

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE  
(AUTONOMOUS)**

**KAKINADA - 533 001, EAST GODAVARI, A.P.**

*Affiliated to Adikavi Nannaya University*

*NAAC Accredited with "A" Grade (3.17 CGPA)*

**BOARD OF STUDIES OF CHEMISTRY**

**B.Sc. Petrochemicals Under CBCS**

**Meeting Minutes/Resolutions**



*Convened on 03 November 2022*

**DEPARTMENT OF PETROCHEMICALS**

**P. R. GOVT. COLLEGE (Autonomous)**

**Opp. Mc Laurin High School, Raja Ram Mohan Roy Road,  
Kakinada**

**[www.prgc.ac.in](http://www.prgc.ac.in); e-mail: [chemistry\\_dept@prgc.ac.in](mailto:chemistry_dept@prgc.ac.in)**

**PROCEEDINGS OF THE PRINCIPAL,  
P.R. GOVERNMENT COLLEGE(A),KAKINADA-A.P  
Present: Dr. B. V. Tirupanyam, M.Sc; Ph.D.  
R.C.No.12A/A.C./BOS/2022-23, Dated: 24.09.2022**

**SUB:** P.R. Government College(A), Kakinada-UG Board of Studies (BOS)-  
Program/Course-B.Sc,/Petrochemicals, Nomination of Members-  
Orders issued.

**REF:** 1. UGC Guidelines of for Autonomous Colleges-2018.

**ORDERS:**

The Principal, P.R. Government College(A), Kakinada is pleased to constitute UG Boards of Studies in Petrochemicals for framing the syllabi in Petrochemicals Subject for all Semesters duly following the norms of the UGC Autonomous guidelines.

S.No	Name of the Nominee	Designation
1	Dr. D. Chenna Rao	Chairman & Lecturer Incharge.
2	Dr. M. Trinadh	University Nominee Lecturer in Chemistry Govt. Degree College (Autonomous), Rajahmundry. Ph: 8639551783
3	Dr. V. Narayana Rao	Subject Expert Lecturer in Chemistry Govt. Degree College ,Perumallapuram.
4	Dr. B. Ramesh Babu	Representative from Industry Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.
5	V. Sanjeeva Kumar	Member
6	T.V.V.Satya Narayana	Member
7	P. Vijay Kumar	Member
8	V. Rambabu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	G. Sai Subrahmanyam	Member
14	Ch. Siva Rama Guru Charan	Student Alumni Member
15	K. Krupalavanya II MCPC	Student Member
16	V. Vijay Babu II MCPC	Student Member

The above members are requested to attend the BoS meeting on \_\_\_\_\_ 2022 and share their valuable reviews, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of Names to the academic council for appointment of Examiners.
- Coordinate research, teaching, extension and other activities in the Department of the college.

  
PRINCIPAL

P. R. Government College(A),  
Kakinada

## **VISION AND MISSION OF THE COLLEGE**

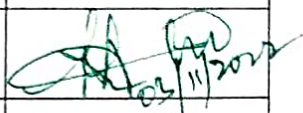

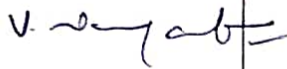


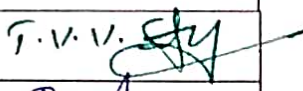
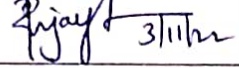
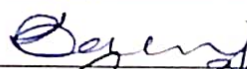
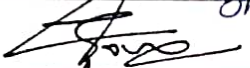
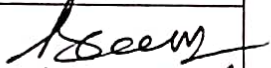
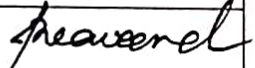
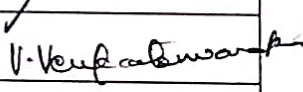
### **Vision**

To provide the right academic environment paving way for intellectual excellence, humane feelings and social commitment. The college believes in providing quality education for the socially disadvantaged, economically weaker sections of the society and thereby help them move up the ladder of success and social order.

### **Mission**

- ➔ To impart holistic education with special emphasis on character, culture, updated knowledge and skill-oriented learning.
- ➔ To make the students enjoy the fruits of globalization without prejudice to their local and cultural environment.
- ➔ To impart necessary life skills so as to make them face any challenge in the bigger world  
– Social, ethical, psychological or professional.

**Signatures of the members who attended the**  
**Board of studies in Petrochemicals 03- 11 -2022 at 10.00 AM**

S. No.	Name of the member	Designation	Signature
1	Dr. D. Chenna Rao	Chairman, Board of Studies, Lecturer in charge	
2	Dr. M. Trinadh	University Nominee Lecturer in Chemistry, Govt.College(A), Rajamahendravaram	
3	Dr. V. Narayana Rao	Subject Expert Lecturer in Chemistry, GDC, Perumallapuram	
4	Dr. B. Ramesh Babu	Representative from Industry Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.	
5	Sri. V.Sanjeeva Kumar	Member Lecturer in Chemistry	
6	Sri. T.V.V. Satyanarayana	Member Lecturer in Chemistry	
7	Sri. P. Vijaya Kumar	Member Lecturer in Chemistry	
8	Sri. V. Rambabu	Member Lecturer in Chemistry	
9	Sri.G.Pavani	Member Lecturer in Chemistry	
10	Dr. N. Bujji Babu	Member Lecturer in Chemistry	
11	Dr. Ch. Praveen	Member Lecturer in Chemistry	
12	V. Venkateswara Rao	Member Lecturer in Chemistry	
13	G.Sai subrahmanyam	Member Lecturer in Chemistry	
14	Ch. Siva Rama Guru Charan	Student Almuni	
14	K. Krupa Lavanya II MCPC	Student Member	
15	V. Vijaya Babu II MCPC	Student Member	

# **P.R. GOVT.COLLEGE (A), KAKINADA**

## **DEPARTMENT OF PETRO CHEMICALS**

### **Minutes of board of studies (BOS) meeting**

**2022-23 on \_\_\_\_\_ 2022**

Meeting of Board of Studies in Petro Chemicals is convened on \_\_\_\_\_ through offline at P.R. Govt. College (A), Kakinada.

