PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA - 533 001, AP.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES PETROCHMICALS

B.Sc. PETROCHEMICALS under CBCS

Meeting Minutes/Resolutions

Convened on 31 August 2023

AY 2023-24

DEPARTMENT OF CHEMISTRY

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

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

www.prgc.edu.in; e-mail: chemistry@prgc.edu.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.1/A.C./BOS/2023-24, Dated: 29.08.2023

SUB: P.R. Government College(A), Kakinada-UG Board of Studies (BOS)- Program/Course-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 respective Subject for all Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Person	Designation
1	Sri. V. Sanjeeva Kumar	Chairman & Lecturer Incharge, Department of Chemistry.
2	Dr. M. Trinadh Government College(Autonomous), Rajamahendravaram	University Nominee
3	Dr. V. Narayana Rao Lecturer in Chemistry Government Degree College, Perumallapuram	Subject Expert -I .
4	Dr. T. Satyanarayana Principal Ideal College of Arts and Science, Kakinada	Subject Expert - II
5	Dr. B. Ramesh Babu Boga R Laboratories Peddapuram	Representative from Industry
6	Sri. T. V. V. Satyanarayana	Member
7	Sri. P. Vijay Kumar	Member
8	Sri. V. Rambabu	Member
9	Sri. G. Pavani	Member
10	Dr. N. Bujjibabu	Member
11	Dr. Ch. Praveen	Member
12	Sri. V. Venkateswara Rao	Member
13	Sri. U.S.N. Prasad	Member
14	K.N.S.Swami	Member
15	S. Vijaya Lakshmi	Member
16	T. Pavan Kumar	Member
17	P. Devi Sunanda	Member
18	V. Durga Bhavani	Member
19	P.R.Ravi Varma	Member
20	V. Priyanka	Member
21	B. Ganesh	Student Alumni Member

22	V. Harshitha I B.Sc MCPc	Student Member
23	A.John II B.Sc, MCPC	Student Member

The above members are requested to attend the BoS meeting on 31-08-2023 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
30 Aug 2023
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 to make them face any challenge in the bigger world – Social, ethical, psychological, or professional.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF PETRO CHEMICALS
MINUTES OF BOARD OF STUDIES (BOS) MEETING

2023-24 on 31 August 2023 Meeting of Board of Studies in Petro Chemicals is convened on 31 August, 2023 through offline at Pithapur Rajah's Government College (A), Kakinada.

Venue: LCD Hall-I, Dt: 31August, 2023.

The Principal Dr. B.V. Tirupanyam, Chairman, Sri. V. Sanjeeva Kumar, Chairman and lecturer in charge, University Nominee, Dr. M. Trinadh, Lecturer in Chemistry, Govt. College (Autonomous), Rajamahendravaram, Industrialist, Dr. B. Ramesh Babu, Founder & M.D., Boga R laboratories, Peddapuram, Subject Expert, Dr. V. Narayana Rao, Lecturer in Chemistry, Government Degree College, Perumallapuram, Subject Expert, Dr. T. Satyanarayana, Principal Ideal College of Arts and Science, All the faculty members of Chemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss the Semester System and revised Choice Based Credit System (CBCS) being implemented for the past 03 years, i.e., w.e.f. 2020-21.
2. To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of III, IV & V Years for 2023-24.
3. Grant of Extra credits for Online SWAYAM MOOCs etc.
4. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mappingfor III, IV and V Semesters.
5. Minimum of 60% integration of ICT into transaction of curriculum.
6. Minimum attendance of 75% for both I mid-term examination, and II mid-term examination under CIA component shall be the benchmark for attendance and itshall be approved in the BOS.
7. Teaching learning methodology by 50:50 (External: Internal) ratio for the present II and III-Year Students. w.e.f. 2023-24.
8. Remedial coaching for slow learners and project work, research, Conferences,etc., for advanced learners.
9. Panel of paper setters and examiners.
10. Proposals for Community Service Projects/Extension activities for the benefit of society.
11. Department action plan for 2023-24. To discuss and resolve the minor

modifications/refinement if any.

12. Any Other Proposal with the Permission of the Chairman.

Resolution:

1. It is resolved to carry forward the CBSE norms for the students who joined in 2020-21.
2. It is resolved to implement the suggestions discuss during the BOS for Continuation/Modifications of the syllabus for the Odd& Even Semesters of I, II, III & IV Years for 2023-24.
3. It is resolved to award extra credits for students who pursue at least one MOOCs course in online plat form.
4. It is resolved to map the syllabus of II to V semesters invoking blooms taxonomy for CoS, Pos, PSOs.
5. It is resolved to implement the ICT skills in teaching learning methodology so as to meet present scenario.
6. It is resolved to increase the attendance of the students and also decreasing the attendance defaulters by allowing Minimum attendance of 75% for both I mid-term examination, and II mid- term examination under CIA component shall be the benchmark for attendance and itshall be approved in the BOS.
7. It is resolved to modify Teaching learning methodology by 50:50 (External: Internal) ratio II & III Year Students commenced w.e.f. 2022-23.
8. It is resolved to implement certain academic procedures for slow and advanced learners by Remedial coaching for slow learners and project works, research, Conferences,etc., for advanced learners.
9. It is resolved appoint experienced faculty for Panel of paper setters and examiners duly following blooms taxonomy.
10. It is resolved to implement community service at adopted villages and Internships, Apprentice ship for Vertical growth of student.
11. It is resolved to implement the Departmental action plan for the AY 2023-24 and add if any needed during the course of the year.

