DIPLOMA IN ENGINEERING AND TECHNOLOGY

1075

DEPARTMENT OF PETROCHEMICAL ENGINEERING

SEMESTER PATTERN

N – SCHEME

IMPLEMENTED FROM 2020 - 2021

CURRICULUM DEVELOPMENT CENTRE

DIRECTORATE OF TECHNICAL EDUCATION
CHENNAI-600 025, TAMIL NADU.

DIPLOMA IN PETROCHEMICAL ENGINEERING

N-SCHEME

(Implemented from academic year 2020-21 onwards)

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DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY
(SEMESTER SYSTEM)

(Implemented from 2020 - 2021)

N – SCHEME

R E G U L A T I O N S*

* *Applicable to the Diploma Courses other than Diploma in Hotel Management & Catering Technology*.

1. Description of the Course:

a. Full Time (3 years)

The Course for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters* and the First Year is common to all Engineering Branches.

b. Sandwich (3½ years)

The Course for the Sandwich Diploma in Engineering shall extend over a period of three and half academic years, consisting of 7 semesters* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience.

During 4th and/or during 7thsemester the students undergo industrial training for six months/ one year. Industrial training examination will be conducted after completion of every 6 months of industrial training.

c. Part Time (4 years)

The course for the Part Time Diploma in Engineering shall extend over a period of 4 academic years containing of 8 semesters*, the subjects of 3 year full time diploma courses being regrouped for academic convenience.

* ***Each Semester will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Courses and 18 hrs. / Week for Part-Time Diploma Courses.***

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses viz. Textile Technology, Leather Technology, Printing Technology, Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2020 – 2021 academic year onwards.

2. Condition for Admission:

Condition for admission to the Diploma courses shall be required to have passed in the S.S.L.C. Examination of the Board of Secondary Education, Tamil Nadu.

(Or)

The Anglo Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examinations recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

Note: In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

3. Admission to Second year (Lateral Entry):

A pass in HSC (academic) or (vocational) courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for University Courses of study or equivalent examination& Should have studied the following subjects.

A pass in 2 Years ITI with appropriate Trade or Equivalent examination.

Sl. No	Courses	H.Sc Academic	H.Sc Vocational		Industrial Training Institutes Courses
		Subjects Studied	Subjects Studied		
			Related subjects	Vocational subjects	
1.	All the Regular and Sandwich Diploma Courses	Physics and Chemistry as compulsory along with Mathematics / Biology	Maths / Physics / Chemistry	Related Vocational Subjects Theory & Practical	2 years course to be passed with appropriate Trade

2.	Diploma Course in Commercial Practice	English & Accountancy English & Elements of Economics English & Elements of Commerce	English & Accountancy, English & Elements of Economics, English & Management Principles & Techniques, English & Typewriting	Accountancy & Auditing, Banking, Business Management, Co-operative Management, International Trade, Marketing & Salesmanship, Insurance& Material Management, Office Secretaryship.	-

- For the Diploma Courses related with Engineering/Technology, the related / equivalent subjects prescribed along with Practicals may also be taken for arriving the eligibility.
- Branch will be allotted according to merit through counseling by the respective Principal as per communal reservation.
- For admission to the Textile Technology, Leather Technology, Printing Technology, Chemical Technology and Commercial Practice Diploma courses the candidates studied the related subjects will be given first preference.
- *Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.*

4. Age Limit: No Age limit.

5. Medium of Instruction: English

6. Eligibility for the Award of Diploma:

No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3 academic years in any institution affiliated to the State Board of Technical Education and Training, Tamil Nadu, when joined in First Year and two years if joined under Lateral Entry scheme in the second year and passed the prescribed examination.

The minimum and maximum period for completion of Diploma Courses are as given below:

Diploma Course	Minimum Period	Maximum Period
Full Time	3 Years	6 Years
FullTime (Lateral Entry)	2 Years	5 Years
Sandwich	3½ Years	6½ Years
Part Time	4 Years	7 Years

This will come into effect from N Scheme onwards i.e. from the academic year 2020-2021.

7. Subjects of Study and Curriculum outline:

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical subjects.

The curriculum outline is given in Annexure – I.

8. Examinations:

Board Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester.

The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment. Board Examinations are conducted for 100 marks and reduced to 75.

The total marks for result are 75 + 25 = 100 Marks.

9. Continuous Internal Assessment:

A. For Theory Subjects:

The Internal Assessment marks for a total of 25 marks, which are to be distributed as follows:

i) Subject Attendance **5 Marks**

(Award of marks for subject attendance to each subject Theory/Practical will be as per the range given below)

80%	-	83%	1 Mark
84%	-	87%	2 Marks
88%	-	91%	3 Marks
92%	-	95%	4 Marks
96%	-	100%	5 Marks

ii) Test # **10 Marks**

2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of the these two test marks will be taken and the marks to be reduced to:	05 Marks
The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to :	05 Marks

TEST	*UNITS*	**WHEN TO CONDUCT**	*MARKS*	*DURATION*
Test I	Unit – I & II	End of 6th week	50	2 Hrs
Test II	Unit – III & IV	End of 12th week	50	2 Hrs
Test III	**Model Examination:** Covering all the 5 Units. (Board Examinations-question paper-pattern).	End of 16th week	100	3 Hrs

From the Academic Year 2020 – 2021 onwards.

Question Paper Pattern for the Test -I and Test – II is as follows. The tests should be conducted by proper schedule. Retest marks should not be considered for internal assessment.

Without Choice:

Part A Type questions:	6 Questions × 1 mark	06 marks
Part B Type questions:	7Questions × 2marks	14 marks
Part C Type questions:	2 Questions × 15 marks	30 marks
	Total	**50 marks**

iii) Assignment **5 Marks**

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 5 marks.

iv) Seminar Presentation **5 Marks**

The students have to select the topics either from their subjects or general subjects which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present seminar (For First and Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member

of the group should participate in the presentation. For the Third Year, the students should present the seminar individually.) The seminar presentation is mandatory for all theory subjects and carries 5 marks for each theory subject. The respective subject faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (2½ marks for the material submitted in writing and 2 ½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 5 marks.

All Test Papers, Assignment Papers / Notebooks and the seminar presentation written material after getting the signature with date from the students must be kept in safe custody in the department for verification and audit. It should be preserved for one semester after publication of Board Exam results and produced to the flying squad and the inspection team at the time of inspection/verification.

B. <u>For Practical Subjects:</u>

The Internal Assessment mark for a total of 25 marks which are to be distributed as follows:-

a) Attendance :**5Marks**

(Award of marks same as theory subjects)

b) Procedure/ observation and tabulation/
Other Practical related Work :**10Marks**

c) Record writing :**10Marks**

TOTAL : **25Marks**

- *All the Experiments/Exercises indicated in the syllabus should be completed and the same to be given for final Board examinations.*
- The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.

- The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks for each exercise as per the above allocation.
- At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks (including Observation and Record writing) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

All the marks awarded for Assignments, Tests, Seminar presentation and Attendance should be entered periodically in the Personal Theory Log Book of the staff, who is handling the theory subject.
The marks awarded for Observation, Record work and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical subject.

10. Communication Skill Practical, Computer Application Practical and Physical Education:

The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to increase the Communication skill and ICT skill of students.

As per the recommendation of MHRD and under Fit India scheme, the Physical education is introduced to encourage students to remain healthy and fit by including physical activities and sports.

11. Project Work and Internship:

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. **The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.**

a) Internal assessment mark for Project Work &Internship:

Project Review I	…	**10 marks**
Project Review II	…	**10 marks**
Attendance	…	**05 marks**(Award of marks same as theory subject pattern)
Total	…	**25 marks**

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

b) Allocation of Marks for Project Work &Internship in Board Examinations:

Demonstration/Presentation	25 marks
Report	25 marks
Viva Voce	30 marks
Internship Report	20 marks
Total	**100* marks**

*Examination will be conducted for 100 marks and will be converted to 75 marks.

c) Internship Report:

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year "Project Work & Internship" for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centres / Institutions / Schemes.

A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work &Internship Board examination.

12.Scheme of Examinations:

The Scheme of examinations for subjects is given in Annexure - II.

13. Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.

2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than 40% in theory subjects and 50% in practical subjects out of the total prescribed maximum marks including both the Internal Assessment and the Board Examinations marks put together, subject to the condition that he/she secures at least a minimum of 40 marks out of 100 marks in the Board Theory Examinations and a minimum of 50 marks out of 100 marks in the Board Practical Examinations.

14. **Classification of successful candidates:**

Classification of candidates who will pass out the final examinations fromApril 2023 onwards (Joined first year in 2020 -2021) will be done as specified below.

First Class with Superlative Distinction:

A candidate will be declared to have passed in **First Class with Superlative Distinction** if he/she secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all

subjects within the stipulated period of study 2 / 3/ 3½/ 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

First Class with Distinction:

A candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all subjects within the stipulated period of study 2 / 3/ 3½/ 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

First Class:

A candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within the stipulated period of study 2 / 3/ 3½/ 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

Second Class:

All other successful candidates will be declared to have passed in **Second Class.**

The above classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021)

15. Duration of a period in the Class Time Table:

The duration of each period of instruction is1 hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

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ANNEXURE I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN PETROCHEMICAL ENGINEERING SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

CURRICULUM OUTLINE

THIRD SEMESTER

Subject Code	SUBJECT	Hours Per Week			
		Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours
4075310	Petroleum Refining	5	-	-	5
4076320	General Engineering*	5	-	-	5
4076330	Momentum Transfer*	5	-	-	5
4075340	Basics of Petrochemicals	5	-	-	5
4076350	Technical Analysis Practical*	-	-	4	4
4076360	General Engineering Practical*	-	-	4	4
4076370	Momentum Transfer Practical*	-	-	4	4
Extra - Curricular activities	Physical Education	-	-	2	2
	Library	1	-	-	1
Total		21	-	14	35

FOURTH SEMESTER

Subject Code	SUBJECT	Hours Per Week			
		Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours
4076410	Mechanical Operations*	5	-	-	5
4076420	Heat Transfer*	5	-	-	5
4076430	Chemical Process Calculations*	5	-	-	5
4075440	Petrochemical Technology	5	-	-	5
4076450	Mechanical Operations Practical*	-	-	4	4
4076460	Heat Transfer Practical*	-	-	4	4
4075470	Distillate Testing Practical I	-	-	4	4
Extra - Curricular activities	Physical Education	-	-	2	2
	Library	1	-	-	1
Total		21	-	14	35

FIFTH SEMESTER

Subject Code	SUBJECT	Hours Per Week			
		Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours
4075510	Processing of Chemicals	6	-	-	6
4076520	Process Instrumentation and Control*	5	-	-	5
	Elective - I				
4075531	Fertilizer Technology	5	-	-	5
4075532	Drilling Engineering				
4075533	Process Utilities				
4076540	Entrepreneurship and Starts ups#	-	-	4	4
4076550	Chemical Process Simulation Practical*	-	-	4	4
4076560	Process Instrumentation and Control Practical*	-	-	4	4
4075570	Distillate Testing Practical II	-	-	4	4
Extra - Curricular activities	Physical Education	-	-	2	2
	Library	1	-	-	1
Total		17	-	18	35