**Venue:**

Conference Hall, Dt: -----.

The Principal Dr. B.V. Tirupanyam,

Chairman: Dr. D. Chenna Rao

Chairman and lecturer in charge,

Department of Chemistry

University Nominee: Dr. M. Trinadh,

Lecturer in Chemistry,

Govt. College (Autonomous), Rajamahendravaram,

Industrialist: Dr. B. Ramesh Babu,

Founder & M.D., BogaR laboratories, Peddapuram,

Subject Expert Dr.V.NarayanaRao,

Lecturer in Chemistry,

Government Degree College Perumallapuram,

All the faculty members of Chemistry Department and student alumni attended the meeting.

## **Agenda:**

- To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years, i.e., w.e.f. 2015-16.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, III & V Years for 2022-23.
- Grant of Extra credits for Online SWAYAM MOOCs etc.
- Syllabus, Model Question Papers and Model Blue Prints for I, II, III, IV, V and VI Semesters.
- Teaching learning methodology by 60:40 (External: Internal) ratio for the present II- and III-Year Students and 50:50 (External: Internal) ratio I Year Students w.e.f. 2022-23.
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2022-23.

To discuss and resolve the minor modifications/refinement if any, in the Chemistry cluster electives CI, CII & CIII as majority of the students opting this cluster as their choice. Any Other Proposal with the Permission of the Chairman.

## **Resolutions:**

The following agenda items are discussed and resolutions are made.

- It is resolved to continue choice based credit system in the chemistry combination programmes as per the directions of the CCE, Vijayawada to the first year and second year and final year student's w.e.f. 2018-19.
- It is resolved to approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.
- It is resolved to encourage students to active participation in various activities and give extra credits for students after successful completion of a particular activity such as SWAYAM, MOOCS etc., (Annexure -II)
- It is Resolved to follow 60%-40% external and internal w.e.f. 2017-2018 admitted batches and it continued in present second and third year students.
- It is resolved to follow 50%-50% external and internal for first year w.e.f 2021-22 admitted batch.
- It is resolved that every student should maintain 75% attendance for both theory and practicals in order to attend the Mid and Semester examination.
- It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY. (Annexure-I)

- It is resolved to implement the recommended andragogy for the first semester 2022-23
- 9. Resolved to conduct practical examinations semester wise.
- It is resolved to organize guest lectures by eminent professors.  
Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.
- It is resolved to maintain status quo for same question paper pattern in II, III years. The following paper setters are recommended
  1. Sri. U. Sai Krishna, Govt. College(A), Rajamahendravaram.
  2. Dr. M. Trinadh, Govt. College(A), Rajamahendravaram
  3. Dr. V. Narayana Rao, GDC, Perumallpuram.
  4. Sri. M. Sudhakar, Govt. College(A), Rajamahendravaram.
  5. Sri. K. Anand, GDC, Pithapuram.
  6. Dr. CH. Vijay Vardhan, GDC, Perumallpuram.
  7. Sri B. Surendra, GDC, Tadepaliigudem.



Semester wise/ Paper wise Marks / Credits allotted.

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
I	I	I	Fundamentals of Petroleum Production	100 (50:50)	04
			Practical - I	50	02
	II	II	Modern Petroleum Refining Processes	100 (50:50)	04
			Practical - II	50	02
II	III	III	Introduction to Chemical Engineering	100 (50:50)	04
			Practical - III	50	02
	IV	IV	Heat Transfer and Polymers	100 (50:50)	04
			Practical - IV	50	02
III	V	V	Mass Transfer operations	100 (50:50)	04
			Practical - V	50	02
	V	VI	Petrochemicals-I	100 60:40	04
			Practical - VI	50	02
VII	VII	Petrochemicals II	100 60:40	04	
		Practical - VII	50	02	



**Pithapur Rajah's Government  
College (Autonomous) Kakinada**

**Program & Semester  
I B.Sc. Mathematics,  
Chemistry,  
Petrochemicals &  
Semester-I**

Course Code	<b>Fundamentals of Petroleum Production</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:	Petroleum reservoirs, drillings, LPG, SNG	60	10	30	4+2

**Course Objectives:**

To gain basic knowledge on Petroleum and petroleum products.

**Course Outcomes:**

On Completion of the course, the students will be able to-

CO1	Gains knowledge Petroleum reservoirs, their characteristics and mechanisms
CO2	Understands the types of drillings
CO3	Gains knowledge on reservoir evaluation
CO4	Gains knowledge on Production of SNG and LPG
CO5	Gains knowledge on composition, properties and uses of natural gas and LPG

**Course with focus on employability / entrepreneurship / Skill Development modules**

Skill Development		Employability		Entrepreneurship	
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**Syllabus:**

**UNIT - I:**

**Petroleum Reservoirs:**

Types of Reservoir Rock and Rock Characteristics, Reservoir formations, Physical Properties of Reservoir fluids, Reservoir Drive mechanisms - Gas cap expansion Drive, Solution Gas expansion Drive, Water Drive Mechanism, Secondary recovery Techniques.