It is resolved to introduce the following new courses in the programme B.Sc. Petrochemicals from the AY 2023-24

S. No	Course Code	Title of the new course	Programmes in which it is introduced
1		Nil	Nil

SIGNATURES OF THE MEMBERS WHO ATTENDED THE BOARD OF STUDIES IN CHEMISTRY ON 31.08.2023 AT 11:00AM

Mode of Conduct of Meeting: Offline/Online

NAME	SIGNATURE	CONTACT NO.
Sri. V. Sanjeeva Kumar	V-S	9849324986
Dr. M. Trinadh	M.T	9441383828
Dr. V. Narayana Rao	V. Narayana Rao	8328634392
Dr. T. Satyanarayana	T. Satyanarayana	9949694875
Dr. B. Ramesh Babu	B. Ramesh Babu	9701712028
Sri. T. V. V. Satyanarayana	T.V.V. Satyanarayana	9490876913
Sri. P. Vijay Kumar	Pvijay	9652023082
Sri. V. Rambabu	31/8/23	9948485537
Sri. G. Pavani	G Pavani	9912526493
Dr. N. Bujjibabu	31/8/23	9441394192
Dr. Ch. Praveen	praveench 31/8/23	9491185518
Sri. V. Venkateswara Rao	V. Venkateswara Rao 31/8/23	9885165588
Sri. U.S.N. Prasad	USN Prasad 31/8/23	63008 82584
K.N.S.Swami	K.N.S.Swami	9908900962
S. Vijaya Lakshmi	S. Vijaya Lakshmi 31/8/23	9133941966
T. Pavan Kumar	T. Pavan Kumar	8125885572
A.Ganesh	A. Ganesh	7815851801
V. Harshitha I B. Sc MCPc	V. Harshitha.	9581153305
A.John II B. Sc MCPc	A. John	7032454103

Semester wise/ Paper wise Marks / Credits allotted.

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
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
		V	Mass Transfer operations	100 (50:50)	04
			Practical – V	50	02
	Summer Internship-II		On the Job Training	100	04
III	V	VI	Petrochemicals-I	100 (50:50)	04
			Practical – VI	50	02
		VII	Petrochemicals II	100 (50:50)	04
			Practical - VII	50	02
	VI	Industry Apprenticeship		400	12

ADDITIONS/DELETIONS IN COURSES
PETROCHEMICALS

Year	SEMESTER & PAPER	ADDITIONS	DELETIONS
II	III & III	NIL	NIL
II	IV & IV	NIL	NIL
II	IV & V	NIL	NIL
III	V & VIA	NIL	NIL
III	V & VIIA	NIL	NIL
III	VI	APPERENTICESHIP	

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program &Semester II B.Sc. Mathematics, Chemistry, Petrochemicals & Semester-III			
CourseCode	**Introduction to chemical engineering-III**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Basic laws, venturi metre, chemical reactors	60	10	30	4+2

Course Objectives:

To gains basic knowledge on fluid mechanics.

Course Outcomes:

	On Completion of the course, the students will be able to-
CO-1	Understand and explain the properties of physico chemical calculations material balances and measuring devices.
CO-2	In Depth understanding of flow-meters and chemical reactors.
CO-3	Learn and analyse the basic concepts of environment management and corrosion in petroleum and petrochemical industries.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

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, Classius – Clapeyron Equation, Cox Chart, Duhring'splot

UNIT-II:

General Principles Applied in studying Industry: - Useful Mathematicalmethods – 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 BedReactors, Moving Bed Reactors.

Unit No	Addition	Deletion	Expected levels of learning as per Blooms taxonomy for assessment of CO	Percentage added/ deleted
1	-	-	K_2, K_3	-
2	-	-	K_1, K_2	-
3	-	-	K_3, K_6	-
4	-	-	K_1, K_2	-
5	-	-	K_3, K_6	-

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	Salil K. Ghosal and others.	Introduction to Chemical Engineering	Tata McGraw Hill
2	K.A. Gavhane. Nirali Prakashan – Pune.	Unit operations – I and II	

Web Links:

1.https://youtu.be/P--6V7Lusoo

2.https://youtu.be/_3JVLyMv5II

3. https://youtu.be/XL2IqiImLO4

Course outcome & Program outcome mapping

	On Completion of the course, the students will be able to-
CO-1	Understand and explain the properties of physico chemical calculations material balances and measuring devices.
CO-2	In Depth understanding of flow-meters and chemical reactors.
CO-3	Learn and analyse the basic concepts of environment management and corrosion in petroleum and petrochemical industries.

