**Questions**

**Lecture 1**

**Short questions**
1. Enlist the classification of materials used in chemical industries on the basis of
   a) Quantity of production and consumption
   b) Chemical composition
   c) Availability
   d) Application
2. What is material of construction?
3. Define:
   a) Heavy chemical
   b) Fine chemical

**Long questions**
1. Discuss the classification of various material used or produced in the chemical industries.

**Lecture 2**

**Short questions**
1. Enlist the properties enhanced by following metals used in material of construction
   a) Chromium
   b) Vanadium
   c) Manganese
   d) Silicon
   e) Phosphorous
   f) Copper
2. Enlist the general categories of bronze.
3. What is the major purpose of desulfurizing the steel?
4. Which metal is used to prevent graphitization?
5. Enlist outstanding characteristic of magnesium.

**Long questions**
1. Discuss the classification of various material used or produced in the chemical industries in detail.
2. Discuss in detail about the general categories of bronzes.
3. Write a note on aluminium and its alloy.
4. Write a brief note on lead and its alloy.
5. Write a note on steel.
6. Write a note on magnesium and its alloy.
Lecture 3 & 4

Short questions
1. What is material safety data sheet?
2. Enlist the various sections of MSDS.
3. What is personnel protective equipment?
4. Enlist the classification of personnel protective equipment.
5. Why skin hazard takes place in working environment?
6. What is fire triangle?
7. What is pyramid of fire?
8. Enlist the factors which affects the methods of fire extinguishing.
9. Enlist the factors for spread of fire.
10. Explain the following terms.
   a) Auto ignition temperature
   b) Spontaneous ignition
   c) Flash point
   d) Fire point
   e) Fuel
   f) Flammability limits
   g) Flame proof enclosure
11. Enlist the various types of material which include for
   a) Class A type fire
   b) Class B type fire
   c) Class C type fire
   d) Class D type fire
   e) Class E type fire
   f) Class K type fire
12. Enlist the common causes which lead to the fire hazards
13. What is waste disposal?
14. Enlist the methods of waste disposal.

Long questions
1. Write a brief note on MSDS.
2. Write a brief note on personnel protective equipment.
3. Explain about respirator.
4. Write a brief note on fire fighting hazards.
5. Discuss in brief about the classification of fire and various fire extinguishers.
6. Explain the factors contributing to the fire hazards.
7. Discuss the various methods of waste disposal.

Lecture 5 & 6

Short questions
1. Enlist the various methods used for manufacturing of acetic acid.
2. What is used as activator in carbonylation of methanol?
3. Which type of reactor is used in carbonylation of methanol?
4. Which catalyst is used in vapour phase oxidation of ethylene?
5. Why ethylene concentration was kept below 3% in ethylene oxidation process?
6. Enlist the properties of acetic acid.
7. Enlist the uses of acetic acid.
8. Draw the labelled diagram of reactor used in acetaldehyde oxidation process.

Long questions
1. With the help of flow diagram discuss the manufacturing of acetic acid by following methods
   a) Methanol carbonylation process
   b) Acetaldehyde oxidation process
   c) Ethylene oxidation process
   d) Oxidative fermentation process
   e) Anaerobic fermentation

Lecture 7

Short questions
1. Enlist the various method used for manufacturing of formic acid.
2. Enlist the raw material for manufacturing of formic acid from sodium formate.
3. Enlist the properties of formic acid.
4. Enlist the uses of formic acid.

Long questions
1. With the help of flow diagram discuss the manufacturing of formic acid from sodium formate.

Lecture 8

Short questions
1. Enlist the steps involved in manufacturing of benzoic acid form phthalic anhydride.
2. Which catalyst is used in manufacture of benzoic acid from phthalic anhydride?
3. Why caustic soda is added during synthesis of phthalic anhydride?
4. Which catalyst is used in the manufacture of benzoic acid form toluene?
5. Write the advantages of toluene air oxidation process.
6. Enlist the properties of benzoic acid.
7. Enlist the uses of benzoic acid.