**UNIT - II:**

**Locating, and Reaching Reservoirs:**

Exploration, Snell's law of refraction and reflection - general scheme of Seismic surveys - Drilling-types of drilling - components of rotary oil well drill-offshore drilling technology- Drilling fluids and their properties- Lost Circulation zones.

**UNIT - III:**

**Reservoir Evaluation:**

Cutting analysis - Mud analysis - Core Analysis - Well logging - self Potential log - Resistivity log - Gamma ray log - Neutron logs - Density logs - Drill stem testing and swab testing.

## **UNIT -IV:**

### **Natural Gas:**

Physical and thermodynamic properties of Natural gas - Lowtemperature processing of Natural gas for separation of ethane and heavy hydrocarbons  
- dehydration and sweetening of Natural Gas, Liquefactionof Natural gas and its Production of Substitute Natural Gas(SNG) from Naphtha.

## **UNIT-V:**

### **Liquefied Petroleum Gas:**

Sources of LPG - Composition of LPG - Chemical and physical properties of LPG - Production of LPG - Handlingand safe use of LPG.

## **SEMESTER -I**

### **PRACTICAL I (AT THE END OF FIRST SEMESTER)**

1. Determination of Flash point and Fire point by Penskey - Marten apparatus.
2. Abel's Flash and Fire Point determination.
3. Cleveland Flash point determination.
4. Smoke point determination.

### **SCHEME OF EVALUATION**

**Max. Marks: 50**

- |  |                 |
|--|-----------------|
| 1. Procedure to be written in the first 15 minutes | <b>15 Marks</b> |
| 2. Recording of data and reporting the value.      |                 |
| Up to 2% error                                     | <b>25 Marks</b> |
| Error up to 5%                                     | <b>15 Marks</b> |
| Error greater than 5%                              | <b>10 Marks</b> |
| 3. Viva - Voice                                    | <b>5 Marks</b>  |
| 4. Record  | <b>5 Marks</b>  |

### **Referencebooks:**

1. Introduction to Petroleum Production Volume - 1 by D.R. Skinner Gulf Publishing Company - Houston.
2. Petroleum Production in Non - Technical languageby Forest Gray, Penwell Publishing Company - Tulsa Oklahoma.
3. Introduction to Petrochemicals by Sukumar Maiti Oxford I.B.H.
4. A text on petrochemicals by Dr. B.K. Bhaskara Rao, KhannaPublishers, Delhi.

**WebLinks:**

1. <https://youtu.be/PdStB9z37eA>
2. <https://youtu.be/OQF-GZnO6Dk>
3. <https://www.youtube.com/watch?v=nrx413rX-3g&list=PLwdnzlV3ogoXXQcErZna6qDw5P-qPMvWQ>

**Activities & Benchmarks Proposed (Table)**

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz

**CO-PO Mapping:**

(1:Slight [Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO 1	3	2	3	1	3	2	3	2	2	2	3	3	2
CO 2	3	3	2	3	2	2	1	2	2	2	3	3	2
CO 3	3	3	3	3	3	2	2	2	2	2	3	3	2
CO 4	3	3	3	3	3	2	2	2	2	2	3	2	3
Avg	3	2.8	2.8	2.5	2.8	2	2	2	2	2	3	2.8	2.3

**Weightage to content  
Semester -I  
Paper-I**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Petroleum reservoirs	2	1	25	Understanding, Application
2	Locating and reaching of reservoir	1	2	20	Remembering, Understanding
3	Reservoir evaluation	1	1	15	Application & Creation
4	Natural gas	1	1	15	Remembering, Understanding
5	Liquified petroleum gas	1	2	20	Application & Creation
	<b>TOTAL</b>	<b>6</b>	<b>7</b>	<b>95</b>	



**Pithapur Rajah's Government College  
(Autonomous) Kakinada**

**Program & Semester  
II B.Sc. Mathematics,  
Chemistry,  
Petrochemicals &  
Semester-III**

Course Code	<b>Introduction to chemical engineering-III</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:	Basic laws, venturimeter, chemical reactors	60	10	30	4+2

**Course Objectives:**

To gain basic knowledge on fluid mechanics.

**Course Outcomes:**

On Completion of the course, the students will be able to-

CO1	Gains knowledge on basic laws
CO2	Gains knowledge on basic principle applied in industries
CO3	Gains knowledge on basic properties of solutions
CO4	Gains knowledge on fluid flowing devices
CO5	Gains knowledge on chemical reactors

**Course with focus on employability / entrepreneurship / Skill Development modules**

Skill Development		Employability		Entrepreneurship	
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**Syllabus:**

**UNIT-I:**

Unit operations and unit processes - Basic laws - Ideal Gas Law, Avogadro's Law Dalton's Law, Amagat's Law, Average Molecular weight of a Gas mixture, Density of a Gas mixture, Mole fraction, Mass fraction Gibbs phase rule Henry's Law, Clausius - Clapeyron Equation, Cox Chart, Dühring's plot

**UNIT-II:**

General Principles Applied in studying Industry: - Useful Mathematical methods - Method of Least squares, Graphical integration and Graphical differentiation, Dimensional Analysis - The Rayleigh method, the Buckingham Method.

**UNIT-III:**

**Physio-Chemical calculations**

Energy Equivalent Mass (weight) solutions - solubility, Distribution coefficient, vapor pressure of solutions, osmosis, Faraday's Laws of Electrolysis - Hardness of water and its removal, Humidity and saturation.