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3
CO1	3	0	0	2	2	2	2	2	2	2	3	0	0
CO2	3	3	0	2	2	2	2	1	1	1	0	3	0
CO3	3	0	3	2	2	2	2	1	1	1	0	1	3

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Program Outcomes

PO1 : Knowledge in petrochemicals : Apply the basic knowledge of petrochemicals to understand the measuring, calculations and balances of materials.

PO2: Problem analysis: Identify and analyse the problems in flow-meters and chemical reactors by applying the fundamental principles of chemical engineering

PO3: Design/development of solutions: Design regulations in environment management and construction of reactors using the principles of chemical engineering.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for chemical engineering.

PO6 : The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of chemical engineering for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9 : Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation and make effective presentations

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes

PSO-1: To identify and analyse the problems in chemical engineering by physic chemical calculation, material balances and measuring devices

PSO-2: Application of chemical engineering techniques to design and construction of eco-friendly chemical reactors.

PSO-3: Use of various environment management simulation tools in petrochemical industries.

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	20	Remembering, Understanding
5	Flow meters & chemical reactors	1	1	15	Application & Creation
	TOTAL	**6**	**7**	**95**	

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

II B.SC, PETROCHEMICALS

MODEL QUESTIONPAPER

PAPER – III – INTRODUCTION TO CHEMICAL ENGINEERING

Time: 2 Hrs. **Max. Marks 50M**

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.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

II B.SC., 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. Determination of Saponification Value.
4. Determination of Cloud and Pour Point of Different Oils.
5. Saybolt Viscometer.

SCHEME OF EVALUATION **Max. Marks: 50**

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

Co-Curricular Activities:

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Determination of Viscosity of different Liquids and Determination of Carbon residue by different methods, Aniline point.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of Viscosity of different Liquids and Determination of Carbon residue by different methods, Aniline point.

Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

P.R.GOVT. COLLEGE(A), KAKINADA.
II B.SC, PETROCHEMICALS
SEMESTER - III
PAPER –III: INTRODUCTION TO CHEMICAL ENGINEERING

QUESTION BANK

UNIT –I:

Essay Questions

1.a. Write in detail bout 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

Short answer Questions

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 andDensity of gas mixture
4. Explain about Mole fraction and mass fraction

UNIT –II:

Essay Questions

1. . 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.

Short answer Questions

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

UNIT –III:

Essay Questions

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

Short answer Questions

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:

Essay Questions

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.

Short answer Questions

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

UNIT –V:

Essay Questions

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

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

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II B.Sc. Mathematics, Chemistry, Petrochemicals & Semester-IV P-IV**			
Course Code	**Heat transfer operations and Polymers-IV**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**Heat transfer and polymers**	**60**	**10**	**30**	**4+2**

Course Objectives:

To gains basic knowledge on heat transfer operations and manufacture of polymers.

Course Outcomes:

	On Completion of the course, the students will be able to-
CO-1	Understand the concepts of general principles applied in studying industry
CO-2	In Depth understanding of flow of fluids
CO-3	Learn and apply the principles of heat transfer and evaporation

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT-I:

Heat Transfer:

Conduction – Fourier's Law, conduction through plane wall and through resistances in series, Heat flow through thick-walled cylinder, Heat flow through a sphere. Thermal Insulation.

Radiation: Laws of Black – Body radiation, Kirchhoff's law, Stefan- Boltzmann law, Planck's law, concept of Black Body.

UNIT-II:

Heat Transfer:

Convection: Natural and forced convection – Heat Transfer with change in Phase – Mechanism of Condensation Heat Transfer and Boiling Heat Transfer, Over all Heat Transfer coefficients, Logarithmic Mean Temperature difference.

Flow arrangements in Heat exchangers, Variation of Fluid Temperatures in Heat exchangers, Heat Transfer Equipment. Double pipe heat exchanger and shell and tube heat exchanger.

UNIT-III:

Evaporation:

Material and Enthalpy balances for single effect – Evaporator– Types of Evaporators-Common methods of feeding multiple evaporation system–Multiple effect Evaporation, Vapour Recompression, capacity, and economy of evaporator

UNIT-IV:

Polymers of Olefins

Polymers of Ethylene: Low Density Polyethylene (LDPE) – conventional and slurry processes, High Density Poly Ethylene (HDPE) – Zeigler process and Solution polymerisation process.

Polymers of Propylene different forms of polypropylene- manufacture of Isotactic polypropylene.

UNIT-V:

Polymers of Olefins

Poly Vinyl Chloride: Manufacture of PVC by suspension polymerization process and emulsion polymerization process.

Polystyrene: Manufacture of Polystyrene by mass polymerization and emulsion polymerization.

Manufacture of Polybutadiene and Poly Tetrafluoro ethylene (PTFE).

