<u>UTKALMANI GOPABANDHU INSTITUTE OF</u> <u>ENGINEERING, ROURKELA</u>



LESSON PLAN

DEPARTMENT OF CHEMICAL ENGINEERING

LESSON PLAN						
SUBJECT CODE	: TH-3					
NAME	: PR&PCT					
BRANCH	: CH					
SEMESTER	:Diploma-VI					
CREDIT POINTS	: 4					
NUMBER OF MODULES	: 4					
CLASSES REQUIRED	: 60					
PRE-REQUISITE	: TO KNOW THE CONCEPT OF SYNTHESIS OF REFINERY PRODUCTS, THEIR PROPERTIES AND USES AND TO UNDERSTAND ABOUT GROWTH AND FUTURE OF PETROLEUM REFINERY AND PETROCHEMICAL INDUSTRIES IN INDIA.					

MODULE-I

Syllabus -

INTRODUCTION TO PETROLEUM INDUSTRIES: 1. Development and growth of petrochemical industry in India, 2. Define petrochemicals & describe the importance of petrochemical industry, 3. Theories on Origin of petroleum, detection and production of petroleum, 4. Pre-treatment of oil before refining, desalting and stabilisation of crude, 5. Classification and composition of petroleum, 6. Transportation of crude oil for refining

Objectives:

To understand the petrochemicals & the importance of petrochemical industry, Theories on Origin of petroleum, detection and production of petroleum, Transportation of crude oil for refining, Classification and composition of petroleum.

Session	Topics to be covered	PRIMARY	EXPECTED
no		(BOOKS/NOTES)	BE DISCUSSED
1	Development of petrochemical industry in	T1, R1, R2	Q.A(1-7)
	India		Q.B.(1-2)
2	Growth of petrochemical industry in India	T1, R2	Q.C(1-3)
3	Define petrochemicals & describe the	T1, R2	
	importance of petrochemical industry		
4	Theories on Origin of petroleum	T1, R1, R2	
5	Detection and production of petroleum	R1, R2	
6	Pre-treatment of oil before refining,	R1,R2	
	desalting and stabilisation of crude		
7	Classification and composition of petroleum	R1,R2	
8	Transportation of crude oil for refining	T1, R1, R2	

MODULE-II

FRACTIONATION OF CRUDE PETROLEUM OIL: 1. Cracking-Principle, necessity and types of cracking, 2. Reaction and parameters in thermal cracking, pyrolysis, visbreaking and coking, 3. Catalytic cracking process, parameters, process in different catalytic crackers, 4. Thermal and catalytic reforming, 5. Polymerisation, Alkylation and isomerisation

Objectives:

To study the Fundamental of Cracking-Principle, Reaction and parameters in thermal cracking, pyrolysis, vis-breaking, coking, Catalytic cracking process, different catalytic crackers, Polymerisation, Alkylation and isomerization.

Session	Topics to be covered	PRIMARY	EXPECTED
no		(BOOKS/NOTES)	BE DISCUSSED
	Cracking-Principle, necessity and types of	T1, R1, R2	Q.A(8-23)
9	cracking		Q.B.(3-11)
10	Reaction and parameters in thermal cracking	T1, R2	Q.C.(4-11)
11	Reaction and parameters in pyrolysis	T1, R2	
12	Reaction and parameters in visbreaking	T2, R1, R2	
13	Reaction and parameters in coking	R1, R2	
14	Reaction and parameters in coking	R1,R2	
	Catalytic cracking process, parameters,	R1,R2	
15	process in different catalytic crackers		
16	Process in different catalytic crackers	T2, R1, R2	

17	Process in different catalytic crackers	T2, R1, R2	
18	Thermal reforming	R1, R2	
19	Catalytic reforming	T1, R1, R2	
	Polymerisation, Alkylation and	T2, R1	
20	isomerisation		

MODULE-III

PETROLEUM REFINING: 1. Product from a refinery, temperature range and uses of petroleum products, 2. Crude oil distillation system- Operation in Single, Two, Three stages distillation units, 3. Flow diagram of an integrated petroleum refinery, 4. Safety, storage and handling of Petrochemical Products, 5. Overviews of Refineries in India

Objectives:

To study the Fundamental of Crude oil distillation system- Operation in Single, Two, Three stages distillation units, Safety, storage and handling of Petrochemical Products. To be acquainted with product from a refinery, temperature range and uses of petroleum products.