Material Balance - steps to be followed in material balance calculations - Energy balance - steps to be followed in energy balance calculations.

## **UNIT-IV:**

### **Measuring Devices**

Density and specific gravity - Hydrostatic Balance, Pycnometer or specific gravity bottle, Hydrometer, Ostwald Viscometer, Say bolt Viscometer, Spectrophotometric Analysis, Temperature Measurements - Liquid in glass thermometers, thermocouples, optical pyrometers.

## **UNIT-V:**

### **Flow Meters and Chemical Reactors**

Flow meters: Orifice meter, Venturi meter, Pitot tube, Rota meter.

Chemical Reactors: Classification of Chemical Reactors - Batch Reactor, Semi-batch reactor, Continuous Flow Reactors, Continuous Stirred Tank Reactor (CSTR) Tubular Reactor, fixed - Bed Reactors, Fluidized Bed Reactors, Moving Bed Reactors.

**P.R.GOV.T. COLLEGE(A), KAKINADA.**

**II B.SC.- PETROLEUM & PETROCHEMICALS**

**MODEL QUESTIONPAPER**

**PAPER - III - INTRODUCTION TO CHEMICAL ENGINEERING**

**Time: 2 Hrs.**

**Max. Marks 50**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section**

Each Question carries **TEN** marks.

**3X10=30M**

**SECTION - A**

1. Question from Unit -I
2. Question from Unit -II
3. Question from Unit -III

**SECTION - B**

4. Question from Unit - IV
5. Question from Unit - V
6. Question from unit-I

**PART-III**

**Answer any FOUR Questions from the following.**

Each Question carries **FIVE** marks.

**4 x 5 =20M**

7. Question from Unit - I
8. Question from Unit - II
9. Question from Unit - III
10. Question from Unit - IV
11. Question from Unit - V
12. Question from Unit - II
13. Question from Unit - IV

**Note to Paper Setter: -**

In section I one essay question is to be set from each of the five units.

Similarly in Section II, one short answer question is to be set from each of the 5 units.

**P.R.GOV.T. COLLEGE(A), KAKINADA.**

**II B.SC., PETROLEUM & PETROCHEMICALS**

**SEMESTER - III**

**PAPER -III: INTRODUCTION TO CHEMICAL ENGINEERING**

**QUESTION BANK**

**ESSAY QUESTIONS: 10 M**

**UNIT -I:**

- 1.a. Write in detail about Unit Operations
  - b. State and explain Clausius claypeyron equation
- 2.a. Write in detail about Unit Processes.
  - b. State and explain about Gibbs phase rule
- 3.a. State and explain (i). Ideal gas law and (ii). Henrys law
  - b. Explain about (i). Cox chart (ii). Duhrings plot

**UNIT -II:**

1. a. Write in detail about method of Least squares
  - b. Explain about Dimensional analysis
2. a. Write about the method of Graphical integration
  - b. Explain about the method of Graphical differentiation.

**UNIT -III:**

1. a. Write about the steps to be followed during material balance calculations
  - b. State and explain Faradays laws of electrolysis
2. a. Write about the steps to be followed during energy balance calculations
  - b. Write about Hardness of water and its removal

**UNIT -IV:**

1. a. Explain about the determination of coefficient of viscosity by OstwaldViscometer
  - b. Explain about hydrostatic balance
2. a. Explain about the design and functioning of a thermocouple
  - b. Explain about the measurement of temperature by liquid in glassthermometer
3. a. Write about the determination of Specific gravity of a liquid by Pyknometer
  - b. Explain about the Spectrophotometric analysis with applications.



**UNIT -V:**

1. a. Explain briefly about Continuous flow reactors  
b. Write in detail about Batch reactor
2. a. Explain the design and working of a Pitot tube  
b. With a neat diagram explain the functioning of Fluidized Bed Reactor.
3. a. Write about Continuous stirred tank reactor (CSTR) and tubular reactor  
b. Explain in detail about Orifice meter.
4. a. Write in detail about Rota meter.  
b. Explain in detail about fixed bed reactors.

**SHORT ANSWER QUESTIONS: 5 MARKS****UNIT - I:**

1. State and explain Amagats law
2. State the Daltons law and Avogadro's law
3. Write about Average molecular weight of a gas mixture and Density of gas mixture
4. Explain about Mole fraction and mass fraction

**UNIT - II:**

1. Write about Rayleigh method
2. Explain about Buckingham method
3. Write a note on graphical integration

**UNIT - III:**

1. Write a short note on Distribution coefficients
2. Explain about Osmosis
3. Write about Humidity and saturation
4. Write about Vapour pressure of a solution

**UNIT - IV:**

1. Write briefly about Optical pyrometers
2. Explain briefly about determination of viscosity by Saybolt viscometer
3. Write about the determination of Specific gravity by Hydrometer
4. Explain the terms Density and Specific gravity.

**UNIT - V:**

1. Write a short note on classification of chemical reactors
2. Explain briefly about Semi batch reactor
3. Write about moving bed reactor.

**IMPORTANT NOTE TO PAPER SETTER:**

In section - I, one essay question is to be set from each of the five units.

Similarly in Section - II, one short answer question is to be set from each of the five units.  
Questions should be given from **QUESTION BANK**.

**P.R.GOV.T. COLLEGE(A), KAKINADA.**  
**II B.SC., PETROLEUM & PETROCHEMICALS**  
**PRACTICAL SYLLABUS**

**SEMESTER - III**

**PRACTICAL - III (At the end of Third Semester)**

1. Aniline point determination – Method A
2. Carbon Residue by Ramsbottom method.
3. Carbon Residue by Conradson method.
4. Saybolt Viscometer.