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_2, K_3	
II	--	--	K_1, K_3	
III	--	--	K_3, K_6	
IV	--	--	K_1, K_2	
V	--	--	K_3, K_6	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books & Reference Books

S. No	Author	Title	Publisher
1	Salil K. Ghosal and others	Introduction to Chemical Engineering	Tata Mc. Graw-Hill Publishing Company.
2	K.A. Gavhane	Heat transfer operations – I	Nirali Prakashan – Pune
3	K.A. Gavhane	Heat transfer operations-II	Nirali Prakashan – Pune

Web Links

1. https://youtu.be/P--6V7Lusoo
2. https://youtu.be/_3JVLyMv5II
3. https://youtu.be/XL2IqiImLO4

Course Outcomes& Programme Outcome Mapping

	On Completion of the course, the students will be able to-
CO-1	Understand the concepts of general principles applied in studying industry
CO-2	In Depth understanding of flow of fluids
CO-3	Learn and apply the principles of heat transfer and evaporation

CO-PO Mapping:

1: Low=1; 2: Moderate=2; 3: High=3; 4: No Correlation=0

	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	0	0	2	1	2	2	1	1	1	3	0	0
CO2	3	3	0	2	3	1	2	1	1	1	0	3	0
CO3	3	0	3	2	2	1	2	1	1	2	0	0	3

PROGRAM OUTCOMES

PO1: Knowledge in petrochemicals: Apply the basic knowledge of petrochemicals to learn the methods and processes like graphical integration and differentiation ….

PO2: Problem analysis: Identify and analyse the problems in industries by the application of principles in flow of fluids.

PO3: Design/development of solutions: Design solutions for heat transfer in industries.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modelling and interpretation of flow of fluids and heat transfer.

PO6: The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of Industrial chemistry for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9: Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation, and make effective presentations

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO-1: To identify and analyse the problems in industries by using principles of Industrial Chemistry

PSO-2: Applying knowledge of Industrial Chemistry to design and novel methods for flow of fluids in the industry.

PSO-3: Use of various heat transfer Simulation for optimisation of heat transfer in the industries.

WEIGHTAGE TO CONTENT
SEMESTER -IV
PAPER-IV
HEAT TRANSFER OPERATIONS AND POLYMERS

S. No	Course Content	Long Answer	Short Answer	Total Marks	As per Blooms Taxonomy
1	Heat transfer-I	1	1	15	Understanding, Application
2	Heat transfer-II	1	2	20	Remembering, Understanding
3	Evaporation	1	1	15	Application & Creation
4	Polymers of olefins-I	2	2	30	Remembering, Understanding
5	Polymers of olefins-II	1	1	15	Application & Creation
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

B.SC.-PETROCHEMICALS

MODEL QUESTIONPAPER

PAPER – IV – HEAT TRANSFER OPERATIONS AND POLYMERS

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– IV

PART-II

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
II B.SC. PETROCHEMICALS
PRACTICAL SYLLABUS
SEMESTER – IV
Paper-IV: Heat Transfer Operations and Polymers

1. Determination of viscosity index
2. Ostwald viscometer.
3. Determination of Acid Value of Oils.
4. Synthesis of Bakelite.

Lab References

S. No	Author	Title	Publisher
1	Salil K. Ghosal and others	Introduction to Chemical Engineering	Tata Mc. Graw- Hill Publishing Company.
2	K.A. Gavhane	Heat transfer operations – I	Nirali Prakashan – Pune
3	K.A. Gavhane	Heat transfer operations-II	Nirali Prakashan – Pune

SCHEME OF EVALUATION
PRACTICAL PAPER-IV: HEAT TRANSFER OPERATIONS AND POLYMERS
(AT THE END OF THE SEMESTER-IV)

Procedure to be written in the first 15 minutes **(15 Marks)**

Principle-5M

Procedure-5M

Tables&Formulas-5M

Recording of data and reporting the value...

Up to 2% error	25 Marks
Error up to 5%	15 Marks
Error greater than 5%	10 Marks
Viva – Voice	**5 Marks**
Record	**5 Marks**
Total	**50 Marks**

Co-Curricular Activities:

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Determination of Viscosity of different Liquids and estimation of their purity.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of Viscosity. And other properties of liquids. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

II B.SC. PETROCHEMICALS

QUESTION BANK

SEMESTER – IV

Heat Transfer Operations and Polymers

UNIT –I:

Essay Questions

1. a. Derive the steady state heat transfer equation through a plane wall.
   b. Derive the steady state heat transfer equation through a flat wall of three layers which are I perfect thermal contact.
2. a. Derive the steady state heat transfer equation through a thick-walled cylinder
   b. Derive the steady state heat transfer equation through a sphere
3. a. State and explain Kirchhoff's law
   b. Explain about the laws of Black body radiation

Short Answer Questions

1. Explain about Fourier's law of conduction
2. Write about thermal insulation
3. Explain the concept of black body
4. Write about Planck's law
5. Explain about Stefan Boltzmann's law

UNIT-II

Essay Questions

1. a. Explain the mechanism of condensation heat transfer.
   b. Derive the expression for overall heat transfer coefficient based on inside area
2. a. Explain about the variation of fluid temperature in Heat Exchanges.
   b. With a neat sketch describe about the design and functioning of shell and tube heat exchanger
3. a. Explain in detail about heat transfer equipment.
   b. Write about the design and functioning of double pipe heat exchanger.