Long questions
1. With the help of flow diagram discuss the manufacturing of benzoic acid by following methods
   a) From phthalic anhydride
   b) From toluene by air oxidation
Lecture 9

Short questions
1. Which catalyst is used in the manufacture of phthalic anhydride from naphthalene?
2. Which salt is used to remove heat of oxidation reaction?
3. Discuss the effect of temperature and space velocity on vapour-phase oxidation of o-xylene.
4. Write the advantages of o-xylene over naphthalene process.
5. Enlist the raw material for manufacturing of phthalic anhydride form naphthalene.
6. Enlist the raw material for manufacturing of phthalic anhydride form o-xylene.
7. Enlist the properties of phthalic acid.
8. Enlist the uses of phthalic acid.
9. Write the engineering problems associated with the synthesis of phthalic anhydride.

Long questions
1. With the help of flow diagram discuss the manufacturing of phthalic acid from phthalic anhydride.
2. With the help of flow diagram discuss the manufacturing of phthalic anhydride by following process
   a) From naphthalene
   b) From o-xylene

Lecture 10

Short questions
1. Enlist the methods used for manufacturing of oxalic acid.
2. Enlist the raw material for manufacturing of oxalic acid by following process
   a) From sodium formate
   b) From propylene
   c) Dimethyl oxalate process
3. Write the reaction for manufacturing of oxalic acid by following process
   a) From sodium formate
   b) From propylene
   c) Dimethyl oxalate process
4. Enlist the properties of oxalic acid.
5. Enlist the uses of oxalic acid.
6. Write the engineering aspect for oxalic acid synthesis from propylene.

Long questions
1. With the help of flow diagram discuss the manufacturing of oxalic acid by following process
   a) From sodium formate
b) From propylene
   c) Dimethyl oxalate process

**Lecture 11 & 12**

**Short questions**
1. What is fermentation?
2. Define the following terms.
   a) Microorganism
   b) Aerobe
   c) Anaerobe
   d) Facultative anaerobe
   e) Sterilization
   f) Medium
   g) Inoculation
   h) Inoculum
   i) Incubation
   j) Agar
   k) Lyophilisation
3. Enlist the prerequisites for the good fermentation process.
4. Enlist the classification of nutrients.
5. Enlist the various chemical elements used for cell growth.
6. Enlist the condition which influence physical environment of microbe.
7. Write the classification of microorganisms based on temperature.
8. Enlist the criteria required for the culture used for fermentation process.
9. Enlist the characteristic of enzymes.

**Long questions**
1. Discuss the classification of nutrients in detail.
2. Discuss the various chemical elements used as nutrients in fermentation process.
3. Discuss the various favourable conditions which influence the physical environment of microbe.
4. Write a note on culture development.
5. Write a note on development of inoculum.

**Lecture 13**

**Short questions**
1. Enlist the various methods used for manufacturing of industrial alcohol.
2. Which catalyst is used for manufacturing of industrial alcohol by esterification and hydrolysis?
3. Which catalyst is used for manufacturing of industrial alcohol by catalytic hydration?
4. Define the term rectified spirit.
5. Enlist the raw material for manufacturing of industrial alcohol by malt fermentation.
6. Enlist the raw material for manufacturing of industrial alcohol by following process
   a) By malt fermentation
   b) Esterification and hydrolysis
   c) By catalytic hydration
7. Enlist the properties of industrial alcohol.
8. Enlist the uses of industrial alcohol.

**Long questions**
1. With the help of flow diagram discuss the manufacturing of industrial alcohol by following process
   a) By malt fermentation
   b) Esterification and hydrolysis
   c) By catalytic hydration

**Lecture 14**

**Short questions**
1. Give the importance and industrial relevance of azeotropic distillation.
2. Enlist the types of azeotrope.
3. Enlist the various distillation methods used to separate azeotropic mixture.
4. Enlist the properties which required for selection of entrainer.
5. Enlist the uses of absolute alcohol.

**Long questions**
1. With the help of flow diagram discuss the manufacture of absolute alcohol from 96% alcohol.

**Lecture 15**

**Short questions**
1. Enlist the various methods used for manufacture of butyl alcohol.
2. Enlist various isomers of butanol.
3. Which process is also known as Oxo process?
4. Enlist the raw materials for manufacturing of butyl alcohol by fermentation of starch product.
5. Enlist the raw materials and write the reaction for manufacture of butyl alcohol from propylene and synthesis gas.
6. Enlist the properties of butyl alcohol.
7. Enlist the uses of butyl alcohol.