**SCHEME OF EVALUATION**

**Max. Marks: 50**

- |  |                 |
|--|-----------------|
| 5. Procedure to be written in the first 15 minutes | <b>15 Marks</b> |
| 6. Recording of data and reporting the value.      |                 |
| Up to 2% error                                     | <b>25 Marks</b> |
| Error up to 5%                                     | <b>15 Marks</b> |
| Error greater than 5%                              | <b>10 Marks</b> |
| 7. Viva – Voice                                    | <b>5 Marks</b>  |
| 8. Record  | <b>5 Marks</b>  |

**Referencebooks:**

1. Introduction to Chemical Engineering by Salil K. Ghosal and others. Tata Mc. Graw-Hill Publishing Company.
2. Unit operations – I and II by K.A. Gavhane. Nirali Prakashan – Pune.

**WebLinks:**

1. <https://youtu.be/P--6V7Lusoo>
2. [https://youtu.be/\\_3JVLyMv5II](https://youtu.be/_3JVLyMv5II)
3. <https://youtu.be/XL2IqiImLO4>

**Activities & Benchmarks Proposed (Table)**

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz

**CO-PO Mapping:**

(1:Slight [Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO 1	3	2	3	1	3	2	3	2	2	2	3	3	2
CO 2	3	3	2	3	2	2	1	2	2	2	3	3	2
CO 3	3	3	3	3	3	2	2	2	2	2	3	3	2
CO 4	3	3	3	3	3	2	2	2	2	2	3	2	3
CO 5	3	2.8	2.8	2.5	2.8	2	2	2	2	2	3	2.8	2.3

**Weightage to content  
Semester -III  
Paper-III**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Unit operations-I	2	1	25	Understanding, Application
2	Unit operations-II	1	2	20	Remembering, Understanding
3	Physio-chemical calculations	1	1	15	Application & Creation
4	Measuring devices	1	2	15	Remembering, Understanding
5	Flow metres & chemical reactors	1	1	20	Application & Creation
	<b>TOTAL</b>	<b>6</b>	<b>7</b>	<b>95</b>	



**Pithapur Rajah's Government College  
(Autonomous) Kakinada**

**Program & Semester  
III B.Sc. Mathematics,  
Chemistry,  
Petrochemicals &  
Semester-V (P-VI)**

CourseCode	PETROCHEMICALS- I				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		60	10	30	4+2

**Course Objectives:**

To gain knowledge on production, purification, properties of natural gases.

**Course Outcomes:**

On Completion of the course, the students will be able to-

CO1	Gains knowledge on separation and purification on C <sub>4</sub> component gases
CO2	Gains knowledge on properties and separation of natural gases
CO3	Gains knowledge on production and treatment of synthesis gas
CO4	Gains knowledge on chemicals obtained from syn gas
CO5	Gains knowledge on production of synthetic detergents

**Course with focus on employability / entrepreneurship / Skill Development modules**

Skill Development		Employability		Entrepreneurship	
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**Syllabus:**

**UNIT-I**

Feed stock for petrochemicals - Purification of gases - ethanolamine sweetening process - separation of gases into individual Constituents, separation of C<sub>4</sub> Components by extractive distillations - Low temperature fractionation-Special techniques - Absorption - Low temperature combination for Separation of Gases.

**UNIT-II**

**Natural Gas:**

Physical and thermodynamic properties of Natural gas - Low temperature processing of Natural gas for separation of ethane and heavy hydrocarbons- dehydration and sweetening of Natural Gas, Liquefaction of Natural gas and its Production of Substitute Natural Gas (SNG) from Naphtha.

**Liquefied Petroleum Gas:**

Sources of LPG - Composition of LPG - Chemical and physical properties of LPG - Production of LPG - Handling and safe use of LPG.

## **UNIT-III**

### **Synthesis gas and its production**

Steam reforming of Hydrocarbons - production of synthesis gas by steam reforming of Natural gas, steam reforming of Naphtha and partial oxidation of Fuel oil - Lurgi Coal gasification - Fischer Tropsch Syn gas technology.

After treatment of synthesis gas - Production of pure hydrogen, production of Ammonia synthesis gas, methanol synthesis gas - oxo - synthesis gas and pure carbon monoxide.

## **UNIT-IV**

### **Chemicals from Synthesis gas:**

Production of methanol - Oxo synthesis - production of Propionaldehyde and 2 - Ethyl Hexanol - Production of Acetic Acid and Butanol from synthesis gas - Fractionation of Air - Air separation plant, synthesis of Urea.

## **UNIT-V**

### **Synthetic Detergents:**

Classification of detergents - Detergents through olefins - manufacture of Linear Alkyl Benzenes, n-paraffin's production and Detergents from n- paraffin's - Manufacture of Aryl Benzene sulphonate (Surf) - manufacture of Alkylated Phenol detergents - Finishing of detergents - additives to detergents.

**PETROCHEMICALS - I**  
**QUESTION BANK**  
**Essay Questions: 16 M**

**UNIT -I:**

1. a. With a neat Flow diagram, explain the typical Ethanolamine sweetening process.  
b. What are the different separation Techniques available industrially to Separate Gases into individual constituents? Discuss any one process briefly
2. a. Write in detail about the separation of C4 Components by extractive distillations  
b. Explain briefly about the Low temperature combination for Separation of Gases.