Short Answer Questions

1. Write about types of convections.
2. Explain about Logarithmic mean temperature difference.

UNIT-III

Essay Questions

1. a. Write about the material and enthalpy balance calculations for single effect evaporator.
   b. Explain the design and functioning of long tube vertical evaporator With a neat diagram
2. a. Describe the Design and functioning of Forced circulation type Evaporator With a neat diagram.
   b. Explain Thermal Vapour Recompression Process With a neat sketch.

Short Answer Questions

1. Write briefly about Capacity and economy of an evaporator
2. Write about the process of evaporation
3. Explain the types of evaporators

UNIT-IV

Essay Questions

1. a. Describe the manufacturing of LDPE by conventional process with a neat flow diagram
   b. Describe the manufacturing of LDPE by slurry process with a neat flow diagram
2. a. Describe the manufacturing of HDPE by Ziegler process With a neat flow diagram
   b. Describe the manufacturing of HDPE by Solution Polymerisation process With a neat flow diagram

Short Answer Questions

1. Manufacturing of isotactic poly propylene.
2. Ziegler Natta catalyst
3. Different types of poly propylene

UNIT-V

Essay Questions

1. a. Describe the manufacturing of Poly vinyl chloride by suspension process with a neat flow diagram.
   b. Describe the manufacturing of Poly vinyl chloride by emulsion polymerization process with a neat flow diagram.
2. a. Describe the manufacturing of poly styrene by bulk polymerization process with a neat flow diagram
   b. Diagram describe the manufacturing of poly styrene by emulsion by polymerization process with a neat flow.

Short Answer Questions

1.Manufacturing of poly butadiene
2.Manufacturing of Poly tetrafluoro ethylene.

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II B.Sc. Mathematics, Chemistry, Petrochemicals & Semester-IV P-V**			
Course Code	**Mass Transfer Operations**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**Basics on adsorption and distillation**	**60**	**10**	**30**	**4+2**

Course Objectives:

To gains knowledge on mass transfer operations of distillation.

Course Outcomes:

	On Completion of the course, the students will be able to-
CO-1	Understand the principles of diffusion of gases, liquids, and absorption of gases.
CO-2	In Depth understanding of distillation operations.
CO-3	Learn and apply liquid extraction and crystallisation.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT-I:

Absorption (Gas Absorption) -Selection criteria for solvent in Gas absorption– material balances for a packed column – Pressure drops in packed columns Gas Absorption equipment – Tower packings. Adsorption: Types of Adsorption - Adsorption equipment.

UNIT-II:

Distillation (I):

Concept of distillation – vapor – liquid equilibrium – relative volatility – Boiling point diagram -Various methods of distillation – differential distillation, Flash distillation, Fractionating column - Analysis of Fractionating columns – calculations of number of theoretical stages by McCabe – Thiele method.

UNIT-III:

Distillation (II):

Derivation of equation of q-line, effect of feed condition on slope of q-line, calculation-of number of plates and location of feed plate, Importance of reflux ratio-concept of total reflux and minimum reflux ratio-optimum reflux ratio. – Equipment for Gas-liquid operations.

UNIT-IV:

Extraction:

Liquid – liquid extraction – extraction schemes – distribution coefficient – triangular diagram – selection of solvent for extraction – single stage equilibrium extraction – multistage extraction process – Industrial liquid – liquid extraction equipment's.

UNIT-V:

Crystallization & Drying –

Solubility and solubility curves, saturation, and super-saturation – methods of achieving super saturation – The Mier's super saturation theory – mechanism of crystallization process – material and Heat balances in crystallization – classification and construction of crystallization equipment.

Drying: Material and Heat balance equations in Continuous drying operation- Drying equipment - Tray dryer, rotary dryer & Spray dryer.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_2, K_3	
II	--	--	K_1, K_2	
III	--	--	K_3, K_6	
IV	--	--	K_1, K_2	
V	--	--	K_3, K_6	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books & Reference Books

S. No	Author	Title	Publisher
1	Salil K. Ghosal and others	Introduction to Chemical Engineering	Tata Mc. Graw- Hill Publishing Company.
2	K.A. Gavhane	Heat transfer operations – I	Nirali Prakashan – Pune
3	K.A. Gavhane	Heat transfer operations-II	Nirali Prakashan – Pune

Web Links

https://youtu.be/SmchkR7jRIE
https://youtu.be/5nTkArHe4bY

Course Outcomes& Programme Outcome Mapping

	On Completion of the course, the students will be able to-
CO-1	Understand the principles of diffusion of gases, liquids, and absorption of gases.
CO-2	In Depth understanding of distillation operations.
CO-3	Learn and apply liquid extraction and crystallisation.