**Long questions**
1. With the help of flow diagram discuss the manufacturing of butyl alcohol by following process
   a) From fermentation of starch product
   b) From propylene and synthesis gas.
Lecture 16 & 17

Short questions
1. Enlist the various methods used for manufacturing of glycerol.
2. Enlist various methods for soap manufacture.
3. Define the term “Sweet water”.
4. What is the main source of Sweet water?
5. How allyl chloride was produced?
6. Which materials were used to remove impurities form spent lye?
7. Based on purity write the classification of glycerol.
8. Enlist the properties of glycerol.
9. Enlist the uses of glycerol.

Long questions
1. With the help of flow diagram discuss the manufacturing of glycerol by following process
   a) From spent lye obtained during soap manufacture
   b) From propylene via ally chloride
   c) From propylene via acrolein
   d) From sweet water
2. Discuss the engineering aspect for glycerol plant.

Lecture 18

Short questions
1. Enlist the various methods used for manufacture of ethylene glycol.
2. Which catalyst is used for manufacture of ethylene glycol via ethylene oxide?
3. Discuss the effect of water ratio.
4. Enlist the properties of
   a) Ethylene glycol.
   b) Di ethylene glycol.
   c) Tri ethylene glycol.
5. Enlist the uses of ethylene glycol.

Long questions
1. With the help of flow diagram discuss the manufacturing of ethylene glycol by following process
   a) Via ethylene oxide
   b) Via ethylene chlorohydrin process

Lecture 19

Short questions
1. Enlist the raw materials and write the reaction for manufacturing of propylene glycol by hydrolysis of propylene oxide.
2. Draw the block diagram for the manufacturing of propylene glycol by hydrolysis of propylene oxide.
3. Write the engineering aspect to be considered for the synthesis of propylene glycol.
4. Enlist the properties of propylene glycol.
5. Enlist the uses of propylene glycol.

**Long questions**
1. With the help of flow diagram discuss the manufacture of propylene glycol by hydrolysis of propylene oxide.

**Lecture 20**

**Short questions**
1. Enlist the various methods used for the production of sodium thiosulfate.
2. Why sulfur was added in manufacture of sodium thiosulfate from soda ash and SO₂?
3. Enlist the raw material for manufacturing of sodium thiosulfate from soda ash.
4. Give the analytical test method for sodium thiosulfate
5. Write the health and safety factors for sodium thiosulfate.
6. Enlist the properties of sodium thiosulfate.
7. Enlist the uses of sodium thiosulfate.

**Long questions**
1. With the help of flow diagram discuss the manufacturing of sodium thiosulfate from soda ash and SO₂.

**Lecture 21**

**Short questions**
1. Enlist the manufacturing methods used for sodium bromide.
2. Enlist the raw materials and write the reaction for manufacturing of sodium bromide using neutralization method.
3. Enlist the raw materials and write the reaction for manufacturing of sodium bromide using excess bromine.
4. Enlist the properties of sodium bromide.
5. Enlist the uses of sodium bromide.

**Long questions**
1. With the help of flow diagram discuss the manufacturing of sodium bromide by following process
   a) Using neutralization method
   b) Using excess bromine
Lecture 22

Short questions
1. Enlist the manufacturing methods used for sodium sulfate.
2. What is natural brine?
4. Enlist the properties of sodium sulfate.
5. Enlist the uses of sodium sulfate.
6. Write the sources of sodium sulfate.

Long questions
1. With the help of flow diagram discuss the manufacturing of sodium sulfate by following process
   a) Using salt and sulfuric acid
   b) Using natural brine

Lecture 23

Short questions
1. Enlist the raw materials and write the reaction for manufacturing of sodium sulfite using soda ash and sulfur dioxide.
2. Enlist the properties of sodium sulfite.
3. Enlist the uses of sodium sulfite.
4. Write the sources of sodium sulfite.
5. Write the engineering aspects of sodium sulfite manufacture plant.
6. Enlist the different commercial grades of sodium sulfite.

Long questions
1. With the help of flow diagram discuss the manufacturing of sodium sulfite using soda ash and sulfur dioxide.