**UNIT -II:**

5. a. Explain how Dehydration and sweetening of Natural gas is carried out.  
b. Explain about the Low temperature processing of Natural gas for separation of Ethane
2. a. Write down the various sources of LPG.  
Discuss in detail about the safe handling and safe usage of LPG as a fuel keeping in view its properties.  
b. Explain in detail about the production of LPG
3. a. Explain in detail about the Production of Substitute Natural Gas (SNG) from Naphtha.  
b. Write about the Liquefaction of Natural gas

**UNIT -III:**

1. a. With neat flow chart, describe the manufacture of synthesis gas by steam reforming of Naphtha.  
b. Write briefly about Fischer Tropsch syn gas Technology
2. a. Explain in detail about the production of Ammonia synthesis gas  
b. Explain in detail about the production of Methanol by Oxo - synthesis

**UNIT -IV:**

1. a. With a neat flow diagram describe the method of production of 2- Ethyl hexanol by Oxo - process.  
b. With a neat flow diagram describe how Acetic Acid can be manufactured from Methanol and Carbon Monoxide (BASF method).
2. a. Explain about the design and working of Air separation plant.  
b. Explain in detail about the synthesis of Urea.

**UNIT -V:**

1. a. With a neat flow chart describe how detergents can be produced from olefins.  
b. Discuss the production of detergents from n - Paraffin's with a neat flow chart.
2. a. Explain in detail about the manufacture of Alkylated Phenol detergents  
b. Explain in detail about the Manufacture of Aryl Benzene sulphonate (Surf)

**Short answer questions: 03 M**

**UNIT - I:**

1. Explain about the purification of gases
2. Write about absorption technique
3. Explain about the separation of gases into individual constituents
4. Write a note on hypersorber

**UNIT - II:**

1. Write about composition of natural gas
2. Write about the properties of natural gas
3. What is LPG? Write the composition of LPG
4. Write briefly about the properties of LPG

**UNIT - III:**

1. Write briefly about Lurgi coal gasification
2. Write about the steam reforming of hydro carbons
3. Write about the production of pure hydrogen

**UNIT - IV:**

1. Write about Oxo synthesis
2. Explain about the production of Butanol

**UNIT - V:**

1. Explain briefly about additives to detergents
2. Write about the classification of detergents
3. Write about the finishing of detergents

**IMPORTANT NOTE TO PAPER SETTER:**

In section - I, one essay question is to be set from each of the five units. Similarly in Section - II, one short answer question is to be set from each of the five units. Questions should be given from QUESTION BANK.

## PRACTICAL - VI (At the end of Fifth Semester)

- 1) Determination of Partition Coefficient.
- 2) Diffusion coefficient.
- 3) Colorimetric estimation of  $\text{KMnO}_4$  solution.
- 4) Colorimetric estimation of Fe (III) - Thiocyanate Method.

### SCHEME OF VALUATION

Max. Marks: 50

- 1) Procedure to be written in the first 15 minutes 10 Marks
- 2) Recording of data and reporting the value 15 Marks upto 2% error  
Error up to 5% 10 Marks  
Error greater than 5% 5 Marks
- 3) Viva - Voice 5 Marks
- 4) Record 5 Marks

#### **Referencebooks:**

1. A text on petrochemicals by Dr. B.K. Bhaskara Rao, Khanna Publishers, Delhi.
2. Petrochemical process Technology by I.D. Mall Macmillan India Ltd.,
3. Fuels and petrochemical processing by B.K. Sharma Goel Publishing House Meerut.
4. Introduction to Petrochemicals by Sukumar Maiti Oxford I.B.H

#### **WebLinks:**

1. <https://youtu.be/SmchkR7jRIE>
2. <https://youtu.be/5nTkArHe4bY>

#### **Activities & Benchmarks Proposed (Table)**

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz



**CO-PO Mapping:**

(1:Slight [Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO 1	3	2	3	1	3	2	3	2	2	2	3	3	2
CO 2	3	3	2	3	2	2	1	2	2	2	3	3	2
CO 3	3	3	3	3	3	2	2	2	2	2	3	3	2
CO 4	3	3	3	3	3	2	2	2	2	2	3	2	3
Avg	3	2.8	2.8	2.5	2.8	2	2	2	2	2	3	2.8	2.3

**Weightage to content  
Semester -V  
Paper-VI**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Feed stock of petrochemicals	1	1	19	Understanding, Application
2	Natural gas	1	1	19	Remembering, Understanding
3	Synthesis gas and its production	1	1	19	Application & Creation
4	Chemicals from synthesis gas	1	1	19	Remembering, Understanding
5	Synthetic detergents	1	1	19	Application & Creation
	<b>TOTAL</b>	<b>5</b>	<b>5</b>	<b>95</b>	

**III B.Sc., Petroleum & Petrochemicals**

**MODEL QUESTION PAPER**

**Paper VI - Petrochemicals - I**

**Time: 2 1/2 Hrs**

**Semester - V**

**Max. Marks 60**

**Section - I**

**Answer any Three questions from the following.**

**All questions carry equal marks**

**3 x 16 =48 marks**

1. a. With a neat Flow diagram, explain the typical Ethanolamine Sweetening process?  
b. What are the different separation Techniques available industrially to separate gases into individual constituents? Discuss any one process briefly.
2. a. Explain how Dehydration and sweetening of Natural gas is carried out.  
b. What is LPG? Write down the various sources of LPG.

Discuss in detail about the safe handling and safe usage of LPG as a fuel keeping in view its properties.

