SO_4$ manufactured in India like countries where H_2SO_4 is not the cheapest material ? Why is mixed fertilizer considered as complete fertilizer for plants ? 2 + 3



GROUP – C

(Long Answer Type Questions)

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

7. a) With a neat flow diagram describe Haber's process for ammonia synthesis.

   b) Mention special features of ammonia converter with schematic diagram.

   c) Discuss the major engineering problem associated with the manufacture of urea from carbon dioxide and ammonia focusing on autoclave variables and production of granular urea. 6 + 5 + 4

8. a) Why is 'Triple super-phosphate', an important fertilizer, so called ?

   b) What are the different phosphorous fertilizers used in the agricultural production ?

   c) Describe the 'Wet Process' for manufacturing of fertilizer grade phosphoric acid (H_3PO_4) from phosphate rock with the help of a process flow diagram. 4 + 3 + 8

9. a) Describe the DCDA process in brief the salient features of manufacturing H_2SO_4 with the help of a neat flow diagram with special reference to thermodynamics and kinetics of the conversion.

   b) Discuss the role of different ingredients used in the 'catalyst formulation' for the manufacture of H_2SO4 for efficient conversion of SO_2 to SO_3.

10. a) Describe the function along with the pictorial representation of

    (i) the kiln

    (ii) four compartment tube mull in Portland cement manufacturing process.

    b) "Unannealed glass will crack or break on heating or even on keeping for sometime." Justify the above statement.

    c) Mention the various compounds that contribute to he heat of hardening of cement explaining the amount of heat liberated by them with duration of time. Also specify how can you reduce the heat of hydration in the type of Portland cement which contains more amount of C_3A. 6 + 3 + 6

11. a) What is refractoriness of a material ? Classify different types of refractory materials used in the industry and other areas. Define the terms RUL, PCE (segar cone) and porosity with reference to refractory materials.

    b) Write down the general methods of production of refractories

    c) Differentiate between acid, basic and neutral refractories with examples. 6 + 5 + 4