SIXTH SEMESTER

Subject Code	SUBJECT	Hours Per Week			
		Theory Hours	Tutorial / Drawing	Practical Hours	Total Hours
4075610	Refinery Mass Transfer	6	-	-	6
4076620	Industrial Safety and Pollution Control*	6	-	-	6
	Elective – II				
4075631	Energy Resources and Management	6	-	-	6
4076632	Natural Gas Engineering*				
4076633	Environmental Engineering and solid waste management*				
4076640	Mass Transfer Practical*	-	-	4	4
4076650	Chemical CAD Practical*	-	-	4	4
4075660	Project work and Internship	-	-	6	6
Extra - Curricular activities	Physical Education	-	-	2	2
	Library	1	-	-	1
Total		19	-	16	35

* Subject common with Diploma in Chemical Engineering

Common to all Branches

ANNEXURE II

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN PETROCHEMICAL ENGINEERING SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

SCHEME OF EXAMINATION

THIRD SEMESTER

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment Mark	Board Exam. Mark*	Total Mark		
4075310	Petroleum Refining	25	100	100	40	3
4076320	General Engineering*	25	100	100	40	3
4076330	Momentum Transfer*	25	100	100	40	3
4075340	Basics of Petrochemicals	25	100	100	40	3
4076350	Technical Analysis Practical*	25	100	100	50	3
4076360	General Engineering Practical*	25	100	100	50	3
4076370	Momentum Transfer Practical*	25	100	100	50	3
	TOTAL	175	700	700		

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

FOURTH SEMESTER

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment Mark	Board Exam. Mark*	Total Mark		
4076410	Mechanical Operations*	25	100	100	40	3
4076420	Heat Transfer*	25	100	100	40	3
4076430	Chemical Process Calculations*	25	100	100	40	3
4075440	Petrochemical Technology	25	100	100	40	3
4076450	Mechanical Operations Practical*	25	100	100	50	3
4076460	Heat Transfer Practical*	25	100	100	50	3
4075470	Distillate Testing Practical I	25	100	100	50	3
	TOTAL	175	700	700		

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

FIFTH SEMESTER

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment Mark	Board Exam. Mark*	Total Mark		
4075510	Processing of Chemicals	25	100	100	40	3
4076520	Process Instrumentation and Control*	25	100	100	40	3
	Elective – I					
4075531	Fertilizer Technology	25	100	100	40	3
4075532	Drilling Engineering					
4075533	Process Utilities					
4076540	Entrepreneurship and Starts ups#	25	100	100	40	3
4076550	Chemical Process Simulation Practical*	25	100	100	50	3
4076560	Process Instrumentation and Control Practical*	25	100	100	50	3
4075570	Distillate Testing Practical II	25	100	100	50	3
	TOTAL	175	700	700		

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

SIXTH SEMESTER

Subject Code	SUBJECT	Examination Marks			Minimum for Pass	Duration of Exam Hours
		Internal Assessment Mark	Board Exam. Mark*	Total Mark		
4075610	Refinery Mass Transfer	25	100	100	40	3
4076620	Industrial Safety and Pollution Control*	25	100	100	40	3
	Elective – II					
4075631	Energy Resources and Management	25	100	100	40	3
4076632	Natural Gas Engineering*					
4076633	Environmental Engineering and solid waste management*					
4076640	Mass Transfer Practical*	25	100	100	50	3
4076650	Chemical CAD Practical*	25	100	100	50	3
4075660	Project work and Internship	25	100	100	50	3
	TOTAL	150	600	600		

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

List of Equivalent Subjects for "M" Scheme to "N" Scheme

Sem	Subject Code	M-Scheme (Implementing Academic Year 2015–2016)	Subject Code	N-Scheme (Implementing Academic Year 2020–2021)
III Semester				
III	37131	Petroleum Refining	4075310	Petroleum Refining
III	37032	Mechanical Engineering	-	No Equivalent
III	37033	Electrical and Electronics Engineering	-	No Equivalent
III	37034	Mechanical Engineering Practical	-	No Equivalent
III	37035	Electrical and Electronics Engineering Practical	-	No Equivalent
III	37136	Distillate Testing Practical – I	4075470	Distillate Testing Practical – I
III	30001	Computer Applications Practical	-	No Equivalent
IV Semester				
IV	37041	Mechanical Operations	4076410	Mechanical Operations
IV	37042	Momentum Transfer	4076330	Momentum Transfer
IV	37143	Basics of Petrochemicals	4075340	Basics of Petrochemicals
IV	37044	Engineering Drawing	-	No Equivalent
IV	37045	Mechanical Operations Practical	4076450	Mechanical Operations Practical
IV	37046	Momentum Transfer Practical	4076370	Momentum Transfer Practical
IV	37047	Technical Analysis Practical	4076350	Technical Analysis Practical
V Semester				
V	37051	Heat Transfer	4076420	Heat Transfer
V	37052	Chemical Process Calculations	4076430	Chemical Process Calculations
V	37053	Process Instrumentation and Control	4076520	Process Instrumentation and Control
V	37171	**Elective-I** 1.Petrochemical Technology	4075440	Petrochemical Technology
	37172	2. Natural Gas Engineering	4076632	Natural Gas Engineering
V	37055	Chemical Process Measurement and Control Practical	4076560	Process Instrumentation and Control Practical
V	37056	Heat Transfer Practical	4076460	Heat Transfer Practical
V	30002	Life and Employability Skill Practical	-	No Equivalent
VI Semester				
VI	37161	Refinery Mass Transfer	4075610	Refinery Mass Transfer
VI	37162	Processing of Chemicals	4075510	Processing of Chemicals
VI	37181	**Elective- II** 1.Energy Resources and Safety Management	4075631	Energy Resources and Management
	37182	2. Environmental Engineering	4076633	Environmental Engineering
VI	37064	Mass Transfer Practical	4076640	Mass Transfer Practical
VI	37165	Distillate Testing Practical – II	4075570	Distillate Testing Practical – II
VI	37066	Chemical CAD and Process Simulation Practical	4076650	Chemical CAD Practical
VI	37167	Project Work	4075660	Project Work

Board Examination - Question Paper Pattern

Time: 3 Hrs. Max.Marks:100

PART – A Five questions will be asked covering all units. All questions are to be answered. Each question carries 1 mark.

PART – B Fifteen questions will be asked covering all the units. Three questions from each unit. Answer any ten questions. Each question carries 2 marks.

PART – C Five questions will be asked Either or type. One question from every unit. Answer either A or B. Each question carries 15 marks. A and B have subdivisions. (7 + 8)

The questions are to be numbered from 1 to 25. All the units are to be covered with equal weightage.

PART A Definitions and Statements. Question Number 1 to 5	5 X 1 = 5 Marks
PART B Short answer type questions Question Number 6 to 20	10 X 2 = 20 Marks
PART C Descriptive answer type questions (Either A or B) Question number 21 to 25	5 X15 = 75 Marks
TOTAL	100 Marks

Note : Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075310

Semester : III

Subject Title : PETROLEUM REFINING

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
PETROLEUM REFINING	**5**	**80**	**25**	**100***	**100**	**3 Hrs**

*** Examination will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
1	Petroleum Exploration	15
2	Storage and Evaluation of Petroleum	15
3	Crude Oil Distillation	14
4	Thermal and Catalytic Conversion Processes	15
5	Finishing Processes	14
Test & Model Exam		7
Total		80

RATIONALE:

Petroleum refining, a prominent process technology in process engineering. It can be viewed upon as a combination of both physical and chemical processes respectively and also plays an important role in people's lives. The various chapters of petroleum refining like Survey methods for Exploration, Drilling Techniques, Petroleum well oil recovery, Storage vessels, Crude evaluation, Crude oil Distillation, Blending, Thermal and Catalytic Conversion processes etc, provide the outline and processes carried out in petroleum refinery.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about Survey methods for Petroleum exploration.

- Drilling technology and its types.
- Petroleum well recovery techniques.
- Crude oil storage vessels.
- General methods for petroleum evaluation.
- Crude oil distillation.
- Importance of Blending in Petroleum Industry.
- Thermal conversion process for Cracking, Reforming and Visbreaking.
- Thermal Conversion process for Coking and its types.
- Catalytic conversion process for FCC and Alkylation.
- Isomerization and its methods
- Removal of sulphur and its compounds from petroleum Products by various methods.
- Reaction Mechanism and process involving in Hydrotreating methods

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**Petroleum Exploration** **Chapter: 1.1:** Survey Methods – Geological, Magnetic Methods - Seismic Technology - Sniffer Survey. **Chapter: 1.2:** Drilling Technology - Auger Drilling - Diamond Core Drilling - Churn Drilling - Rotary Drilling types – On shore and Off shore rigs – Barge - Jackup, Semi Submersible and Drill Ships. **Chapter: 1.3:** Primary, Secondary and Enhanced Oil Recovery Techniques and its methods - Major Well complication and Remedies.	**15 Hrs**
II	**Storage and Evaluation of Petroleum** **Chapter: 2.1:** Storage tank and its types - Floating roof tank, Fixed roof tank, External floating roof tanks, Internal floating roof tanks, Horizontal tanks, Pressure tanks, Variable space tanks. **Chapter: 2.2:** Introduction – TBP apparatus – API gravity - Vapour pressure – Flash point and Fire point – Octane number – Aniline Point - Cetane number – Diesel index – Calorific value – Smoke point – Viscosity and Viscosity index – Penetration Tests – Cloud point and Pour point – Drop point – Melting point – Softening point – Copper Corrosion Test – Carbone residue – Conradson and Ramsbottom Method – Refractive index and its applications.	**15 Hrs**

III	**Crude Oil Distillation** **Chapter: 3.1:** Introduction – Impurities in Crude Oils – Need for Desalting of Crude Oils – Electrical Desalting of Crude Oils – Crude Oil Distillation – Atmospheric Distillation – Vaccum Distillation of Reduced Crude Oil – Two stage Distillation with stabilizer. **Chapter: 3.2:** Blending – Types and its Importance – PI diagram and its significance in Industry.	**14 Hrs**
IV	**Thermal and Catalytic Conversion Processes** **Chapter: 4.1:** Introduction – Thermal Cracking - Reactions Mechanism and Processes. Thermal Reforming – Reaction mechanism and Process. Visbreaking – Conventional Visbreaking – Soaker Visbreaking. **Chapter: 4.2:** Coking – Delayed Coking – Fluid Coking – Flexicoking – Conventional and Dual Gasification – Other Coking Processes – Calcination of Green Coke. **Chapter: 4.3:** Introduction – Fluid Catalytic Cracking – Catalytic Reforming – Hydrocracking. Alkylation - Catalytic Alkylation – Sulphuric Acid Alkylation and HF Alkylation. **Chapter: 4.4:** Isomerization - Catalytic Isomerization – UOP Butamer Isomerization and UOP Penex Process – Catalytic Polymerization	**15 Hrs**

V	Finishing Processes	14 Hrs
	Chapter: 5.1: Introduction – Hydrogen Sulphide Removal Processes – Sulphur Conversion Processes – Sweetening Processes – Doctor Treating Processes – Merox Processes – Solvent Extraction Processes – Amine Treatment for LPG. **Chapter: 5.2:** Hydrotreating Processes – Application, Reaction Mechanism and Hydrotreating Process for Desulphurization and Smoke Point Improvements.	