3. a. With neat flow chart, describe the manufacture of synthesis gas by steam reforming of Naphtha.  
b. Write briefly about Fischer Tropsch syn gas Technology
4. a. With a neat flow diagram describe the method of production of 2- Ethyl hexanol by Oxo - process.  
b. With a neat flow diagram describe how Acetic Acid can be manufactured from Methanol and Carbon Monoxide (BASF method).
5. a. Write about the classification of Detergents. With a neat flow chart describe how detergents can be produced from olefins.  
b. Discuss the production of detergents from n - Paraffin's with a neat flow chart.

**Section II**

**Write short notes on any FOUR of the following**

**4x3=12 Marks**

6. Hypersorber.
7. Distinguish LNG, SNG and CNG.
8. Ammonia Synthesis Gas.
9. Oxo Synthesis.
10. Additives to detergents.

**Note to paper setter:**

In section I, one essay question is to be set from each of the 5 units. Similarly, in section II one short answer question is to be set from each of the 5 units.



**Pithapur Rajah's Government College  
(Autonomous) Kakinada**

**Program & Semester  
III B.Sc. Mathematics,  
Chemistry,  
Petrochemicals &  
Semester-V (P-VII)**

CourseCode	PETROCHEMICALS- II				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:		60	10	30	4+2

**Course Objectives:**

To gains knowledge on production, properties of C1-C4 components.

**Course Outcomes:**

On Completion of the course, the students will be able to-

CO1	Gains knowledge on production and properties of C1 component gases
CO2	Gains knowledge on production and properties of C2 component gases
CO3	Gains knowledge on production and properties of C3 component gases
CO4	Gains knowledge on production and properties of C4&C5 component gases
CO5	Gains knowledge on production of BTX aromatics

**Course with focus on employability / entrepreneurship / Skill Development modules**

Skill Development		Employability		Entrepreneurship	
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**Syllabus:**

**Chemicals from Methane (C<sub>1</sub> Compounds).**

Production of Methanol, Fluorochloromethanes, Hydrogen Cyanide and Methylamine from Methane.

Production of Formaldehyde, Tertiary Amyl Methyl Ether (TAME), Dimethylformamide from Methanol.

Production of Hexamethylene Tetramine and Ethylene Glycol from formaldehyde.

**Unit 2: Chemicals from Ethylene (C<sub>2</sub> compounds)**

Production of Ethylene by Naphtha cracking - manufacture of vinyl chloride, vinyl Acetate, Ethanol, Acetaldehyde, Ethylene oxide, Ethylene glycols from Ethylene -

**Unit 3: Chemicals from propylene (C<sub>3</sub> compounds)**

Production of Propylene by catalytic cracking of Petroleum distillate - Production of Isopropyl Alcohol, Propylene oxide, Acrylonitrile, Acrolein, Acrylic Acid and Epichlorohydrin from Propylene.

#### **Unit 4: Chemicals from Butylene, Butadiene and pentanes. (C<sub>4</sub> and C<sub>5</sub> compounds)**

Dehydrogenation of Butanes for the Production of Butenes and Butadiene - catalytic dehydrogenation of butanes for the production of Butadiene - Production of methacrylic acid, MTBE from Butenes.

Production of Adipic acid from Butadiene - production of Isoprene from methyl butenes (C<sub>5</sub> feed).

#### **Unit 5- : Petroleum Aromatics and its chemicals:**

Production of BTX through catalytic reforming, Reformate separation into Aromatics (Udex process), BTX separation from crude BTX Disproportionation of Toluene into Benzene and Xylenes, Isomerization of Xylenes to p-Xylene.

Chemicals from BTX Aromatics - Styrene from Benzene, Caprolactam and Toluene Diisocyanate from Toluene, Dimethyl Terephthalate from p-xylene.

**PETROCHEMICALS - II**  
**QUESTION BANK**

**Essay Questions: 16 M**

**UNIT -I:**

1. a. With a neat flow chart, describe the process of manufacturing of methanol from Methane.  
b. With a neat flow chart, describe the process of manufacturing of HCN from Methane.
2. a. With a neat flow chart, describe the process of manufacturing of formaldehyde from methanol.  
b. With a neat flow chart, describe the process of manufacturing Di methyl Formaldehyde (DMF) from methanol.
3. a. With a neat flow chart, describe the process of manufacturing of Tertiary Amyl Methyl Ether (TAME) from methanol.  
b. With a neat flow chart, describe the process of manufacturing Ethylene Glycol from formaldehyde.

**UNIT -II:**

1. a. Explain about the production of Ethylene by steam cracking of Naphtha.  
b. With a neat flow diagram describe the manufacture of vinyl chloride from ethylene.
2. a. With a neat flow diagram describe the manufacture of vinyl acetate from Ethylene.  
b. With a neat flow diagram describe the manufacture of Ethyl alcohol from Ethylene.
3. a. With a neat flow diagram describe the process of production of Ethylene Oxide from ethylene.  
b. With a neat flow diagram describe the process of production of Acetaldehyde from ethylene.

**UNIT -III:**

1. a. With a neat flow chart explain the process of production of Propylene by catalytic cracking of petroleum Distillate.  
b. With a neat flow chart explain the process of production of Isopropyl alcohol from propylene.
2. a. With a neat flow chart explain the process of production of Propylene oxide from propylene.  
b. With a neat flow diagram describe the process of production of Acrylonitrile from Propylene

**UNIT -IV:**

1. a. With a neat flow diagram describe the process of catalytic dehydrogenation of Butenes for the production of Butadiene.  
b. With a neat flow diagram describe the process of production of methacrylic acid from Isobutylene
2. a. Explain the production of MTBE with a neat flow chart from Isobutene  
b. With a neat flow diagram describe the process of production of Maleic anhydride from C4 unsaturates.
3. a. With a neat flow diagram describe the process of production of Isoprene from methyl butenes  
b. With a neat flow diagram describe the process of production of adipic acid from Butadiene.