CO-PO Mapping:

1: Low=1; 2: Moderate=2; 3: High=3; 4: No Correlation=0

	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO2	PSO3
CO1	3	0	0	2	2	2	2	1	1	1	3	0	0
CO2	0	3	0	2	2	1	2	1	2	2	0	3	0
CO3	0	0	3	2	2	2	2	2	1	1	0	0	3

PROGRAM OUTCOMES

PO1 : Knowledge in Petrochemicals : Apply the basic knowledge of diffusion and absorption to study the properties of gases and liquids.

PO2: Problem analysis: Identify and analyse problems of distillation of liquids.

PO3: Design/development of solutions: Designing solutions for the problems in extraction of liquids and crystallisation of solutions.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of diffusion, absorption and distillation properties of liquids and gases.

PO6 : The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of mass transfer operations for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9 : Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation and make effective presentations

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO-1: To identify and analyse the problems in diffusion and absorption of liquids and gases.

PSO-2: Applying the knowledge of mass transfer operations to design a system, analyse and interpret data towards distillation of liquids.

PSO-3: Use of various extraction and crystallisation Simulation tools to study the liquids, solubility of liquids and crystallisation of liquids.

WEIGHTAGE TO CONTENT
SEMESTER -IV
PAPER-V
MASS TRANSFER OPERATIONS

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Absorption	2	1	25	Understanding, Application
2	Distillation-I	1	2	20	Remembering, Understanding
3	Distillation-II	1	1	15	Application & Creation
4	Extraction	1	2	20	Remembering, Understanding
5	Crystallization & drying	1	1	15	Application & Creation
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

B.SC.-PETROCHEMICALS

MODEL QUESTIONPAPER

PAPER – IV – HEAT TRANSFER OPERATIONS AND POLYMERS

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-II

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
II B.SC. PETROCHEMICALS
PRACTICAL SYLLABUS
SEMESTER – IV
Mass Transfer Operations

1. Determination of Specific gravity by Specific gravity bottle.
2. Determination of Specific gravity by Pycnometer.
3. Simple Distillation
4. Steam distillation

SCHEME OFVALUATION

Procedure to be written in the first 15 minutes	**15 Marks**
Procedure-5M	
Principle-5M	
Tables&formula-5M	
Recording of data and reporting the value	**25 Marks**
up to 2% error	25M
Error up to 5%	15 M
Error greater than 5%	10 Marks
Viva – Voice	**5 Marks**
Record	**5 Marks**
Total	**50 Marks**

Co-Curricular Activities:

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Determination of Specific Gravity of different Liquids and estimation of their percentage of purity.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of Viscosity. And other properties of liquids. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

II B.SC. PETROCHEMICALS

QUESTION BANK

SEMESTER – IV

Paper-V: Mass Transfer Operations

UNIT –I:

Essay Questions

1.a. Define gas absorption. Give suitable examples.

b. What factors should be considered while selecting solvent for gas absorption

2. a Explain about the material balances for packed columns.

b. Draw a neat sketch of packed column and write its construction and functioning

c. Write about the pressure drop in packed columns.

3.a. State and derive Longmuir's adsorption isotherm

b. Explain in detail about adsorption equipment

Short Answer Questions

1. Write about types of adsorption
2. Explain about Freundlich adsorption isotherm
3. What factors should be considered while selecting solvent for gas absorption.
4. What is gas absorption? Give example.

UNIT –II:

Essay Questions

1. a. What is differential distillation? Derive Rayleigh equation

b. Describe the details of constructing boiling point diagrams

2. a. Explain about the Flash distillation and derive the expression for operating material balance of flash distillation.

b. Explain in detail about the method of carrying out analysis of fractionating columns.

Short Answer Questions

1. Explain briefly the concept of Distillation
2. Write a short note on Vapor – Liquid equilibria
3. Write a short note on relative volality.

UNIT –III:

Essay Questions

1. a. Explain the flow through feed plate for various thermal conditions of feed.

b. What is q – factor? Derive the expression for q – factor and write about theeffect of feed conditions on feed line.

2. a. Explain the method of calculating the total number ofplates and location of feed plate in a fractionating column.

b. Explain the concepts of minimum and total Reflux Ratios.

Short Answer Questions

1. Explain the terms Reflux and Reflux ratios
2. Write about Optimum reflex ratio
3. Write about q – line

UNIT –IV:

Essay Questions

1. a. Explain the principles of Liquid – liquid extractions and explain briefly the selection criteria for solvents to be used for liquid – liquid extraction.
   b. Explain about single stage equilibrium extraction.
2. a. Explain about the extraction schemes used in Liquid – liquid extraction.
   b. Write about multi stage extraction process.