Reference Books:

1. "B.K. Bhaskara Rao" "Modern Petroleum Refining Process", 4th Edition, OXFORD & IBH Publishing Co. Pvt. Limited.
2. "Dr. B.K. BhaskaraRao" "A Text on Petro Chemicals", 1st Edition, Khanna Publishers.
3. "Dr. Ram Prasad" "Petroleum Refining Technology", 1st Edition, Khanna Publishers.
4. "Bhagan Sahay" "Petroleum Exploration and Exploitation Practices", Allied Publishers Limited.
5. "W.L Nelson" "Petroleum Refinery Engineering", 4th Edition, Tata McGraw Hill.
6. "G.D.Hobson and W.Rohl" "Modern Petroleum Technology", Applied Science.
7. "Howard B.Bradley" "Petroleum Engineering Handbook", Society of Petroleum Engineers.
8. "Shay B" "Well site Geological Techniques for Petroleum Exploration", Allied Publishers Limited.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076320

Semester : III Semester

Subject Title : GENERAL ENGINEERING

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
GENERAL ENGINEERING	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Strength of materials	12
II	Steam Generation systems and Boilers	15
III	Steam Turbine and Refrigeration Systems	16
IV	Electricity and Electrical Distribution System	15
V	Electrical Transmissions	15
Test & Model Exam		7
Total		**80**

RATIONALE:

The subject allows the students to gain knowledge in understanding the various mechanical properties of materials, steam generation systems, Boiler function and the important components of a boiler, steam turbines, refrigeration systems, Electrical Distribution systems and Electrical Transmissions.

OBJECTIVES:

On completion of this subject, the students can able to understand the following concepts:

- Various Mechanical properties of the materials and types of stresses.
- Comparison of Thin and Thick cylindrical shell.
- Understand the properties of steam and the function of Boiler.
- Function of Boiler accessories and Boiler mountings.
- Understand the importance of steam turbines.
- Understand the importance of Refrigeration systems.
- Importance of Electrical Distribution system.
- Importance of Electrical Emergency systems.
- Importance of Electric motor and its working principle.
- Importance of D.C Generator and its working principle.

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DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**STRENGTH OF MATERILAS** Mechanical properties of materials – Elasticity, Plasticity, Ductility, Malleability, Wear resistance, Toughness, Brittleness, Hardness, Fatigue and Creep. Simple stresses and strains - types of stress - tensile, Compressive and shear stress – Stress - Strain diagram – Hooke's law – Young's modulus – Lateral strain – Poisson's ratio – Volumetric Strain – Bulk modulus - Temperature stress and strains. Cylindrical shells – Definition – Thin and thick cylindrical shell Comparison.	12 Hrs
II	**STEAM GENERATION SYSTEM AND BOILERS** Steam - Distinguish the wet steam, dry steam, saturated steam and supersaturated steam. Properties of steam- sensible heat, latent heat, total heat of steam, superheat and dryness fraction. Boiler- function of boiler- Distinguish between fire tube boiler and water tube boiler- Distinguish between low pressure boiler and high pressure boiler- Definition of low pressure steam, medium pressure steam and high pressure steam- Describe with line diagram the construction and working of a Simple Vertical Boiler. Function of boiler mountings such as safety valve, water level indicator, pressure gauge, feed check valve, and fusible plug. (Brief descriptions only). Function of Boiler accessories such as Economizer, feed pump, super heater and air pre-heater. (Brief descriptions only)	15 Hrs
III	**STEAM TURBINE AND REFRIGERATION SYSTEM** Steam turbine - purpose of steam turbine in process industries - common types of steam turbines: Reactive steam turbine, impulse turbine, condensing turbine and non-condensing turbine (Brief description only).	16 Hrs

	Construction and working principle of steam turbine with simple sketch- Turbine efficiency- Explain how lowering the exhaust pressure of steam turbine effects efficiency. Importance of Refrigeration system in process industries- Vapour compression refrigeration system – Capacity of refrigeration unit – Co-efficient of performance – Ton of Refrigeration- Refrigerants– Desirable properties – List the common types of refrigerants – Claude Liquefaction process.	
IV	**ELECTRICITY AND ELECTRICAL DISTRIBUTION SYSTEM** Definition the following terms: Electricity- Voltage- Voltmeter- Ampere- Ammeter – watts – wattmeter - Ohms. Statement of Ohm's Law- simple problems in Ohm's Law. Grounding and the purpose of grounding the motors and equipments. Types of current - AC Current & DC current- comparison of AC & DC current. Electrical Distribution systems: Transformers - Motor Control Centers (MCC) - Fuses- Circuit breakers- Switch. (Functions of the above with brief description). Electrical power failure and effect of power failure in process units- Electrical Emergency system- Uninterrupted power source (UPS).	**15 Hrs**
V	**ELECTRICAL TRANSMISSIONS** Electric motor - purpose of electric motor - D.C motor - principle and characteristics of D.C Motor - Synchronous motor and Induction motor - construction and working principle of D.C electric motor. Electric motors and maintenance: Starting the motor, motor vibration, temperature and lubrication, cleaning and ventilation & overload motors. D.C Generator - Principle, construction and working of D.C Generator.	**15 Hrs**

Reference Books:

1. “R.S Khurmi” “Theory of Mechanics”, Eurasia Publishing House.
2. “R.K. Rajput” “A text book of Power Plant Engineering”, Laxmi Publishers.
3. “R.S.Khurmi” “A text book of Refrigeration and Air conditioning”, S.Chand Publishers.
4. “Mallick Ranjan” “Practical boiler operation engineering and power”, PHI Publishers.
5. “B.L.Theraja” “A text book of Electrical Technology” Vol.1 and Vol.2, S.Chand Publishers.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro- Chemical Engineering (FT)

Subject Code : 4076330

Semester : III Semester

Subject Title : MOMENTUM TRANSFER

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
MOMENTUM TRANSFER	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Fluid Statics	14
II	Fluid Flow Phenomena	14
III	Flow of incompressible Fluids	15
IV	Pipes, Fittings and Valves	15
V	Transportation of Fluids	15
Test & Model Exam		7
Total		**80**

RATIONALE:

The knowledge of fluid flow is very essential because all chemical plants involved fluid flow. The examples are flow of stream and gases in pipes, flow of liquid in pipes and open Channels etc. This subject aims at the basic concepts of fluid flow, measurement Techniques involved for the same and equipments used for the transportation of fluids. With this background, students will be able to quantitatively find out material and power Requirement for a process.

OBJECTIVES:

On completion of this subject, the students can able to understand the following concepts:

- Importance of Fluid Mechanics.
- Basic principles and properties of fluids.
- Manometers.
- Boundary layer concept
- Behavior of fluids, Newtonian and non- Newtonian fluids.
- Reynolds number and its use.
- Continuity equation and its application. Bernoulli's equation and its application.
- Flow of fluids through circular pipes in steady state.
- Haugen – Poiseullie's equation, Friction factor chart.
- Different types of valves used in controlling flow and their specific applications.
- Different types of fittings and gaskets.
- Performance characteristics of centrifugal and reciprocating pumps.
- Blowers and compressors and their types.
- Their method of construction and working principles.
- Method of generating vacuum.

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DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**FLUID STATICS** Fluids – Definition, Properties of Fluids – Density, Specific Gravity, Viscosity - Dynamic Viscosity & Kinematic Viscosity, Variation of Viscosity of Gases and Liquids with temperature. Classification of Fluids: Ideal Fluid, Compressible, Incompressible Fluids. Newton's Law of Viscosity, Newtonian Fluids and Non-Newtonian Fluids with examples. Time dependent fluids – Thixotropic and Rheopectic fluids. Pressure – Types of Pressure – Atmospheric, Gauge & Absolute Pressure. List of Pressure measuring devices. U-Tube Manometer – computation of Pressure difference using U-Tube manometer - Inclined Manometer – Simple Problems in U-Tube manometer. Concept of boundary layer - Boundary layer separation & Wake formation.	**14 Hrs**
II	**FLUID FLOW PHENOMENA** Types of Flow – Laminar & Turbulent Flow, Potential Flow. Reynolds's Experiment – Critical velocity, Reynolds's Number and its Significance, Velocity Profile for Laminar Flow & Turbulent Flow, Simple Problem's using Reynolds's Number. Energies of fluids - Potential energy, pressure energy and kinetic energy (Statement only) - Statement of Bernoulli's Equation (derivation excluded) - Significance of Bernoulli's Equation, Practical applications of Bernoulli's Equation – Pump Work in Bernoulli's Equation. Mass flow rate & Volumetric flow rate, Average velocity, Mass Velocity, Relation between maximum velocity & Average velocity (derivation	**14 Hrs**

	excluded). Continuity equation & its Significance, Simple problems in Continuity equation.	
III	**FLOW OF INCOMPRESSIBLE FLUIDS** Pressure drop – Skin Friction & Form Friction – Fanning Friction factor – Relation between Skin friction & Friction Factor (derivation excluded) - Friction factor Chart & its use - Application of Hagen Poiseuille's equation & Fanning Equation in calculating energy loss - Simple problems. Energy Loss due to sudden expansion, sudden contraction & Pipe fittings (derivation excluded) – Equivalent length concept – Hydraulics radius & Equivalent diameter. Drag – Drag Co-efficient – Stoke's Law. Fluidization – Minimum fluidized velocity - Advantages & disadvantages of Fluidization, Applications of Fluidization – Simple problems.	**15 Hrs**
IV	**PIPES, FITTINGS AND VALVES** Difference between Pipes & Tubes, Sizes of Pipes and Tubes – Schedule Number, BWG Number. Methods of Joining Pipes – Gaskets – List of commonly used Gasket materials in Chemical Industry & its characteristics. Valves – Functions of Valves, Types of Valves – Gate Valve, Globe Valve, Ball Valve, Diaphragm Valve, Butterfly Valve & Check valve (NRV Valve) (Brief description of the above valves with line diagram) - Water hammer & its Prevention. Purpose of Wear rings and Bearings in centrifugal pump - Allowances for thermal expansion - Recommended practice in installing piping system.	**15 Hrs**
V	**TRANSPORTATION OF FLUIDS** Pumps – Classification of Pumps – Centrifugal Pump - Principle of operation and working, salient features of Centrifugal pumps, Types of Impellers and its uses – Priming – Cavitation - Symptoms and Causes of	**15 Hrs**

	Cavitation & its Prevention - NPSH – Affinity Law's – Simple problems in Affinity Law's, Characteristics curves of Centrifugal pump - Symptoms & possible Causes for Centrifugal pump problems & its remedies. Positive displacement pump – Reciprocating pump (Single acting & Double acting). Gear Pump – External Gear Pump & Internal Gear Pump Vacuum Pump - Steam jet ejector. Comparison of devices for moving fluids. Difference between Fans, Blowers & Compressors. Principle of Operation and working of Reciprocating Compressor & Centrifugal Compressor.	

Reference Books:

1. "Warren Mc-Cabe and Julian Smith and Peter Harriott" "Unit Operations of Chemical Engineering", 6th Edition, Tata McGraw Hill.
2. "W.L.Badger and J.T. Banchero" "Introduction to Chemical Engineering", Tata McGraw Hill.
3. "K. A. Gavhane" "Unit Operations-I", Nirali Publications.
4. "Salil K. Ghosal and Siddhartha Datta" "Introduction to Chemical Engineering", Tata McGraw Hill.
5. "Dr. R.K. Bansal" "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Limited.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075340

Semester : III

Subject Title : BASICS OF PETROCHEMICALS

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
BASICS OF PETROCHEMICALS	**5**	**80**	**25**	**100***	**100**	**3 Hrs**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
1	Origin, Composition of Petroleum and Sedimentary Environment	15
2	Nomenclature and IUPAC Names of Organic Compounds	14
3	Purification and Estimation of Organic Compounds in Crude oil	15
4	Reaction Kinetics, Reactors and catalyst	15
5	Corrosion and its control measures	14
Test & Model Exam		7
Total		80

RATIONALE:

With the advent of Globalization the face of the industry is changing. Large expansions in production capacities are presently taking place. This is the first time that major investments are taking place in all areas of the Petrochemical Industry. The Petrochemical industry in India is poised for explosive growth in the coming years. The various chapters of Basics of Petrochemicals like origin, composition of petroleum and sedimentary environment, Nomenclature and IUPAC names, purification and estimation of organic compounds, composition, properties and end uses of petroleum products, corrosion and control measures. etc, provide the complete idea about the processes in all petrochemical industries.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about Basics of fundamentals of petroleum related to process industries.