Session	Topics to be covered	PRIMARY	EXPECTED OUESTIONS TO
no		(BOOKS/NOTES)	BE DISCUSSED
21	Product from a petroleum refinery	T1, R1, R2	Q.A.24
	Temperature range and uses of petroleum	T1, R2	Q.B.(12-17)
22	products		Q.C.15
	Crude oil distillation system- Operation in	T2, R2	
23	Single stage distillation units		
	Crude oil distillation system- Operation in	T1, R1, R2	
24	Two stages distillation units		
	Crude oil distillation system- Operation in	R1, R2	
25	vacuum distillation column		
	Crude oil distillation system- Operation in	R1,R2	
26	Atmospheric distillation column		
	Crude oil distillation system- Operation in	R1,R2	
27	Three stages distillation units		
	Crude oil distillation system- Operation in	T2, R1, R2	
28	Three stages distillation units		
	Flow diagram of an integrated petroleum	T1, R1, R2	
29	refinery		
30	Safety, storage of Petrochemical Products	R1, R2	
31	Handling of Petrochemical Products	T1, R1, R2	
32	Overviews of Refineries in India	T2, R1	

MODULE-IV

CHEMICAL FEED STOCK-FIRST GENERATION PETROCHEMICALS : 1. History and growth of Petrochemical industries globally and in India, 2. Petrochemical feed stock-category, composition and source, 3. Process of Steam reforming of naphtha ,4. Separation of C4 cuts from naphtha crackers, 5. Industrial method of cyclohexane manufacturing

Objectives:

To understand the growth and history of Petrochemical industries globally and in India, petrochemical feed stock-category, composition, sources. To understand the manufacturing of Steam reforming of naphtha, cyclohexane.

Session	Topics to be covered	PRIMARY REFERENCE	EXPECTED QUESTIONS TO
10		(BOOKS/NOTES)	BE DISCUSSED
	History of Petrochemical industries globally	T1, R1, R2	Q.A.(25-26)
33	and in India		Q.B.18
	Growth of Petrochemical industries globally	T2, R2	Q.C.(16-18)
34	and in India		
35	Petrochemical feed stock- category	T1, R2	
36	Petrochemical feed stock- composition	T2, R1, R2	
37	Petrochemical feed stock- source	R1, R2	
	Process flow-sheet of Steam reforming of	R1,R2	
38	naphtha		
	Process description of Steam reforming of	R1,R2	
39	naphtha		
	Process flow-sheet of Separation of C4 cuts	T1, R1, R2	
40	from naphtha crackers		
	Process description of Separation of C4	T2, R1, R2	
41	cuts from naphtha crackers		
	Industrial method of cyclohexane	R1, R2	
42	manufacturing		

MODULE-V

SECOND GENERATION PETROCHEMICALS: 1. Manufacturing of methanol, ethanol from synthesis gas, 2. Manufacturing of vinyl monomer (vinyl chloride, vinyl acetate, Acrylonitrile),3. Manufacturing of Polyester monomer (Terephthalic acid, Phthalic Anhydride)

Objectives:

To study the manufacturing of methanol from synthesis gas, ethanol from synthesis gas, vinyl monomer (vinyl acetate), Polyester monomer (Terephthalic acid), Phthalic Anhydride.

