PETROCHEMICAL TECHNOLOGY
(CHEN 3131)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Metallurgical coke is obtained from
(a) Vis – breaking unit (b) Delayed coking unit
(c) Fluid catalytic cracking unit (d) Bitumen blowing unit.

(ii) High temperature shift reactor converts
(a) 65 – 80% carbon monoxide into additional hydrogen
(b) 30 – 50% carbon monoxide into additional hydrogen
(c) 80 – 100% carbon monoxide into additional hydrogen
(d) 10 – 50% carbon monoxide into additional hydrogen.

(iii) Catalyst used in the fluid catalytic cracking unit is
(a) Platinum (b) Bismuth molybdenum
(c) Zeolite (d) Zinc.

(iv) Stabilizer used in the vinynl chloride production is
(a) Naptha (b) Phosphite (c) Hexane (d) Ferfural.

(v) Suspension agent used in the detergent is
(a) Sodium silicate (b) Carboxymethyl cellulose
(c) Bicarbonate (d) Methylene blue.

(vi) Initiator used in the low density polyethylene production are
(a) Oxygen and bromine (b) Hydrogen peroxide and benzene
(c) Oxygen and $TiCl_4$ (d) Oxygen and hydrogen peroxide.

(vii) Plasticizer used in the polymer production is
(a) Silica (b) Activated carbon (c) Membrane (d) White clay.

(viii) Example of reinforcing filler is
(a) Silica (b) Wax (c) White clay (d) Carbon black.

(ix) Thermosetting polymer's example is
(a) Phenol formaldehyde (b) Polypropylene
(c) Butadiene (d) Nylon 66.

(x) The composition of Ziegler – Nutta catalyst is
(a) $TiCl_4$ in alkyl aluminium (b) $TiCl_4$ in cobalt aluminium
(c) alkyl aluminium in cobalt aluminium (d) cobalt aluminium in $TiCl_3$.

Group- B

2. (a) Give an overview of petrochemical feedstock. [(CO1)(Analyze/HOCQ)]
(b) What is the composition of natural gas? [(CO2)(Understand/IOCQ)]
(c) Discuss the manufacturing process of methanol production from synthesis gas with help of neat flow sheet. [(CO1)(Remember/LOCQ)]
4 + 1 + 7 = 12

3. (a) Briefly discuss the manufacturing process of ammonia production with the help of a neat flow sheet. [(CO1)(Remember/LOCQ)]
(b) How the salt impurities are removed from crude oil in a refinery? [(CO1)(Understand/IOCQ)]
(c) Why the raw asphalt is treated in a bitumen blowing unit? [(CO1)(Analyse/HOCQ)]
7 + 2 + 3 = 12

Group - C

4. (a) Write the reactions that occur during isopropanol production from propylene. [(CO2)(Remember/LOCQ)]
(b) Briefly discuss the manufacturing process of glycerine production with the help of a neat flow sheet. [(CO2)(Understand/IOCQ)]
(c) Why dowtherm fluid is used during ethylene oxide production? [(CO2)(Analyze/HOCQ)]
3 + 7 + 2 = 12

5. (a) Briefly discuss the manufacturing process of acrylonitrile production from propylene with the help of a neat flow sheet. [(CO2)(Remember/LOCQ)]
(b) Why two reactors are used during butadiene production from n – butane? [(CO2)(Understand/IOCQ)]
(c) Discuss the major engineering problems associated with the vinyl chloride production. [(CO2)(Analyze/HOCQ)]
6 + 3 + 3 = 12

Group - D

6. (a) Discuss about the process variables' role in catalytic reforming of naptha. [(CO3)(Understand/IOCQ)]
(b) Draw the manufacturing flow sheet of phthalic anhydride from naphthalene. [(CO3)(Remember/LOCQ)]
(c) Discuss the major engineering problems associated with cumene production. [(CO3)(Analyze/HOCQ)]
5 + 5 + 2 = 12

7. (a) Write a short note on "detergent additives". [(CO3)(Remember/LOCQ)]
   (b) Draw the block diagram of pre-fractionation, pre treatment and paraffin separation units of LABS productions. [(CO3)(Understand/IOCQ)]
   (c) Why alpha methyl styrene is used during phenol production. [(CO3)(Analyze/HOCQ)]

5 + 5 + 2 = 12

Group - E

8. (a) Briefly discuss the manufacturing process of SBR production. [(CO4)(Remember/LOCQ)]
   (b) Write the reactions that occurduring Nylon 6 production. [(CO4)(Understand/IOCQ)]
   (c) Draw the flow sheet of low density polyethylene production plants. [(CO4)(Analyse/HOCQ)]

6 + 2 + 4 = 12

9. (a) Write the reactions that occur during phenol formaldehyde production. [(CO4)(Remember/LOCQ)]
   (b) Briefly discuss the manufacturing process of polyvinyl chloride production with the help of aneat flow sheet. [(CO4)(Understand/IOCQ)]
   (c) What is rubber compounding? [(CO4)(Analyse/IOCQ)]

3 + 7 + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	43.75	35.42	20.83

Course Outcome (CO):

After the completion of the course students will be able to

1. Classify the variety of petrochemical feedstocks, petroleum refinery products and categorize the synthesis gas productions feedstocks.
2. Interpret the steam cracking operation of naptha and discuss the production mechanism of petrochemical complexes like EDC, VCM, VAM, EO, EA, ACN, PO, Isopropanol etc.
3. Classify the catalytic reforming operation of naptha and interpret the production mechanism of synthetic detergent.
4. Compare and contrast major polymerization processes in industry and describe various process technologies for Fibers, Elastomers and resins etc.

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