- Composition of petroleum and Physical properties of Hydrocarbon and Non hydrocarbon.
- Availability petroleum in various sources.
- Nomenclature and naming of compounds.
- General methods of preparation and properties of Organic Compounds.
- Importance and purification of organic compounds.
- Estimation of organic compounds.
- Composition and properties of petroleum products.
- Introduction and types of corrosion.
- Corrosion control methods in petroleum industries.

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**Origin, Composition of Petroleum and Sedimentary Environment** **Chapter: 1.1:** Introduction, Occurrence of Petroleum by Biological method **Chapter: 1.2:** Characterization of Crude oil – Composition of Crude oil - Constituents of Crude oil – Properties of Hydrocarbon and Non Hydrocarbon - Classification of Crude oil. **Chapter: 1.3:** Source and Reservoir Rocks – Oil bearing Rocks – Continental environment – Transitional environment and Marine environment.	15 Hrs
II	**Nomenclature and IUPAC Names of Organic Compounds** **Chapter: 2.1:** Nomenclature - importance, IUPAC rules for naming Alkanes, Alkenes, Alcohol, Aldehyde, Acids and Aromatics – Benzene and Phenol. **Chapter: 2.2:** General methods for preparation and properties of Alkanes, Alkenes, Alcohol, Aldehyde, Acids and Aromatics – Benzene and Phenol.	14 Hrs
III	**Purification and Estimation of Organic Compounds in Crude oil** **Chapter: 3.1:** Introduction – Importance of Organic compounds, Purification methods - Sublimation, Crystallization, Distillation, Extraction and Chromotography. **Chapter: 3.2:** Estimation methods of Nitrogen, Oxygen, Carbon, Hydrogen, Halogens and sulphur – Simple Problems.	15 Hrs

IV	**Reaction Kinetics, Reactors and catalyst** **Chapter: 4.1:** Chemical reaction - classification of chemical reactions- Definitions of reaction rate - elementary and non-elementary reactions - Molecularity and order of a reaction - Rate law, rate constant and units of rate constant. **Chapter: 4.2:**: Importance of chemical reactors in chemical industry- classification of chemical reactors- construction, operation and application of Batch reactor, Continuous Stirred Tank Reactor (CSTR) and Plug Flow Tubular Reactor (PFTR), Fluidized bed reactors. **Chapter: 4.3:** Catalyst - Classification of Catalyst - Preparation of Solid Catalyst and its types. Brief description about inhibitors, poisons and promoters. Catalyst deactivation and methods of Catalyst regeneration.	**15 Hrs**
V	**Corrosion and its control measures** **Chapter: 5.1:** Corrosion – Definition – General effects – Different types of Corrosion - Uniform corrosion – Galvanic corrosion – Crevice corrosion - Pitting corrosion – Inter granular corrosion - Selective leaching corrosion – Erosion corrosion – Stress corrosion – Galvanic series – Factors affecting corrosion Galvanic series. **Chapter: 5.2:** Corrosion control - cathodic protection anodic protection – surface coatings-selection of materials - use of corrosion inhibitor	**14Hrs**

Reference Books:

1. "B.K. Bhaskara Rao" "Modern Petroleum Refining Process", 4th Edition, OXFORD & IBH Publishing Co. Pvt. Limited.
2. "Dr. B.K. BhaskaraRao" "A Text on Petro Chemicals", 1st Edition, Khanna Publishers.
3. "Dr. Ram Prasad" "Petroleum Refining Technology", 1st Edition, Khanna Publishers.
4. "Bhagan Sahay" "Petroleum Exploration and Exploitation Practices", Allied Publishers Limited.
5. "W.L Nelson" "Petroleum Refinery Engineering", 4th Edition, Tata McGraw Hill.
6. "G.D.Hobson and W.Rohl" "Modern Petroleum Technology", Applied Science.
7. "Howard B.Bradley" "Petroleum Engineering Handbook", Society of Petroleum Engineers.
8. "Shay B" "Well site Geological Techniques for Petroleum Exploration", Allied Publishers Limited.
9. "Salil K. Ghosal and Siddhartha Datta" "Introduction to Chemical Engineering", Tata McGraw Hill.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076350

Semester : III Semester

Subject Title : TECHNICAL ANALYSIS PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
TECHNICAL ANALYSIS PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

Analysis of various chemical commodities is necessary for controlling the quality of product in industry. This can be achieved in handling various analyses in the laboratory. The students can be learned all these by doing experiments in the practical classes.

OBJECTIVES:

To train the students on basic principles involved in estimation and Characterization of industrially important materials like Water, Oils and Fat, Soap, Cement, Bleaching powder, Glycerol, and Sucrose. The students can able

- To determine the water quality for various applications.
- To determine the standard quality of fat and oil for food and cosmetic grades
- To determine the quality of soap for pharmaceutical and cosmetic grades.
- To determine the quality of cement.
- To determine the glycerol quality to meet cosmetics standards.
- To determine the purity of sugar to meet the sugar and food industry standards.

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LIST OF EXPERIMENTS

1. Estimation of Hardness of water by EDTA method.
2. Estimation of Acid value of Oil.
3. Estimation of Total Fatty Matter content of soap.
4. Estimation of calcium oxide content of cement.
5. Determination of available chlorine in Bleaching Powder.
6. Estimation of purity of Glycerol by Dichromate method.
7. Determination of purity of Sucrose.
8. Determination of PH using PH meter
9. Estimation of Saponification of Oil.
10. Estimation of Mixed Oxide content of cement.

LIST OF EQUIPMENTS / GLASSWARES

- Burettes 50 ml - 5 Nos.
- Pipettes 25 ml, 20 ml, 10 ml - 5 Nos.
- Conical flask 500 ml, 250 ml, 100 ml - 5 Nos.
- Burette stand with clamp - 10 Nos.
- Round bottomed flask 500 ml, 250 ml - 5 Nos.
- Liebig's condenser - 2 No.
- Distillation set - 2 No.
- Funnels & Separating funnels - 5 Nos.
- Watch Glass 6",3",3" - 5 Nos.
- Wash bottles plastics - 5 Nos.
- Tripod stand & Wire gauge - 5 Nos.
- Hot plate & Muffle Furnace - 1 No
- Silica Crucible with lid – 1 No.
- Buchner funnel – 2 Nos.
- Suction pump - 1 No.
- Aspirator bottles - 4 Nos.
- Refractometer - 1 No.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076360

Semester : III Semester

Subject Title : GENERAL ENGINEERING PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
GENERAL ENGINEERING PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a vital role. These can be achieved by experience in handling various equipments, which are used to identify the strength of material, identify the parts of valves, and in handling electrical machineries and instruments. These will help to handle various equipments in process industries for a chemical engineer.

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OBJECTIVES:

The students can able to Identifying the various parts of valves and centrifugal pump and understand how dismantle and assemble the valves and centrifugal pump.

- Find out the COP of refrigeration Test Rig and Hardness of a given sample.
- Determination of Unknown Resistance by ohms law.
- Energy measurement in a single phase circuit using Lamp load.
- Load test on a single phase transformer.
- Verification of Series and parallel circuit.

LIST OF EXPERIMENTS

1. Identify the parts of Gate valve, dismantle and assemble the parts of Gate valve.
2. Identify the parts of Globe valve, dismantle and assemble the parts of Globe valve.
3. Identify the parts of centrifugal pump, dismantle and assemble the parts of Centrifugal pump.
4. Refrigeration Test Rig – COP Determination
5. Determine the Hardness Test value of given material (mild steel or plastic material) using hardness testing machine.
6. Compressor Test Rig
7. Determination of Unknown Resistance by ohms law.
8. Energy measurement in a single phase circuit using Lamp load.
9. Load test on a single phase transformer.
10. Verification of Series and parallel circuit.

LIST OF EQUIPMENTS

1.	Gate Valve	- 1 No.
2.	Globe Valve	- 1 No.
3.	Centrifugal pump	- 1 No.
4.	Refrigeration test rig	- 1 No
5.	Hardness Testing machine	- 1 No.
6.	Compressor Test Rig	- 1 No.
7.	Rheostat of various range	- 2 Nos.
8.	RPS (0-12v, 0-30v)	- 2 Nos.
9.	Ammeters (MC and MI) of various ranges	- 2 Nos.
10.	Voltmeters (MC and MI) of various ranges	- 2 Nos.
11.	Wattmeter (300v/5A - 2.5A/UPF)	- 2 Nos.

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076370

Semester : III Semester

Subject Title : MOMENTUM TRANSFER PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
MOMENTUM TRANSFER PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education to skill development especially working with instruments and Equipment's play a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing engineering related equipment's in practical classes.

LIST OF EXPERIMENTS

1. Determination of flow rate using Orifice meter
2. Determination of flow rate using Venturi meter.
3. Flow through a straight pipe
4. Flow through a helical coil
5. Rota Meter Calibration
6. Flow through packed column
7. Flow through fluidization column
8. Centrifugal pump characteristics
9. Flow through a Weir
10. Reciprocating pump characteristics

LIST OF EQUIPMENTS

- Orifice Meter - 1 No.
- Venturi Meter - 1 No.
- Straight pipe - 1 No.
- V notch experimental setup - 1No.
- Rota Meter - 1 No.
- Packed column - 1 No.
- Fluidization column - 1 No.
- Centrifugal Pump - 1No.
- Reciprocating Pump - 1 No.
- Helical coil / spiral coil - 1 No.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076410

Semester : IV Semester

Subject Title : MECHANICAL OPERATIONS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
MECHANICAL OPERATIONS	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Size Reduction	15
II	Properties of solids, screening and conveying	15
III	Sedimentation, Centrifugation and Filtration	15
IV	Classification of solid particles	14
V	Mixing and Agitation	14
	Test & Model Exam	7
Total		**80**

RATIONALE:

It gives the student the knowledge of various mechanical operations and their significance in chemical industries. With this information student can control the operation of equipment in order to separate solid-solid, solid-liquid & gas-solid systems.