Session	Topics to be covered	PRIMARY	EXPECTED
no		(BOOKS/NOTES)	BE DISCUSSED
	Process flow-diagram for manufacturing	T1, R1, R2	Q.A.(25-26)
43	of methanol from synthesis gas		Q.B.18
	Process description for manufacturing of	T2, R2	Q.C.(19-25)
44	methanol from synthesis gas		
	Manufacturing of ethanol from synthesis	T1, R2	
45	gas		
	Manufacturing of vinyl monomer(vinyl	T2, R1, R2	
46	chloride)		
	Manufacturing of vinyl monomer(vinyl	R1, R2	
47	acetate)		
	Manufacturing of vinyl	R1,R2	
48	monomer(Acrylonitrile)		
	Manufacturing of Polyester	R1,R2	
49	monomer(Terephthalic acid)		
	Process flow-diagram for Manufacturing	T1, R1, R2	
50	of Phthalic Anhydride		
	Process description for Manufacturing of	T2, R1, R2	
51	Phthalic Anhydride		
52	Revision of the chapter	R1, R2	

MODULE-VI

THIRD GENERATION PETROCHEMICALS: 1.Manufacturing of formaldehyde, acetaldehyde, Acetic acid, 2. Manufacture of BTX (Benzene, Toluene, Xylene), Aniline 3. Manufacture of Melamine and linear alkyl benzene

Objectives:

To study the manufacturing of formaldehyde, acetaldehyde, Acetic acid, Benzene, Toulene and Xylene, Aniline and Melamine.

Session no	Topics to be covered	PRIMARY REFERENCE (BOOKS/NOTES)	EXPECTED QUESTIONS TO BE DISCUSSED
53	Manufacturing of formaldehyde	T1, R1, R2	Q.A.(27-28)
54	Manufacturing of acetaldehyde	T2, R2	Q.C.(26-31)
55	Manufacturing of Acetic acid	T1, R2	
56	Manufacturing of BTX(Benzene)	T2, R1, R2	
57	Manufacturing of BTX(Toluene)	R1, R2	
58	Manufacturing of BTX(Xylene)	R1,R2	
59	Manufacturing of Aniline	R1,R2	
60	Manufacturing of Melamine	T1, R1, R2	

Course Delivery Plan

We ek	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
MO DU LE	1	1	2	2	2	3	3	3	4	4	4&5	5	5	6	6

BOOKS FOR REFERENCE: TEXT BOOKS

T1: Modern Petroleum Refining Process by B K B Rao, Oxford IBH Publication T2: Petroleum Refining Technology by Dr. Ram Prasad, Khanna Publications

REFERENCE

R1: Outline of Chemical Technology by Dryden, Tata Mc Grawhill Publication. R2: Fuels And Petroleum Processing by B.K Sarma, Goel Publication.

	Prepared by	Approved by
Signature	Satarcupa Saha	Born.
Name	Satarupa Sahu	B.K GANTAYAT
Designation	Lecturer	HOD, Chemical.

QUESTION BANK ON PR&PCT 6TH SEMESTER, CHEMICAL ENGINEERING UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA PREPARED BY SATARUPA SAHU

A. 2 MARKS

- 1. Define Petrochemicals.
- 2. Differentiate between petroleum and petrochemical.
- 3. What are the methods used for detection of petroleum?
- 4. What are the various means for transportation of crude oil?
- 5. Define desalting of crude.
- 6. Define stabilisation of crude.
- 7. Write down the composition of crude oil by weight percentage of elements.
- 8. Define cracking.
- 9. What are the types of cracking?
- 10. What is the necessity of cracking?
- 11. What is the effect of temperature on cracking?
- 12. What is the effect of pressure on cracking?
- 13. Define visbreaking.
- 14. Write down the dis-advantages of pyrolysis.
- 15. Define Conrandson Decarbonising Efficiency (CDE).
- 16. Write down the different methods of coking.
- 17. Define catalytic cracking.
- 18. Define catalytic reforming.
- 19. Write down the names of catalyst used in catalytic reforming (any two).
- 20. Define Polymerisation.
- 21. Define Alkylation.
- 22. Define isomerisation.
- 23. Define slip- velocity for cracking.
- 24. Why vacuum is used in three stage crude oil distillation system?
- 25. Write down the uses of aromatics.
- 26. Write the uses of olefins.
- 27. Write down the reactions involved in manufacturing of formaldehyde.
- 28. Write the operating conditions for high pressure for melamine manufacturing.

