CHEMICAL PROCESS TECHNOLOGY
(CHEN 3101)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Which chemicals are added as corrosion inhibitors in Solvay method?
(a) Chloride and iodine (b) Cyanides and sulfides
(c) Cyanides and Iron (d) Sulfides and chloride.

(ii) The currying time of continuous - den process during superphosphate production is
(a) 24 hrs (b) 15 – 20 days (c) 5 days (d) 2 – 6 weeks

(iii) NaOH collected from membrane cell process contains
(a) Waste acid 42% by weight (b) Ca 33% by weight
(c) H_2 20% by weight (d) Amalgam 10% by weight.

(iv) Match the following petrochemical production with their catalyst

P	Vinyl Chloride	I	Bismuth phosphomolybdate
Q	Acrylonitrile	II	Pumic/charcoal
R	Ethylene dichloride	III	Ferric chloride

(a) P-I, Q-II, R-III (b) P-III, Q-I, R-II
(c) P-II, Q-III, R-II (d) P-II, Q-I, R-III

(v) Hydrocarbons are converted into $CO+H_2$ in
(a) Primary reformer (b) Secondary reformer
(c) Shift reactor (d) Combustion unit.

(vi) Which antioxidant is used to stabilize the vinyl chloride?
(a) Isopropyl ether (b) Sulphuric acid
(c) Phosphite (d) Vanadium pentoxide.

(vii) Petroleum coke is produced in
(a) Delayed coking unit (b) Visbreaking unit
(c) Bitumen blowing unit (d) Vacuum distillation unit.

(viii) Internal stresses of glass is removed through
(a) Soft method (b) Extrusion method
(c) Injection molding method (d) Annealing process.

(ix) Ion exchange is used in soap production unit to remove
(a) Salt and colour (b) Colour and odour
(c) Salt and impruities (d) Glycerine.

(x) Yellow glycerine is obtained from
(a) Ion exchanger (b) Hydrolyser
(c) Blender (d) Vacuum still.

Fill in the blanks with the correct word

(xi) High refractory's fusion temperature range is _____.

(xii) Paving grade bitumen is obtained from _____unit.

(xiii) The evaporator is lined with _____ to avoid the iron contamination in diaphragm cell process.

(xiv) The hardness of boiler feed water is less than _____.

(xv) Flue gas is used in _____unit during vinyl chloride production.

Group - B

2. (a) Explain the catalytic conversion steps of SO_2 into SO_3 with a help of a diagram. *[(CO1)(Understand/IOCQ)]*
(b) Write the reactions involved in nitric acid production. *[(CO1)(Remember/LOCQ)]*
(c) What is the modification of dual solvay process? *[(CO1)(Apply/LOCQ)]*
(d) Write the reactions involved in caustic soda production. *[(CO1)(Remember/LOCQ)]*
6 + 2 + 2 + 2 = 12

3. (a) Compare the configuration and operation of diaphragm cell and membrane cell process with the help of a diagram. *[(CO1,CO2)(Analyse/HOCQ)]*
(b) What are the design modifications of nitric acid production unit? *[(CO1)(Understand/IOCQ)]*
(c) Discuss the advantages and disadvantage of diaphragm cell process of chlorine production. *[(CO1)(Analyse/HOCQ)]*
5 + 2 + 5 = 12

Group - C

4. Write short notes on any three of the followings:
(i) Diesel hydrodesulphurisation (DHDS)
(ii) Vacuum distillation unit
(iii) Process parameters and reactions of steam reforming of naptha.
(iv) Chemical reactions of single superphosphate production.
[(CO2,CO4,CO3)(Understand/IOCQ)]
(3 × 4) = 12

5. (a) Briefly discuss the manufacturing process of ammonia fertiliser production with the help of a neat flow sheet. *[(CO2,CO4)(Analyse/HOCQ)]*
   (b) Write the reactions involved in urea production. *[(CO1)(Remember/LOCQ)]*
   (c) What are the operating temperatures range of atmospheric distillation unit and vacuum distillation unit for naptha treatment? *[(CO3)(Remember/LOCQ)]*

7 + 3 + 2 = 12

Group - D

6. (a) Discuss the manufacturing process of glycerine production from propylene through acrolein route with the help of a neat flow sheet. *[(CO3,CO4,CO2)(Analyse/HOCQ)]*
   (b) Discuss the major engineering problems associated with ethylene oxide production. *[(CO5)(Understand/IOCQ)]*
   (c) Why vacuum pressures are applied in di-ethanol and tri-ethanol amine distillation column? *[(CO5)(Understand/IOCQ)]*

8 + 2 + 2 = 12

7. (a) Write the reactions involved in isopropanol production from propylene. *[(CO4)(Remember/LOCQ)]*
   (b) Discuss the major engineering problems associated with vinyl chloride production. *[(CO4,CO5)(Analyse/HOCQ)]*
   (c) Draw the flow sheet of vinyl chloride production from ethylene dichloride. *[(CO2)(Apply/IOCQ)]*

3 + 3 + 6 = 12

Group - E

8. (a) Define refractoriness. *[(CO5)(Remember/LOCQ)]*
   (b) What is cement hardening? *[(CO5)(Apply/IOCQ)]*
   (c) Briefly discuss the hydrogenation of oil with the help of a neat flow sheet. *[(CO2)(Understand/IOCQ)]*
   (d) What is PLC? *[(CO5)(Remember/LOCQ)]*

2 + 2 + 7 + 1 = 12

9. Answer any three of the following questions:
   (i) Discuss the major engineering problems associated with hydrogenation of oil.
   (ii) Draw the block diagram of drinking water treatment process.
   (iii) Discuss the mechanism and advantages of enzymatic interesterification.
   (iv) Classify the refractories with example. *[(CO4,CO5)(Apply/IOCQ)]*

(3 × 4) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	17.71	53.13	29.16

Course Outcome (CO):

After the completion of the course students will be able to

1. Describe sources and processes of manufacture of various industrially important chemicals.
2. Draw block diagrams/ process flow diagrams of the processes used for manufacture of industrially important chemicals.
3. Explain and calculate economic aspects of Projects involved in manufacturing of chemicals.
4. Understand the applications of various unit operations involved in the manufacture of various chemicals and other useful materials.
5. Understand the implications of heat & mass transfer and fluid mechanics in chemical engineering industries

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*