OBJECTIVES:

On completion of the following exercise, the student must be able

- To know the principles of various size Reduction machines
- To define the different Laws of size Reduction
- To understand the operation of various types of conveyors
- To analyze the solid particles in the set of sieves
- To understand the working of various Industrial screens.
- To know the principles of gas- solid separation
- To understand the principles of settling
- To distinguish between filtration & settling
- To describe the working of various Filtration equipments
- To discuss various special methods of separation
- To know the application of various separators
- To distinguish between Mixing & Agitation
- To list out various types of Impellors
- To design the mixing tank
- To understand the principles of various industrial mixer

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**SIZE REDUCTION** Objectives of Size Reduction – Methods of Size Reduction – Crushing Efficiency.Laws of Crushing - Rittinger's Law, Kick's Law & Bond's Law – Work Index – Simple problems in Laws of Crushing. Size Reduction Equipments – Classification of size reduction reductions-Construction, Principle of Working and application of the following Equipments – Blake Jaw Crusher, Smooth Double Roll Crusher – Angle of Nip (Simple Problems) – Ball Mill – Critical Speed of Ball mill & simple problems in critical Speed. Fluid Energy Mill.	**15 Hrs**
II	**PROPERTIES OF SOLIDS, SCREENING & CONVEYING** Characterization of solid particles - Shape – Sphericity (simple Problem). Definitions of the following terms - Volume shape factor & surface shape factor, Average particle size, Sauter mean diameter, mass mean diameter and volume mean diameter, specific surface of the mixture & specific surface ratio. Screening – Tyler Standard screen series, Capacity & Effectiveness of screens - Screen Analysis - Differential Analysis & Cumulative analysis. Screening Equipments - Working Principle of Gyrating Screens & Vibrating Screens. Conveying of Solids - Working Principles & applications of Belt Conveyor, Screw Conveyor & Bucket Elevator.	**15 Hrs**
III	**SEDIMENTATION, CENTRIFUGATION & FILTRATION** Settling - Free settling & Hindered Settling – Terminal settling Velocity – Batch sedimentation test. Distinguish between of Thickener & Clarifier – Construction and Working Principle of Dorr Thickener.	**15 Hrs**

	Centrifugation - Principle of Centrifugation - Construction and Working Principle of Top suspended Centrifuge & Disc Type Centrifuge. Filtration - Filter Medium & its Requirements – Filter aids & its function – Constant Pressure filtration – Constant rate filtration – Filter Medium Resistance & Filter Cake Resistance (definitions only) - Filtration Equipments - Construction, Principle of Operation & Applications of Filter Press, Leaf Filter & Rotary Drum Filter.	
IV	**CLASSIFICATION OF SOLID PARTICLES** Construction, Principle of Operation & Applications of the following Equipments: Mechanical Classifier - Dorr Classifier Gravity Concentration - Heavy Medium Separator (Sink & Float Method). Special Separation Techniques- Elutriation and Jigging. Froth Flotation - Functions of Frothers and Collectors – Working principle of Floatation cell. Gas - Solid Separation- Cyclone Separator, Bag Filter & Electrostatic Precipitator.	**14 Hrs**
V	**MIXING AND AGITATION** Difference between Mixing and Agitation – Purpose of Agitation – Working Principle of Agitation Vessel – Function of Baffles. Impellers, Types of Impellers & Their applications - Propeller, Paddles & Turbines. Swirling & Vortex Formation in Mixing tanks and their prevention. Concept of Mixing Index – Power Number. Industrial Mixers - Principle of Operation & Applications of Change Can Mixer, Muller Mixer, Banbury Mixer & Ribbon Blender.	**14 Hrs**

Reference Books:

1. “Warren Mc-Cabe and Julian Smith and Peter Harriott” “Unit Operations of Chemical Engineering”, 6th Edition, Tata McGraw Hill.
2. “W.L.Badger and J.T. Banchero” “Introduction to Chemical Engineering”, Tata McGraw Hill.
3. “K. A. Gavhane” “Unit Operations-I”, Nirali Publications.
4. “Anup K. Swain and G.K. Roy and Hemlata Patra” “Mechanical Operations”, Tata McGraw Hill.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro- Chemical Engineering (FT)

Subject Code : 4076420

Semester : IV Semester

Subject Title : HEAT TRANSFER

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
HEAT TRANSFER	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Conduction	12
II	Convection and Radiation	16
III	Heat flow in fluids and heat exchanger	17
IV	Evaporation	14
V	Multiple Effect Evaporation and Insulation	14
Test & Model Exam		7
Total		**80**

RATIONALE:

Most of the chemical engineering operations will involve either heat addition or heat removal in one way or the other. It is, therefore, extremely necessary to have good understanding about the heat transfer mechanisms such as conduction, convection and radiation. This subject enables the students to apply the understanding of heat transfer mechanisms such as conduction, convection and radiation for understanding the performances of various heat transfer equipment such as heat exchangers, condensers, boilers, evaporators etc. used in almost all chemical and related industries. The knowledge of this subject helps in design and fabricates different heat exchange equipment.

OBJECTIVES:

On completion of the units of syllabus the students must be able to know about

- Mechanism of Heat Transfer, and Heat Transfer by conduction;
- Conduction through Composite walls and Hollow cylinders
- Variation of Thermal conductivity with temperature.
- To calculate the amount of heat loss through flat wall and cylinder.
- To study the concept of convection heat transfer
- Significance of Dimensionless numbers
- To calculate the heat flow rate by Radiation.
- Principles of Heat Transfer in Fluids, Log Mean Temperature Difference.
- Heat Exchange Equipment (Double Pipe, Shell and Tube, Plate Type, Fin).
- To study the construction, working and application of various types of heat transfer Equipments.
- Principle of Evaporation, Performance of Evaporators, Types of Evaporators and their operational methods
- Evaporator accessories
- Multiple effect evaporators and methods of feeding
- To study some of the evaporator accessories.
- Insulating materials, need for insulation, properties and their applications.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**CONDUCTION** Heat Transfer – Modes of Heat Transfer – importance of heat transfer in process units - Fourier's Law of Conduction – Steady State & unsteady state heat conduction. Heat conduction through Composite Wall, Hollow Cylinder & Composite cylinders. Simple problems in conduction Thermal Conductivity, Thermal diffusivity & its significance. Variation of thermal conductivity with temperature. Analogy between heat conduction & Electrical Current flow.	**12 Hrs**
II	**CONVECTION & RADIATION** Convection - Types of Convection – Free Convection & Forced Convection. Individual heat transfer coefficient (h) & its significance – Film concept in convection - Application of Sieder - Date Equation & Dittus Boelter Equation. Different modes of condensation – Drop wise Condensation & Film wise Condensation – Effect of non-condensable gases in condensable vapours- Condensation of superheated vapours. Boiling Mechanism in Heat Transfer – Nucleate boiling & Film boiling (principles only) – Leidenfrost Phenomenon.	**16 Hrs**

	Dimensionless Numbers & their Significance in Heat Transfer - Graetz Number, Prandlt Number, Nusselt Number, Rayleigh Number & Grashoff Number. (Brief description only). Radiation Heat transfer - Reflectivity, Absorptivity & Transmissivity – Emissive Power & Emissivity - Concept of Black body – Stephen Boltzman Law & Krichoff's Law - Simple Problems in Radiation.	
III	**HEAT FLOW IN FLUIDS & HEAT EXCHANGERS** Heat Exchangers - Counter current flow & Parallel flow in heat exchangers – Energy balance in heat exchangers – Heat Flux – Overall heat transfer coefficient – derivation of overall heat transfer coefficient from hot fluid to cold fluid through a metal wall – Fouling factors & its significance – Logarithmic mean temperature difference (LMTD) (derivation excluded). Simple problem's in LMTD. Heat Exchangers: Types of Heat exchangers – Construction & Working Principle of Double pipe Heat Exchanger and Shell & Tube Heat exchanger - Functions of Baffles – Application of floating head and U-Tube heat exchangers - Pitch – Triangular & Square Pitch – its advantages & disadvantages. Construction and working principles of plate type heat exchanger – concept of Extended surface heat exchanger (principle only) – Heat exchanger efficiency and common problems – Scale formation in heat exchangers and its cleaning.	**17 Hrs**
IV	**EVAPORATION** Evaporation – Principles of Evaporation – Factors affecting rate of evaporation – Capacity & Economy – Boiling point elevation & Duhring's rule – Energy balance in single effect evaporator- Simple problems in single effect evaporator.	**14 Hrs**

	Evaporators - Types of evaporator – Calendria evaporator, Long tube vertical evaporator (Climbing Film) – Falling Film evaporator & Forced circulation evaporator – Construction, operation & applications of all types of evaporators – Important factors to be considered in efficient operation of an Evaporator.	
V	**MULTIPLE EFFECT EVAPORATION AND INSULATION** Principle of Multiple effect Evaporation – Methods of feeding of multiple effect evaporator – Forward feed, backward feed, mixed feed & parallel feed – Merits & Limitations. Evaporator Accessories - Steam traps - purpose of steam trap - list the four types of steam traps - brief description about any one steam trap. Brief description about Barometric condenser & Entrainment separators. Thermal Insulation – importance of avoiding heat loss in process units - Properties of Insulting materials – Need for thermal insulation – Critical thickness of insulation – important types of insulating materials & their applications.	**14 Hrs**

Reference Books:

1. "Warren Mc-Cabe and Julian Smith and Peter Harriott" "Unit Operations of Chemical Engineering", 6th Edition, Tata McGraw Hill.
2. "W.L.Badger and J.T. Banchero" "Introduction to Chemical Engineering", Tata McGraw Hill.
3. "K. A. Gavhane" "Unit Operations-II", Nirali Publications.
4. "Binay K Dutta" Heat Transfer Principles and Applications", PHI Learning Pvt. Limited.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076430

Semester : IV Semester

Subject Title : CHEMICAL PROCESS CALCULATIONS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
CHEMICAL PROCESS CALCULATIONS	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Basic Chemical Calculations	14
II	Behaviour of Ideal Gases	14
III	Material Balance without Chemical Reaction	15
IV	Material Balance with Chemical Reaction	15
V	Energy Balance	15
Test & Model Exam		7
Total		**80**

RATIONALE:

This subject prepares the students to formulate and solve material and energy balances on chemical process systems. In process industries raw materials are processed to get different products. The components present in the raw material combine in a definite proportion and the percentage of product formed depend on various parameters like temperature and pressure etc. It is highly essential to know the stoichiometry ratio and proportions and the process conditions to achieve maximum product formation and recycle of the unused materials for better economy. Therefore, knowledge of stoichiometry is the first and foremost requirement for the success of a chemical engineer.

OBJECTIVES:

On Completion of the units of syllabus contents the students must be able to understand the following:

- The uses of different units.
- Basic concepts of chemical calculation.
- The law of conservation of mass.
- The material balance in unit operations.
- Exact quantities of materials are to be used to achieve good percentage of conversion.
- The concept of flue gas analysis.
- The law of conservation of energy.
- The energy saving possibilities in chemical processes.
- The different type of reactors used in chemical industries.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**BASIC CHEMICAL CALCULATIONS** Dimensions – Measurement - Use of different units - Fundamental quantities and Derived quantities - FPS, CGS, MKS and SI systems - Conversion factors. Basis of calculation - Mole concept - Atomic weight, Molecular weight Methods of expressing the composition of solids and solutions - Weight percent & Volume percent - Mole percent and mole fraction - Concept of PPM (Parts Per Million) - Equivalent weight - Molarity, Molality and Normality. Density and Specific gravity.	14 Hrs
II	**BEHAVIOUR OF IDEAL GASES** Behaviour of Ideal gases - Ideal gas law - absolute pressure and gauge pressure - absolute temperature and relative temperature - temperature scales - unit conversion of temperature and pressure. Gaseous mixtures - Dalton's law of partial pressure for gas mixtures - Amagot's law of partial volume - Average molecular weight and density of gaseous mixtures. Vapour pressure - Effect of temperature on vapour pressure - Hausbrand chart and its use - Effect of pressure and vapour pressure on boiling point. Calculating vapour pressure using Clausius – Clapeyron equation.	14 Hrs
III	**MATERIAL BALANCE WITHOUT CHEMICAL REACTION** Material balance - definition of steady state and unsteady state material balance equations - Methods of solving the three basic types of material balance problems - definitions of terms Tie substance, Inert material, simultaneous equation - Calculating quantities of acids required in mixed acid blending process.	15 Hrs