Lecture 24

Short questions
1. Enlist the raw material with specification for fluorine.
2. Write the composition of gas leaving from cell.
3. What is corrosion?
4. Enlist the properties of fluorine.
5. Enlist the uses of fluorine.
6. Enlist the uses of fluorine compounds.
7. Enlist the uses of hydrofluoric acid.
8. Enlist the important minerals used for industrial production of fluorine.

Long questions
1. With the help of flow diagram discuss the manufacturing of fluorine using electrolysis method.
2. Explain the material of construction used for manufacturing of fluorine.

**Lecture 25**

**Short questions**
1. Enlist the manufacturing methods used for bromine.
2. Enlist the raw materials and write the reaction for manufacturing of bromine by following process
   a) Using sea water
   b) By steaming out process
1. Enlist the properties of bromine.
2. Enlist the uses of bromine.
3. Write the engineering aspects of bromine plant.

**Long questions**
1. With the help of flow diagram discuss the manufacturing of bromine by following process
   a) Using sea water
   b) By steaming out process

**Lecture 26**

**Short questions**
1. Enlist the raw materials for manufacturing of iodine.
2. Enlist the properties of iodine.
3. Enlist the uses of iodine.
4. Write the engineering aspects for synthesis of iodine.

**Long questions**
1. With the help of flow diagram discuss the manufacturing of iodine from bromine and chlorine.

**Lecture 27 & 28**

**Short questions**
1. Enlist the methods for manufacturing of chlorine.
2. Why the temperature of gas was reduced to 12 – 14°C in manufacture of chlorine by electrolysis of salt?
3. Enlist the refrigerant used to condensed chlorine.
4. Which alloy was used to construct digester-condenser?
5. Why temperature of the chlorine gas was reduced to 12°C in mercury cell process?
6. Which materials are used in diaphragm cell?
7. Draw the neat diagram of membrane cell.
8. Enlist the advantage and disadvantages of membrane cell used for manufacturing of chlorine.
9. Enlist the principal sources of solid waste from the diaphragm cell process.
10. Why electrostatic precipitator is used in chlorine manufacturing plant?
11. Enlist the properties of chlorine.
12. Enlist the uses of chlorine.

Long questions
1. With the help of flow diagram discuss the manufacturing of chlorine by following process
   a) By electrolysis of salt
   b) Using salt and nitric acid
   c) Mercury cell
   d) By diaphragm cell
2. Explain the engineering aspects for chlorine preparation in detail.

Lecture 29

Short questions
1. Which lamp is used to promote the chlorination reaction?
2. What is the composition of product which leaves the chlorinator reactor?
3. Which mixture is used to separate unreacted methane and HCl?
4. Enlist the properties of methyl chloride.
5. Enlist the properties of dichloromethane.
6. Enlist the uses of methyl chloride.
7. Enlist the uses of dichloromethane.

Long questions
1. With the help of flow diagram discuss the manufacturing of methyl chloride by chlorination of methane.
2. With the help of flow diagram discuss the manufacturing of dichloromethane by chlorination of methane.
3. Write engineering aspects to be considered for the synthesis of methyl chloride and dichloromethane in detail.

Lecture 30

Short questions
1. Enlist the raw materials and write the reaction for manufacture of chloroform by chlorination of methane.
2. Enlist the raw materials and write the reaction for manufacture of chloroform using acetone and bleaching powder.
3. Enlist the properties of chloroform.
4. Enlist the uses of chloroform.
5. Describe the health and safety factor for chloroform.

Long questions
1. With the help of flow diagram discuss the manufacture of chloroform by following process
   a) Using acetone and bleaching powder
b) By chlorination of methane

Lecture 31

Short questions
1. Which catalyst is used in chlorinator?
2. Why the excess of chlorine is used for chlorination?
3. Which solution is used to neutralize the acidic material?
4. Which material is used as desiccant?
5. Enlist the properties of carbon tetrachloride.
6. Enlist the uses of carbon tetrachloride.

Long questions
1. With the help of flow diagram discuss the manufacturing of carbon tetrachloride by following process
   a) Using carbon disulfide and chlorine
   b) By chlorination of methane

Lecture 32

Short questions
1. Give the classification of electric furnace.
2. Enlist the types of resistance furnace.
3. Enlist the factors for selection of electric furnace.
4. Enlist the advantages of electric furnace.