Short Answer Questions

1. Write about triangular diagrams
2. Write about distribution coefficient
3. Explain briefly about Solvent extraction

UNIT –V:

Essay Questions

1. a. Define solubility and write in detail about solubility curves
   b. Write in detail about the Miers super saturation theory
2. a. Explain in detail about the mechanism of crystallization
   b. Carry out the material balance calculations for crystallization process.
3. a. With a neat sketch explain the construction and working of continuous vacuum crystallizer.
   b. With a neat sketch explain the construction and working of agitated tank crystallizer.

Short Answer Questions

1.Explain the terms saturation and super saturation.
2.Write briefly about the methods of super saturation.
3. Write a short note on drying process.

	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:	Basics on synthetic gas and detergents	60	10	30	4+2

Course Objectives:

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

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand and explain the basic principles of feed stock for petrochemicals and natural gas.
CO2	In Depth understanding of synthesis gas and its production.
CO3	Learn and apply the production of synthetic detergents, petroleum coke and carbon black.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-I

Feed stock for petrochemicals – Purification of gases – ethanolamine sweetening process –separation of gases into individual Constituents, separation of C_4 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 andits Production of Substitute Natural Gas (SNG) from Naphtha.

Liquefied Petroleum Gas:

Sources of LPG – Composition of LPG – Chemical and physical properties ofLPG – 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 ofFuel 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 andpure carbon monoxide.

UNIT-IV

Chemicals from Synthesis gas:

Production of methanol – Oxo synthesis – production of Propionaldehyde and2 – 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.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_2, K_3	
II	--	--	K_1, K_3	
III	--	--	K_3, K_6	
IV	--	--	K_1, K_2	
V	--	--	K_3, K_6	

K_1= Remembering, K_2= Understanding, K_3= Applying,
K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books & Reference Books

S. No	Author	Title	Publisher
1	Dr. B.K. Bhaskara Rao	A text on petrochemicals	Khanna Publishers, Delhi.
2	I.D. Mall	Petrochemical process Technology	Macmillan India Ltd.,
3	B.K. Sharma	Fuels and petrochemical processing	Goel Publishing HouseMeerut.

Weblinks

1.https://youtu.be/SmchkR7jRIE

2. https://youtu.be/5nTkArHe4bY

Course outcome & Program outcome mapping

On Completion of the course, the students will be able to-	
CO1	Understand and explain the basic principles of feed stock for petrochemicals and natural gas.
CO2	In Depth understanding of synthesis gas and its production.
CO3	Learn and apply the production of synthetic detergents, petroleum coke and carbon black.

CO-PO Mapping

1: Low=1; 2: Moderate=2; 3: High=3; 4: No Correlation=0

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	0	0	2	2	1	2	1	1	1	3	0	0
CO2	0	3	3	2	1	1	1	1	1	1	0	3	3
CO3	0	0	3	2	3	1	1	1	1	1	0	3	3

Program Outcomes

PO1: Knowledge in Petrochemicals: Apply the basic knowledge of petrochemicals to learn feed stock for petrochemicals and natural gas.

PO2: Problem analysis: Identify and analyse problems in synthesis gas production.

PO3: Design/development of solutions: Design solutions for the production of synthetic detergents, petroleum coke and carbon black.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of synthesis gas and by products of petroleum.

PO6 : The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of petrochemicals for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9 : Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation and make effective presentations

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO-1: To identify and analyze the problems in feed stock for petrochemicals and natural gas using principles of Petro chemistry

PSO-2: Applying knowledge of Petro chemistry to design production for synthesis gas, synthetic detergents, petroleum coke and carbon black.

PSO-3: Use of various simulation tools for the synthesis gas, synthetic detergents, petroleum coke and carbon black.

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	2	20	Understanding, Application
2	Natural gas	2	1	25	Remembering, Understanding
3	Synthesis gas and its production	1	2	20	Application & Creation
4	Chemicals from synthesis gas	1	1	15	Remembering, Understanding
5	Synthetic detergents	1	1	15	Application & Creation
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

B.Sc. -PETROCHEMICALS

MODEL QUESTIONPAPER

PAPER VI – PETROCHEMICALS – I

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– II

PART-II

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 – I
9. Question from Unit – II
10. Question from Unit – III
11. Question from Unit – III
12. Question from Unit – IV
13. Question from Unit – V

Note to Paper Setter: -

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

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

SEMESTER-V

PAPER-VI-Petrochemicals

PRACTICAL – VI (At the end of Fifth Semester)

1. Determination of Partition Coefficient.
2. Diffusion coefficient.
3. Colorimetric estimation of KMnO4 solution.
4. Colorimetric estimation of Fe (III) – Thiocyanate Method.