	Material balance problems involving in unit operation such as distillation, Evaporation, Leaching and drying. Bypass operation - Recycle operation - Purging operation (Brief descriptions only).	
IV	**MATERIAL BALANCE WITH CHEMICAL REACTIONS** Definition of the following terms - Stoichiometric coefficient - Stoichiometric ratio - Limiting reactant - Excess reactant - Percentage of excess reactant - Percentage conversion - Percentage yield - Selectivity - Simple problems. Combustion – Gross calorific value and Net calorific value - Theoretical air requirement – percentage excess air - Orsat analysis of Flue gases – simple problems.	**15 Hrs**
V	**ENERGY BALANCE** Energy balance - definition of terms Heat capacity, Molal heat capacity, specific heat, sensible heat and Latent heat of pure liquid. Heat capacity of pure gas and gaseous mixtures at constant pressure - Calculating amount of heat required to raise the temperature of process fluid using heat capacity data. Enthalpy changes accompanying chemical reaction - standard heat of formation - standard heat of combustion - heat of reaction.	**15 Hrs**

Reference Books:

1. “B.I.Bhatt & S.B Thakore” “Stoichiometry”, 5th edition, Tata McGraw Hill.
2. “D.C.Sikdar” “Chemical Process Calculations”, PHI Learning Pvt Limited.
3. “V.Venkataramani, N.Anantharaman & K.M.Sheriffa Begum” “Process Calculations”, PHI Learning Pvt Limited.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075440

Semester : IV

Subject Title : PETROCHEMICAL TECHNOLOGY

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
PETROCHEMICAL TECHNOLOGY	**5**	**80**	**25**	**100***	**100**	**3 Hours**

*** Examination will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
1	C1 Compounds	14
2	C2 Compounds	15
3	C3 Compounds	14
4	C4 Compounds and Aromatics	15
5	Plastic Derivatives	15
Test & Model Exam		7
Total		80

RATIONALE:

Every Petrochemical engineering technologist gets acquainted with knowledge of petrochemical technology to operate a plant efficiency, safety and economically. Proper selection of equipment and process improves efficiency of the plant. By learning this subject they can measure performance of various refinery products and select relevant process with safe handling of equipment to obtain desired petrochemicals such as C1 to C4 and also aromatics Compounds. The various chapters of Petrochemical technology likes C1, C2, C3, C4 fractions, aromatics and plastic derivatives etc, provide the complete sketch about the processes in all petrochemical complexes also provides the processing of raw materials for various commercial products based on crude petroleum.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about

- The manufacturing process, Physical properties and uses from C1 compounds like Methanol, Chloromethane.
- The manufacturing process, Physical properties and uses from C2 compounds like Ethylene, Acetylene.
- The manufacturing process, Physical properties and uses from C3 compounds like Isopropanol, acetone. C4 Compounds - Butadiene manufacturing from various chemicals and its physical properties.
- The manufacturing process, Physical properties and uses of Aromatic Compounds.
- Properties, Classification, manufacturing and industrial applications of Plastics.

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**C1 COMPOUNDS** **Chapter: 1.1:** Process Description, flow diagram, Physical Properties and uses of - Methanol via synthesis gas route, Formaldehyde from methanol - Chloromethane by direct chlorination of methane, Trichloroethylene Perchloro ethyene by Pyrolysis of carbon tetrachloride.	**14 Hrs**
II	**C2 COMPOUNDS** **Chapter: 2.1:** Process Description, flow diagram, Physical Properties and uses of - Ethylene and acetylene Production by steam cracking of hydrocarbons, Ethylene dichloride, Vinyl Chloride Via ethylene dichloride pyrolysis, Ethylene oxide by oxidation of ethylene, Ethanol amines from ethylene oxide and Ammonia.	**15 Hrs**
III	**C3 COMPOUNDS** **Chapter: 3.1:** Process Description, flow diagram, Physical Properties and uses of - Isopropanol by hydration of propylene, Acetone by dehydrogenation of Isopropanol, Acrylonitrile from Propylene Ammonia Oxidation, Isoprene from propylene dimmer, Propylene Oxide via Chlorohydrins.	**14 Hrs**
IV	**C4 COMPOUNDS & AROMATICS** **Chapter: 4.1:** Process Description, flow diagram, Physical Properties and uses of Butadiene, Butadiene from Dehydrogenation of butane, Butadiene from ethanol. **Chapter: 4.2:** Process Description, flow diagram, Physical Properties and uses of Benzene from Alkyl Aromatics, Phenol by Cumene Process, Phenol from toluene Oxidation, Styrene from benzene and ethylene.	**15 Hrs**

V	**PLASTIC DERIVATIVES** **Chapter: 5.1:** Process Description, flow diagram, Physical Properties and uses of – Classification of Plastics – Thermosetting and Thermoplastic, Engineering Plastics. Production and uses of – Phenol formaldehyde Resins, Polyethylene, Epoxy resins - ABS plastics, Polycarbonate, Polystyrene.	**15 Hrs**

Reference Books:

1. "M. Gopala Rao Marshall Sittig" "Dryden's Outliness of Chemical Technology", Edited and Reprinted by, 3rd Edition, East-West Press.
2. "Dr. B.K. BhaskaraRao" "A Text on Petro Chemicals", 1st Edition, Khanna Publishers.
3. "Austin, G.T" "Shreve's Chemical Process Industries", 5th Edition, Tata McGraw Hill.
4. "Kirk-Othmer" "Encyclopedia of Chemical Technology", 4th Edition, 1993, Wiley – Inter Science Publication, John Wiley & Sons.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076450

Semester : IV Semester

Subject Title : MECHANICAL OPERATIONS PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
MECHANICAL OPERATIONS PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing engineering related experiments in practical classes.

OBJECTIVES:

- To determine the absolute viscosity of given liquid within the permissible limit of +/- 0. 5 Poise using different type and size of solid particles.
- To study the settling characteristics of given slurry using Batch settling test jar and plot a set of curves using Kynch Theory.
- To determine the power consumption, power number, Froude number & Reynolds number of given Impellor in the Mixing tank and compare the above parameters using the liquids of different viscosity.
- To determine specific cake resistance and filter medium resistance of given slurry using Leaf filters and compares the above parameters with other types of filters.
- To determine the sieve efficiency using the set of sieves and to compare the efficiency for different nature of feed particles.
- To determine the Reduction ratio and specific surface area of newly generated solid particles within the permissible limit of +/ - 0.5 &1 cm^2/ gm respectively using the Jaw crusher.
- To determine the Reduction ratio and specific surface area of newly generated solid particles within the permissible limit of +/ 0.5 & 1 cm^ gm respectively using the Roller crusher.
- To find out the parameters such as Grinding efficiency, optimum size of ball, critical speed, optimum speed and power requirement for grinding in a cylindrical ball mill and compare the above parameters with the same ball mill by changing the size & number of balls.
- To determine specific cake resistance and filter medium resistance of given slurry using Plate & Frame Filter press and compare the above parameter with other types of filters.
- To separate the given size range of solid particle from air stream and determine the settling velocity of solid particle in different regions of settling and compare the same using different size ranges of solid particle using a Cyclone Separator.

LIST OF EXPERIMENTS

1. Stoke's Law of Settling
2. Batch Settling
3. Industrial Mixer
4. Leaf filter
5. Sieve Analysis
6. Jaw Crusher
7. Roller crusher
8. Ball mill
9. Filter press (Plate and Frame)
10. Cyclone Separator

LIST OF EQUIPMENTS

- Long, wide glass tube - 2 Nos.
- Measuring Jar (1Litre) - 2Nos.
- Mixing Tank with accessories - 1No.
- Leaf Filter with accessories such as Vacuum pump, manometer etc - 1No.
- Set of sieves and sieve shaker machine - 1No.
- Jaw Crusher - 1No.
- Double Roller Crusher - 1No.
- Ball mill with different size of balls - 1No.
- Plate and Frame filter press with accessories - 1No.
- Cyclone separator - 1 No.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Chemical Engineering (FT)

Subject Code : 4076460

Semester : IV Semester

Subject Title : HEAT TRANSFER PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
HEAT TRANSFER PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing engineering related experiments in practical classes.

OBJECTIVES:

After completing all the experiments of the laboratory the student will able to

- Determine the Thermal conductivity of the metal, Insulating Material and Glass wool.
- Determine the overall heat transfer coefficient of a double pipe heat exchanger by co-current flow & counter current flow.

- Determine the quantity of heat transferred and over all hear transfer coefficient of a condenser.
- Determine the heat transfer characteristics under forced convection
- Determine the heat transfer characteristics under free convection
- Determine the emissivity of the given metal
- Determine the Stefan Boltzmann Constant

LIST OF EXPERIMENTS

1. Thermal Conductivity of Metal Bar
2. Heat loss in pipe
3. Double Pipe Heat Exchanger by co-current Flow
4. Double Pipe Heat Exchanger by Counter-current flow
5. Natural Convection Heat Transfer
6. Forced Convection Heat Transfer
7. Determination of Heat Transfer co-efficient in Vertical Condenser
8. Determination of Heat Transfer co-efficient in Horizontal Condenser
9. Determination of Emissivity of a grey Body
10. Verification of Stefan Boltzmann constant

LIST OF EQUIPMENTS

Modules for the determination of the following:-

1. Thermal Conductivity of Metal Bar - 1 No
2. Heat loss in pipes - 1 No
3. Double Pipe Heat Exchanger by co-current Flow - 1No
4. Double Pipe Heat Exchanger by Counter-current flow - 1 No
5. Natural Convection Heat Transfer - 1 No
6. Forced Convection Heat Transfer - 1 No
7. Horizontal Condenser and vertical condenser - 1 No.
8. Emissivity apparatus - 1 No
9. Stefan Boltzmann apparatus - 1 No

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOG SYLLABUS

M-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075470

Semester : IV SEMESTER

Subject Title : DISTILLATE TESTING PRACTICAL - I

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
DISTILLATE TESTING PRACTICAL - I	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a keyhole. The skill development can be achieved by hands on experience in handling various instruments, apparatus and equipment in focus of improving new trends in petroleum Refinery. This is accomplished by doing engineering related experiments in practical classes in various laboratories.

OBJECTIVES:

After completion of this laboratory, the students will be able

- To know the water quality standards.
- To know the basic properties of petroleum fractions.
- To identify the problems during the process.
- To prevent the distillation column from corrosion.
- To know the importance of aniline point for aromatics.

GUIDELINES:

- All the Ten experiments given in the list of experiments should be completed and given for the end semester practical examination.
- In order to develop best skills in handling Instruments/Equipment and taking readings in the practical classes, every two students should be provided with a separate experimental setup for doing experiments in the laboratory.
- The external examiners are requested to ensure that a single experimental question should not be given to more than four students while admitting a batch of 30 students during Board Examinations.

LIST OF EXPERIMENTS

1. Determination of aromatics using aniline point
2. A.S.T.M Distillation of Petroleum Products
3. Smoke point of Petroleum Products
4. Drop point of grease
5. Determinations of specific gravity by using hydrometer.
6. Determination of acidity for Petroleum Products
7. Melting point
8. Softening point
9. Flash and Fire point of the given sample.
10. Viscosity measurement by saybolt viscometer.
11. Viscosity measurement by redwood viscometer.

LIST OF EQUIPMENTS

1. Aniline point apparatus - 1 No.
2. A.S.T.M Distillation apparatus - 1 No.
3. Smoke point apparatus - 1 No.
4. Drop point apparatus - 1 No.
5. Centrifuge apparatus - 1 No.
6. Acidity determination apparatus - 1 No.
7. Melting point apparatus - 1 No.
8. Ring & ball apparatus - 1 No.
9. Open cup and closed cup - 1 No.
10. Saybolt viscometer - 1 No.
11. Redwood viscometer - 1 No.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075510

Semester : V SEMESTER

Subject Title : PROCESSING OF CHEMICALS

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
PROCESSING OF CHEMICALS	**6**	**96**	**25**	**100***	**100**	**3 Hours**

* **Examination will be conducted for 100 marks and it will be reduced to 75 marks**.