Long questions
1. Writ explanatory note on
   a) Arc furnace
   b) Resistance furnace
   c) Induction furnace

Lecture 33

Short questions
1. Enlist the raw materials and write the reaction for manufacturing of SiC using Acheson process.
2. Draw the diagram of Acheson furnace.
3. Draw the diagram of ESK furnace.
5. Give the engineering aspect for manufacturing of SiC using ESK furnace.
6. Enlist the properties of SiC.
7. Enlist the uses of SiC.
Long questions
1. With the help of diagram discuss the manufacturing of SiC by following process
   a) Acheson process
   b) ESK process

Lecture 34

Short questions
1. Enlist the methods for manufacturing of CaC$_2$.
2. Enlist the raw materials and write the reaction for manufacturing of CaC$_2$
   by following process
   a) Using standard process
   b) Using open furnace
   c) Using water
   d) Using standard process
3. Enlist the properties of CaC$_2$.
4. Enlist the uses of CaC$_2$.

Long questions
1. With the help of flow diagram discuss the manufacturing of CaC$_2$ by following process
   a) Using standard process
   b) Using open furnace
   c) Using water
   d) Using standard process
2. Write the engineering aspect for CaC$_2$ synthesis in detail.

Lecture 35

Short questions
1. Enlist the raw materials and write the reaction for manufacturing of graphite.
2. Enlist the raw materials for manufacturing of carbon electrode.
3. Enlist the types of natural graphite.
4. Enlist the properties of graphite.
5. Enlist the uses of natural graphite.
6. Enlist the uses of artificial graphite.
7. Enlist the characteristic of graphite.

Long questions
1. With the help of flow diagram discuss the manufacturing of graphite.
2. With the help of neat flow diagram discuss the manufacturing of carbon electrode from petroleum coke and anthracite.
Lecture 36

Short questions
1. Which catalyst is used in the manufacture of DMF?
2. Why carbon monoxide used in excess amount in the manufacture of DMF?
3. Enlist the raw material for manufacturing of DMF.
4. Enlist the properties of DMF.
5. Enlist the uses of DMF.

Long questions
1. With the help of flow diagram discuss the manufacturing of DMF from methyl amine.

Lecture 37

Short questions
1. What is the main source of black liquor?
2. Enlist the raw material for manufacturing of DMSO.
3. Enlist the properties of DMSO.
4. Enlist the uses of DMSO.
5. Give the health and safety factors for DMSO.

Long questions
1. With the help of flow diagram discuss the manufacturing of DMSO wood liquor.
2. Discuss the engineering aspect of DMSO plant in detail.

Lecture 38

Short questions
1. Which catalyst is used in cyclization tower?
2. Which process is known as Lyondell process?
3. Which catalyst is used in Lyondell process?
4. Enlist the various methods for manufacturing THF.
5. Enlist the raw material for manufacturing of THF by following process
   a) Using acetylene and formaldehyde
   b) Using butadiene acetoxylation
   c) Using propylene oxide
   d) Using maleic anhydride hydrogenation process
6. Enlist the properties of THF.
7. Enlist the uses of THF.

Long questions
1. With the help of flow diagram discuss the manufacturing of THF by following process
   a) Using acetylene and formaldehyde
b) Using butadiene acetoxylation

c) Using propylene oxide

d) Using maleic anhydride hydrogenation process

Lecture 39

Short questions
1. Enlist the raw material for manufacturing of dimethyl ether.
2. Enlist the properties of dimethyl ether.
3. Enlist the uses of dimethyl ether.
4. Give the toxicology for dimethyl ether.

Long questions
1. With the help of flow diagram discuss the manufacture of dimethyl ether by dehydration of methanol.
2. Discuss the engineering aspect for dimethyl ether synthesis in detail.

Lecture 40

Short questions
1. Which catalyst is used in the manufacture of diethyl ether?
2. Enlist the raw material for manufacturing of diethyl ether.
3. Enlist the properties of diethyl ether.
4. Enlist the uses of diethyl ether.
5. Give the health and safety factors for diethyl ether.

Long questions
1. With the help of flow diagram discuss the manufacturing of diethyl ether by dehydration of ethanol.