B. 5 MARKS

- 1. Write down the development and growth of petrochemical industry in India.
- 2. Describe the importance of petrochemical industry.
- 3. Write the theory/ reaction mechanism of thermal cracking.
- 4. Define pyrolysis and write a short notes on pyrolysis process.
- 5. Briefly describe the process of fluid coking with flow-sheet.
- 6. Briefly describe the process of flex coking with flow-sheet.
- 7. Write the main advantages of catalytic cracking.
- 8. Write down the difference between Amorphous catalysts and Zeolites
- 9. Write down the reforming reactions.
- 10. Write the types of catalytic reforming.



- 11. Describe the olefin polymerisation.
- 12. Write down the products obtained from a refinery, temperature range and uses of petroleum products.
- 13. Describe single stage crude oil distillation system with flow sheet.
- 14. Describe two stage crude oil distillation system with flow sheet.
- 15. Describe three stage crude oil distillation system with flow sheet.
- 16. Describe the storage of Petrochemical Products.
- 17. Describe the safety procedure of Petrochemical Products.
- 18. Classify the aromatics feed stock with examples.

C. 10 MARKS

- 1. Write down the theories on origin of petroleum.
- 2. Write down the classification and composition of petroleum.
- 3. Describe the various ways of transportation of crude oil for refining.
- 4. Describe the sulphuric acid alkylation process with flow-sheet.
- 5. Briefly describe the process of thermal cracking with flow-sheet.
- 6. Briefly describe the process of visbreaking with flow-sheet.
- 7. Briefly describe the process of delayed coking and decoking with flow-sheet.
- 8. Write down the Carbonium ion mechanism on catalytic cracking.
- 9. Write down the Fixed Bed Crackers (Houdry Process) with flow-sheet.
- 10. Write down the Moving Bed-Air lift- Thermofar catalytic cracking with flow sheet.
- 11. Write down the Moving Bed- Houdri Flow Process with flow sheet.
- 12. Describe the catalytic reforming with flow sheet.
- 13. Describe the isomerisation process with flow-sheet.
- 14. Describe fluid catalytic cracking with flow-sheet.
- 15. Describe the overviews of refineries in India.
- 16. Describe the category of Petrochemical feed stock.
- 17. Describe the process of Steam reforming of naphtha with flow-sheet.
- 18. Describe industrial method of cyclohexane manufacturing with flow-sheet.
- 19. Describe manufacturing of methanol from synthesis gas with flow-sheet.
- 20. Describe manufacturing of ethanol from synthesis gas with flow-sheet.
- 21. Describe manufacturing of vinyl monomer (vinyl chloride) with flow-sheet.
- 22. Describe manufacturing of vinyl monomer (vinyl acetate) with flow-sheet.
- 23. Describe manufacturing of vinyl monomer (Acrylonitrile) with flow-sheet.
- 24. Describe manufacturing of Polyester monomer (Terephthalic acid) with flow-sheet.
- 25. Describe manufacturing of Phthalic Anhydride with flow-sheet.
- 26. Describe the manufacturing of formaldehyde from synthesis gas with a neat diagram.
- 27. Describe the manufacturing of acetaldehyde with flow-sheet.
- 28. Describe the manufacturing of Acetic acid with flow-sheet.
- 29. Describe the manufacturing of Benzene, Toulene and Xylene with flow-sheet.
- 30. Describe the manufacturing of Aniline with flow-sheet.
- 31. Describe the manufacturing of Melamine with flow-sheet