Topics and Allocation of Hours

Unit	Topic	Hours
1	Chloro - Alkali Industries and Acid Industry	17
2	Sugar, Fermentation and Pharmaceutical Industries	18
3	Cement, Glass, Surface Coating Industries	18
4	Synthetic Detergent	18
5	Polymerization, Synthetic Fibres and Rubber	18
Test & Model Exam		7
Total		96

RATIONALE:

Chemical processing is done to change the chemical structure of raw materials in order to obtain product. A Petrochemical engineer, during his/her professional career, is primarily working in plants engaged in the manufacture of various chemical products. It is therefore necessary to provide adequate information to the Petrochemical engineering student about the raw materials, the chemistry involved and the outline of manufacturing process for various chemical products such as Chloro alkali and acid, fertilizer, glass, cement, paint, pigment, synthetic detergent, fibers and rubbers etc. in corresponding process industries.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about Properties and manufacturing process of Chloro alkai products.

- Manufacturing of Sulphuric acid and hydrochloric acid.
- Manufacturing of Sugar and Starch.
- Manufacturing of Industrial alcohols and also production of Antibiotic.
- Manufacturing of cement and glass products
- Manufacturing of paint and pigments.
- Classification, structure and manufacturing of synthetic detergents.
- Finishing of detergents.
- Polymerization and its types.
- Manufacturing of rubbers.

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**CHLORO ALKALI INDUSTRIES AND ACID INDUSTRY** **Chapter: 1.1:** Manufacture of Soda Ash by Solvay's Process, Manufacture of caustic Soda - Membrane cells Manufacture of chlorine, Comparison of caustic soda by membrane, diaphragm and mercury cell process, manufacture of caustic soda by mercury process. **Chapter: 1.2:** Sulphuric acid manufacture by DCDA process and Contact Process, Manufacture of Hydrochloric acid, Properties and uses.	**17 Hrs**
II	**SUGAR, FERMENTATION AND PHARMACEUTICAL INDUSTRIES** **Chapter: 2.1:** Saccharrides and its types – Production of sucrose from cane sugar, Production of starch from maize and other sources. **Chapter: 2.2:** Fermentation definition – Enzymes and its types – Production of Industrial alcohol, absolute alcohol, Beer and Citric acid and its uses. **Chapter: 2.3:** Production of Antibiotic likes Penicillin, Insulin and Salicylic acid.	**18 Hrs**
III	**CEMENT, GLASS, SURFACE COATING INDUSTRIES** **Chapter: 3.1:** Manufacture of Portland cement by dry process, types of cement - Raw materials and Method of manufacture of Glass, types of glasses, and commercial – Glasses - Electronic grade Silica. **Chapter: 3.2:** Constituent of paints - Definition of PVC (Pigment, Volume, Concentration) Manufacturing procedure – Pigments manufacture of Lithophone and Titanium dioxide.	**18 Hrs**

IV	**SYNTHETIC DETERGENT** **Chapter: 4.1:** Classification of Detergent, Structure of Detergents, Anionic, Non–Ionic Detergents. Production with flow diagram – detergent through olefins, Sulphonation of Olefins, Keryl Benzene Sulphonate, Linear Alkyl Benzene Sulphonate. **Chapter: 4.2:** ISO SIV Adsorption Process for n-paraffin's - Finishing of Detergent – Builders, Bleaches and Whiteners, fillers and processing aids, perfumes, corrosion Inhibitors foams Agents, other Additives.	**18 Hrs**
V	**POLYMERIZATION, SYNTHETIC FIBRES AND RUBBER** **Chapter: 5.1:** Definition on Polymerization, Mass Polymerization, Solution Polymerization, Emulsion Polymerization. Introduction, General Properties of Fibers, Production technique, Melt Spinning, dry Spinning, Solution spinning. **Chapter: 5.2:** Production and uses of – Polyester Ribbon, Nylon 6.6, Nylon 6, Acrylic Fibers, Synthetic paper. Production and uses of – Synthetic Isoprene, Butadiene Rubber, styrene Butadiene Rubber, Butyl Rubber, ABS Rubber.	**18 Hrs**

Reference Books:

1. "M. Gopala Rao Marshall Sittig" "Dryden's Outliness of Chemical Technology", Edited and Reprinted by, 3rd Edition, East-West Press.
2. "Dr. B.K. BhaskaraRao" "A Text on Petro Chemicals", 1st Edition, Khanna Publishers.
3. "Austin, G.T" "Shreve's Chemical Process Industries", 5th Edition, Tata McGraw Hill.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Chemical Engineering (FT)

Subject Code : 4076520

Semester : V Semester

Subject Title : PROCESS INSTRUMENTATION AND CONTROL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
PROCESS INSTRUMENTATION AND CONTROL	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	BASIC CONCEPTS OF MEASUREMENT AND MEASUREMENT OF TEMPERATURE	14
II	MEASUREMENT OF PRESSURE	14
III	MEASUREMENT OF FLOW, LIQUID LEVEL AND HUMIDITY.	15
IV	PROCESS CONTROL	15
V	COMPUTERIZED PROCESS CONTROL	15
Test & Model Exam		7
Total		**80**

RATIONALE:

This subject gives the knowledge of various instruments used to measure various processes parameters. This course will impart knowledge on working principle, construction, repair, and use of these instruments. This course will make the students knowledgeable in various types of measuring instruments used in chemical process industries.

The diploma holder in chemical engineering has to deal with all kinds of equipment's in the chemical industry. This subject provides him/her thorough knowledge using all type of measuring & control instruments along with heat transfer; mass transfer equipment's along with pumps, blowers, compressors, crushers and screens and size reduction machines.

OBJECTIVE:

- To understand the application of various Industrial instruments & control system to measure the process variables.
- To know the necessity of studying Instrumentation
- To list out various Temperature measuring Instruments
- To list out various pressure measuring Instruments
- To understand the working of various temperature measuring Instruments
- To understand the working of various pressure measuring Instruments
- To list out various Flow measuring Instruments
- To list out various Liquid level measuring Instruments
- To measure the Flow rate using different flow measuring Instruments
- To handle various level measuring Instruments
- To understand the operation of different Humidity measuring Instruments
- To understand the significance of automatic control system.
- To distinguish the various modes of control actions
- To understand the principle of various controllers
- To understand about transmission of both analog and digital signals
- To understand the concept about Distributed Controlled System and its applications.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**BASIC CONCEPT OF MEASUREMENT AND MEASUREMENTOF TEMPERATURE** Purpose of Instrumentation – Measurement and its aim - Functional elements of Instruments – Static and Dynamic characteristics of Instruments - Signalling and Recording Instruments – Instrumentation diagram. Temperature measuring Instruments- Methods of temperature measurement- - Bimetallic Thermometer – RTD - Thermocouples – Thermistor – Radiation Pyrometer - optical pyrometer - Temperature Transmitter.	14 Hrs
II	**MEASUREMENT OF PRESSURE** Pressure- Units of Pressure - Different types of pressure - Methods of pressure measurement - Bourdon gauge - Bellow and Diaphragm pressure sensors. Vacuum measurement - Pirani gauge - Ionization gauge. Electrical pressure Transducers - Strain gauge pressure Transducers - Differential pressure Transmitter - Piezoelectric Pressure Transducer.	14 Hrs
III	**MEASUREMENT OF FLOW, LIQUID LEVEL AND HUMIDITY** Flow measurement: Introduction - Methods of flow measurement - Orifice meter – Venturimeter – Rotameter - Pitot tube - Electromagnetic Flowmeter - Turbine flow meter - Nutating Disc type. Liquid level measurement: Introduction- Methods of level measurement - Sight glass – Float - tape level indicator - Air purge system - Capactive and Conductivity type level sensor- Radiation level detector. Humidity measurement: Hair Hygrometer – Sling Psychrometer.	15 Hrs

IV	**PROCESS CONTROL** Automatic control system – significance – Terminology used in control system: controlled variable, manipulated variable, set point, etc. - General process control system: open loop system, closed loop system, Feedback control system, Feed forward control system and Ratio control system (Principles and Purposes only) - Block diagram - elements of process dynamics – static and dynamic behavior of process - process lag - dead time - process degree of freedom. Automatic controllers: controllers- classification; based on control action such as P,I,PI,PD,PID – based on actuating medium such as Pneumatic, Hydraulic and Electronic (concept and application only in Pneumatic system) - Final control element: control valves, variable speed drives. Control application in (a) liquid level system (b) Heat Exchanger - control of temperature and flow rate. (c) Batch Reactor - control of temperature and pressure.	**15 Hrs**
V	**COMPUTERIZED PROCESS CONTROL** Modes of signal - Transmission of Analog signal - electronic and pneumatic methods - Transmission of Digital signal - Data logging and transmission using computer-conversion of analog signal into digital vice-versa. Process control computers: Analog computer system, Digital computer system - Features of both types - application of Distributed Controlled System (DCS) in unit operation, unit process and plant control - schematic diagrams for the control of simple unit process - computer supervisory control - simple control flow sheets using computer for Batch reactor and CSTR.	**15 Hrs**

Reference Books:

1. “Donald P Eckman” “Industrial instrumentation”, John Wiley & Sons Inc.
2. “S.K. Singh” “. Industrial Instrumentation and Control”, Tata McGraw Hill.
3. “Donald P Eckman” “Automatic Process Control”, John Wiley & Sons Inc.
4. “M Chidambaram” “Computer Control of Processes”, Narosa Publishing House.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075531

Semester : V

Subject Title : FERTILIZER TECHNOLOGY

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
FERTILIZER TECHNOLOGY	**5**	**80**	**25**	**100***	**100**	**3 Hrs**

*** Examination will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
1	Overview of Fertilizers	15
2	Nitrogenous Fertilizers	15
3	Phosphatic Fertilizers	15
4	Potash Fertilizers	14
5	Complex, Mixed and Bio Fertilizers	14
Test & Model Exam		7
Total		80

RATIONALE:

Agriculture sector is an important role in Indian economy. Chemical fertilizers are must for producing good crops. Hence it is needed to provide comprehensive and balanced understanding of essential link between chemistry and the chemical fertilizer industry. It is therefore vital for chemical engineers to understand for each fertilizer product, its flow diagram for industry production. For this purpose, students should have skills for arranging treatment, reaction and separation steps in a flow diagram for variety of fertilizers including Nitrogenous fertilizers, Phosphatic fertilizer, Potash fertilizer, Complex fertilizer and Bio fertilizers is essential. Hence this course is designed to achieve this objective.

OBJECTIVES:

On completion of this subject, the students can able to understand the following concepts:

- Introduction and classification of chemical fertilizers.
- Role of essential Elements in plant growth.
- Macro elements and Micro elements.
- Application of fertilizers.
- Feed stock and raw materials for various fertilizers
- Methods of production of ammonia and urea.
- Methods of production of nitrogen fertilizers such as nitric acid, ammonium sulphate etc.
- Characteristics, storage and handling specifications of nitrogenous fertilizers.
- Process for the production of sulphuric and phosphoric acids.
- Methods of production, specification, characteristics for complex fertilizers, NPK fertilizers and Mono ammonium phosphate etc.
- Manufacturing of NPK, ASP, CAN and biofertilizers.
- Preparation of a biofertilizers.