SCHEME OFVALUATION

Procedure to be written in the first 15 minutes	**15 Marks**
Recording of data and reporting the value	**25 Marks**
Marks upto 2% error	25 Marks
Error up to 5%	15 Marks
Error greater than 5%	10 Marks
Viva – Voice	**5 Marks**
Record	**5 Marks**
Total	**50Marks**

Co-Curricular Activities:

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Determination of Partition of different Solutes and estimation of Concentration of solution by colorimetry.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of Partition of different Solutes and estimation of Concentration of solution by colorimetry. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

B.Sc. -PETROCHEMICALS

QUESTION BANK

PAPER VI – PETROCHEMICALS – I

UNIT –I:

Essay Questions

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.

Short Answer Questions

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

Essay Questions

1. 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

Short Answer Questions

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

Essay Questions

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

Short Answer Questions

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

Essay Questions

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.

Short Answer Questions

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

UNIT-V

Essay Questions

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

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

	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:	Basics on organic compounds	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	Understand the concepts of production of chemicals from methane
CO2	In Depth understanding and production of chemicals from alkenes
CO3	Learn and apply the principles production of chemicals from aromatic petrochemicals.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT-I

Chemicals from Methane (C_1 Compounds).

Production of Methanol, Fluro chloromethanes, Hydrogen Cyanide and Methylamine from Methane.

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

Production of Hexamethylene Tetramine and Ethylene Glycol fromformaldehyde.

UNIT-II

Chemicals from Ethylene (C_2 compounds)

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

UNIT-III

Chemicals from propylene (C_3 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-IV

Chemicals from Butylene, Butadiene and pentanes. (C_4 and C_5 compounds)

Dehydrogenation of Butanes for the Production of Butene's 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_5 feed).

UNIT-V

Petroleum Aromatics and its chemicals:

Production of BTX through catalytic reforming, Reformate separation into Aromatics (Undex 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.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_2, K_3	
II	--	--	K_1, K_3	
III	--	--	K_3, K_6	
IV	--	--	K_1, K_2	
V	--	--	K_3, K_6	

K_1= Remembering, K_2= Understanding, K_3= Applying,
K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books & Reference Books

S. No	Author	Title	Publisher
1	Dr. B.K. Bhaskara Rao	A text on petrochemicals	Khanna Publishers, Delhi.
2	I.D. Mall	Petrochemical process Technology	Macmillan India Ltd.,
3	B.K. Sharma	Fuels and petrochemical processing	Goel Publishing HouseMeerut.

Web Links:

1.https://youtu.be/SmchkR7jRIE

2. https://youtu.be/5nTkArHe4bY

CO-PO Mapping:

1: Low=1; 2: Moderate=2; 3: High=3; 4: No Correlation=0

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO 1	3	3	3	2	1	1	2	1	1	1	3	3	2
CO 2	3	3	3	2	2	1	2	1	1	1	3	3	3
CO 3	3	3	3	2	1	1	1	1	1	1	3	3	3

Program Outcomes

PO1 : Knowledge in production of chemicals: Apply the knowledge of petrochemicals in the production of chemicals from alkanes, alkenes and aromatic petroleum substances.

PO2: Problem analysis: Identify and analyze the problems in the production of chemicals from alkanes, alkenes and aromatic petroleum substances.

PO3: Design/development of solutions: Design solutions for simple to complex problems in the production of chemicals from alkanes, alkenes and aromatic petroleum substances.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of simple to complex reactions

PO6 : The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of production of chemicals from petroleum industry for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.
PO9: Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation and make effective presentations
PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

PSO-1: To identify and analyze the problems in production of chemicals from alkanes, alkenes and aromatic petroleum substances.
PSO-2: Applying knowledge of petrochemicals to increase the production of chemicals from alkanes, alkenes and aromatic petroleum substances.

PSO-3: Use of various Simulation tools to improve the production of chemicals.

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	2	20	Understanding, Application
2	Chemicals from C2 components	1	1	15	Remembering, Understanding
3	Chemicals from C3 components	1	1	15	Application & Creation
4	Chemicals from C4components	1	2	20	Remembering, Understanding
5	Chemicals from BTX aromatics	2	1	25	Application & Creation
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

B.SC.-PETROCHEMICALS

MODEL QUESTIONPAPER

PAPER –VII: PETROCHEMICALS – II

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– V

PART-II

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 – I
13. Question from Unit – IV

Note to Paper Setter: -

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

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

PAPER-VII: Petrochemicals-II
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 EVALUATION

Procedure to be written in the first 15 minutes	
Chemical Reaction-	10 Marks
Procedure-	10Marks
Yield	10Marks
Viva – Voice	10 Marks
Record	10 Marks
Total	**50 Marks**

Co-Curricular Activities:

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Preparation of Dyes and their applications.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Preparation of Dyes and their applications. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.

B.SC.-PETROCHEMICALS

QUESTION BANK

PAPER –VII: PETROCHEMICALS – II

UNIT-I

Essay Questions

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.

Short Answer Questions

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

Essay Questions

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

Short Answer Questions

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

UNIT-III

Essay Questions

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

neat flow

Short Answer Questions

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

UNIT-IV

Essay Questions

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

Short Answer Questions

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

UNIT-V

Essay Questions

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

Short Answer Questions

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