### **UNIT -V:**

1. a. With a neat flow chart describe the Udex process for Aromatics Separation from Reformate.  
b. With a neat flow diagram describe the process of production of BTX aromatics by catalytic reforming of Naphtha
2. a. With a neat flow diagram describe the process of disproportionation of toluene into Benzene and Xylenes.  
b. With a neat flow diagram describe the process of isomerization of xylene to p- xylene.
3. a. With a neat flow diagram describe the process of production of styrene from benzene.  
b. With a neat flow diagram describe the process of production of

### **Short answer questions: 03 M**

### **UNIT - I:**

1. Explain about the production of ethyl amine from methane
2. Write about the production of Fluoro - chloro methane's from methane
3. Write about the production of hexa methylene tetra amine
4. Write about the production of Dimethyl formamide from Methanol.

### **UNIT - II:**

1. Production of Ethylene glycol from Ethylene
2. Production of acetaldehyde from Ethylene

### **UNIT - III:**

1. Production of Epichlorohydrin from propylene
2. Production of Acrolein from propylene

### **UNIT - IV:**

1. Production of Adipic acid from Butadiene.
2. Conversion of Butanes to Butenes
3. Manufacture of Butadiene from Butanes

### **UNIT - V:**

1. Production of DMT from Para xylene.
2. Reformate separation into aromatics
3. Toluene di isocyanate from toluene

### **IMPORTANT NOTE TO PAPER SETTER:**

In section - I, one essay question is to be set from each of the five units. Similarly in Section - II, one short answer question is to be set from each of the five units. Questions should be given from QUESTION BANK.

Time: 2 $\frac{1}{2}$ Hrs

Max. Marks 60M

**Section-I**

**Answer any Three questions.**

**All questions carry equal marks.**

**3 x 16 = 48 Marks**

1. a. With a neat flow chart, describe the process of manufacturing of methanol from methane.  
b. With a neat flow chart, describe the process of manufacturing formaldehyde from methanol.
2. a. Explain about the production of Ethylene by steam cracking of Naphtha.  
b. With a neat flow diagram describe the process of production of Ethylene Oxide from ethylene.
3. a. with a neat flow chart explain the process of production of Propylene by catalytic cracking of petroleum Distillate.  
b. With a neat flow diagram describe the process of production of Acrylonitrile from Propylene.
4. a. With a neat flow diagram describe the process of catalytic dehydrogenation of Butenes for the production of Butadiene.  
b. Explain the production of MTBE with a neat flow chart.
5. a. With a neat flow chart describe the Udex process for Aromatics Separation from Reformate.  
b. With a neat flow diagram, describe the process of isomerization of Xylenes to p-Xylene.

**Section II**

**Write short notes on ANY FOUR of the following:**

**4x3=12 Marks**

6. Production of Methylamines from Methane.
7. Production of Ethylene glycol from Ethylene.
8. Epichlorohydrin from propylene.
9. Production of Adipic acid from Butadiene.
10. Production of DMT from Paraxylene.

## III B.Sc., - (Petroleum & Petrochemicals) Practical Syllabus

### Semester - V

#### PRACTICAL - VII : (At the end of Fifth Semester)

- 1) Preparation of Fluorescein Dye.
- 2) Preparation of Azo Dye.
- 3) Preparation of Novolac resin.
- 4) Preparation of Resol Resin.

#### SCHEME OF VALUATION

Max. Marks: 50

- 1) Procedure to be written in the first 15 minutes -10 Marks
- 2) Recording of data and reporting the value 15 Marks upto 2%error  
Error up to 5% 10 Marks  
Error greater than 5% 5 Marks
- 3) Viva - Voice 5 Marks
- 4) Record 5 Marks

#### **Referencebooks:**

1. A text on petrochemicals by Dr. B.K. Bhaskara Rao, Khanna Publishers, Delhi.
2. Petrochemical process Technology by I.D. Mall Macmillan India Ltd.,
3. Fuels and petrochemical processing by B.K. Sharma Goel Publishing House Meerut.
4. Introduction to Petrochemicals by Sukumar Maiti Oxford I.B.H

#### **WebLinks:**

1. <https://youtu.be/SmchkR7jRIE>
2. <https://youtu.be/5nTkArHe4bY>

#### **Activities & Benchmarks Proposed (Table)**

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz



**Weightage to content  
Semester -V  
Paper-VII**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Chemicals from C1 components	1	1	19	Understanding, Application
2	Chemicals from C2 components	1	1	19	Remembering, Understanding
3	Chemicals from C3 components	1	1	19	Application & Creation
4	Chemicals from C4 components	1	1	19	Remembering, Understanding
5	Chemicals from BTX aromatics	1	1	19	Application & Creation
	<b>TOTAL</b>	<b>5</b>	<b>5</b>	<b>95</b>	

**CO-PO Mapping:**

(1:Slight [Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':No Correlatio

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO 1	3	2	3	1	3	2	3	2	2	2	3	3	2
CO 2	3	3	2	3	2	2	1	2	2	2	3	3	2
CO 3	3	3	3	3	3	2	2	2	2	2	3	3	2
CO 4	3	3	3	3	3	2	2	2	2	2	3	2	3
Avg	3	2.8	2.8	2.5	2.8	2	2	2	2	2	3	2.8	2.3