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**OVERVIEW OF FERTILIZERS** Chemical Fertilizers, Classification of Fertilizers, Role of essential elements in plant growth, Macro nutrients elements and Micro nutrients elements, Applications of fertilizers considering nutrients. Feed stock and raw materials for Nitrogenous, Phosphatic and Potassic fertilizers, Acid used for production of Fertilizer – Manufacture methods – Product characteristics and application of Nitric acid, Sulphuric acid and Phosphoric acid.	**15 Hrs**
II	**NITROGENOUS FERTILIZERS** Nitrogen sources - Manufacture, Characteristics and Application of Ammonia, Methods of Production, Characteristics and storage and handling specifications of various Nitrogen fertilizer such as Urea, Ammonium Sulphate, Ammonium Nitrate, Ammonium Chloride.	**15 Hrs**
III	**PHOSPHATIC FERTILIZERS** Phosphatic fertilizers, Raw materials, Classification of Phosphatic Fertilizer, Methods of Production, Characteristics and storage and handling specifications of Various Phosphatic fertilizer - Single super Phosphate, Triple super Phosphate, Mano Ammonium Phosphate, Diammonium Phosphate, Ammounium Poly Phosphate.	**15 Hrs**
IV	**POTASH FERTILIZERS** Introduction of Potash fertilizers, Raw material for Potash fertilizer, Muriate of Potash – raw materials – Various methods of production and product characteristics of Muriate Potash, Potassium sulphate – Raw materials – Various methods of production and Product characteristics, Potassium Nitrate – Raw materials - Methods of Production, Specification, Characteristics.	**14 Hrs**

V	COMPLEX, MIXED AND BIO FERTILIZERS	14 Hrs
	Introduction of Complex Fertilizers – Raw materials – Various types of Complex fertilizers – Ammonium Phosphate Sulphate – Raw materials – Methods of production – Product characteristics – Urea Ammonium Phosphate – Raw materials – Manufacture method – Specification – NPK – Raw materials – Methods of production. Introduction of Mixed Fertilizers - Manufacture methods. Biofertilizers, Types of Biofertilizers, Nitrogen fixing, Biofertilizers Phosphate solubilizing Biofertilizers, Preparation of a Biofertilizers.	

Reference Books:

1. Hand book of Fertilizer Association of India, New Delhi, 1998.
2. Hand book of Fertilizer Technology, Fertilizer Association of India, New Delhi, 1977.
3. "Slack A.V." "Chemistry and Technology of Fertilizers", Interscience, New York, 1967.
4. "Gopala Rao.M & Marshall Sittig" "Dryden's Outlines of Chemical Technology", East-West Press, 3rd Edition, New Delhi.
5. "Austin G.T." Shreve's Chemical Process Industries, 5th edition, Tata McGraw Hill.
6. "Pandey & Shukla" "Chemical Technology, Volume I & II", 2nd edition, Vanis Books Company.
7. "Subba Rai N.S" "Bio fertilizers in Agriculture", Oxford & IBH Publishing Company.
8. "Collings G H" "Commercial Fertilizers", 5th Edn., Mcgraw Hill, New York, 1955.
9. "Slacks A V" "Chemistry and Technology of Fertilizers" Interscience, New York, 1966.
10. "Brahma Mishra" "Fertilizer Technology and Management", IK International Publishing House Private Limited, New Delhi, India.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075532

Semester : V Semester

Subject Title : DRILLING ENGINEERING

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
DRILLING ENGINEERING	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	DRILLING ENGINEERING AND DRILLING FLUID	14
II	DRILLING HYDRAULICS, WELL CONTROL AND MONITORING PROGRAM	15
III	CASING DESIGN	15
IV	CEMENTING	15
V	HORIZONTAL, DIRECTIONAL DRILLING AND WELL COMPLETION	14
Test & Model Exam		7
Total		**80**

RATIONALE:

1. To produce employable students with the knowledge and competency in Petrochemical and Drilling Technology complemented by the appropriate skills and attributes.
2. To produce creative and innovative students with design and soft skills to carry out various problem solving tasks.
3. To enable the students to work as teams on multi disciplinary projects with effective communication skills, individual, supportive and leadership qualities with the right attitudes and ethics.
4. To produce students who possess interest in research and lifelong learning, as well as continuously striving for the forefront of technology.
5. To enable the students to set up models for an Drilling Technology system based on continuity equations and transport equations for relevant variables, and with necessary boundary conditions.

OBJECTIVES:

The students of this program would have

1. To understand various aspects involved in drilling a well including completion.
2. To understand the plan of drilling a well, the process of drilling and various equipment used for drilling and design of the drill string.
3. To know the drilling fluid importance and its properties and hydraulics.
4. To understand different types of casings lowered in a well, the requirement of cementation in a well and cement slurry design.
5. To understand different tools used for directional drilling and various techniques, fishing, stuck pipe and well control concepts.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**DRILLING ENGINEERING AND DRILLING FLUID** Introduction of Drilling Engineering - Importance and Application of Drilling Engineering - An Overview of Drilling Engineering. Introduction of drilling - Types of Drilling Methods - Cable Tool Drilling, Rotary Drilling - Rotary Drilling Rig and its Components - Drilling Process - Types of Rotary Drilling Rigs. Introduction - Drilling Fluid Circulating System - Classification of Drilling Fluids - Water-base Mud, Oil-based Mud, Air or Gas-base Mud, Foam, Special Types of Muds. Composition of Drilling Fluids - Mud Additives - Chemical Additives, Additives for Water-based Mud, Additives for Oil-based Mud - Measurement of Drilling Fluids Properties.	14
II	**DRILLING HYDRAULICS, WELL CONTROL AND MONITORING PROGRAM** Introduction - Types of Fluids, Flow Regimes, Laminar Flow, Turbulent Flow, Transitional Flow - Hydrostatic Pressure Calculation, Liquid Columns, Gas Columns, Fluid Flow through Pipes - Fluid Flow through Drill Bits. Introduction, Well Control System, Well Control Principles, Warning Signals of Kicks, Primary Indicators, Secondary Indicators, BOP Equipment for Well Control System, Kick Detection Equipment, Kick Management Equipment, Well Monitoring System.	15
III	**CASING DESIGN** Introduction, Importance of Casing String, Types of Casing String, Classification and Properties of Casing, Manufacturing of Casing, Rig-site Operation, Handling Procedures, Running Procedures, Landing Procedures.	15

IV	**CEMENTING** Introduction, Applications of Oil Well Cements, Cement Production, Classifications of Oil Well Cements, Cement Properties, Types of Cementing, Primary Cementing, Squeeze Cementing, Plug Cementing, Liner Cementing, Oil Well Cement Additives, Cementing Design Process, Mechanics of Cementing, Cementing Equipment, Cementing Processes, Cement Volume Calculation.	15
V	**HORIZONTAL, DIRECTIONAL DRILLING AND WELL COMPLETION** Introduction, Functions, Basic Terminologies, Types of Directional Drilling, Horizontal Drilling, Multilateral Drilling, Extended Reach Drilling (ERD), Coiled Tubing Drilling (CTD), Well Planning Trajectory, Directional Patterns, Directional Drilling Tools, Well Survey. Introduction, History of Well Completion, Requirements for Well Completion, Types of Well Completion, Open-hole Completion, Un cemented Liner Completions, Cased and Cemented Completions, Perforated Completion, Multi-Zone Completions, Factors Influencing Well Completion Design, Completion Equipment and Materials, Sand Control, Remedial Cementing, Corrosion and Corrosion Prevention.	14

Reference Books:

1. "Carl Gatlin" "Petroleum Engineering: Drilling and Well Completion", Prentice-Hall, Inc.,1960.
2. "J.J. Azar and G. Robello Samuel" "Drilling Engineering", Pennwell Books, 2007.
3. **"**William Lyons" "Working Guide to Drilling Equipment and Operations", Gulf Publishing, 2009.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075533

Semester : V SEMESTER

Subject Title : PROCESS UTILITIES

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
PROCESS UTILITIES	**5**	**80**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

TOPICS AND ALLOCATION OF HOURS

Unit	Topic	Hours
1.	Water and its Importance	15
2.	Refrigeration	15
3.	Steam Generation	15
4.	Piping and its importance	14
5.	Pinch Analysis	14
6.	Test & Revision	7
Total		80

RATIONALE:

All oil refineries and other petroleum processing facilities need utilities in order to function. The subject is introduced to give the student a thorough knowledge of process utilities such as demineralization of water and its importance, refrigeration, steam generation, piping and its importance and s pinch analysis, which is essentially for the processes, design, reliability and operation of these critical systems in petrochemical industries.

OBJECTIVES:

On completion of the units of syllabus the students must be able to know about:

- Sources and properties of water
- Methods of water treatment
- Refrigeration and its performances
- Different types of Refrigeration cycle
- Refrigeration on PV and TS diagram
- Classification and solution criteria for Refrigerator
- Introduction and properties of steam
- Different types of steam generators
- Boiler mounting and accessories
- Piping and its importance
- Role and scope of piping
- Process flow diagram and instrumentation diagram.
- Pinch analysis process representation
- Temperature enthalpy diagram
- Heat exchanger, networks, synthesis using pinch technology

DETAILED SYLLABUS

Contents : Theory

UNIT	Name of Topics	Hours
I	**WATER & ITS IMPORTANCE** Sources of water- parameters like hardness, suspended solids (SS), turbidity and alkalinity etc., hard and soft water Requisites of industrial water and its uses-Methods of water treatment –flow diagram-coagulation by iron compounds like alum-sedimentation – filtration - chemical softening and demineralization (Ion Exchange Process) - Resins used for water softening - Reverse osmosis and membrane separation - Effects of impure boiler feed water - scale and sludge formation, corrosion, priming and foaming, caustic embrittlement	**15 Hrs**
II	**REFRIGERATION** Refrigeration - Definition, unit of refrigeration - coefficient of performance. Refrigeration cycles - Reversed Carnot cycle, representation on PV and TS diagram. Air refrigeration cycle - Bell Coleman air refrigeration cycle. Vapor compression and absorption cycle - Li-Br absorption system Refrigerants – Classification - selection criteria and applications.	**15 Hrs**
III	**STEAM GENERATION** Properties of steam - Problems based on enthalpy calculation for wet steam, dry saturated steam, superheated steam Types of steam generators/boilers: water tube & fire tube, Solid fuel fired boiler, waste gas fired boiler, Waste heat boiler, Fluidized bed boiler. Scaling, trouble shooting, blow down preparing boiler for inspection	**15 Hrs**

	Steam traps, pressure reducing valves (PRV), steam ejectors, boiler mountings and accessories: feed water pump, injector, economizer, air preheater, super heater, pressure gauge, water level indicator, safety valve etc.	
IV	**PIPING & ITS IMPORTANCE** Piping: Role & scope of piping, line diagram, Process flow diagram and piping and instrumentation diagram - Piping networks for water, steam, condensate and air.	**14 Hrs**
V	**S PINCH ANALYSIS** Pinch Analysis: Problem representation, temperature enthalpy diagram, simple match matrix. Heat content diagram, Temperature interval diagram. Heat Exchanger Network Synthesis using Pinch technology	**14 Hrs**

Reference Books :

1. “Jack Broughton” “Process Utility Systems: Introduction to Design, Operation and Maintenance”, IChemE.
2. “Mahesh M. Rathore” “Thermal Engineering”, Tata McGraw Hill.
3. “Robin Smith” “Chemical Process Design and Integration”, John Wiley & Sons Limited.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076540

Semester : V Semester

Subject Title : ENTREPRENERUSHIP AND STARTSUPS

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
ENTREPRENERUSHIP AND STARTSUPS	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspiration of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promoting concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs, relevant to social prosperity and thereby ensure good means of living for every individual, provides jobs and develop Indian economy.

OBJECTIVES:

At the end of the study of 5th semester the students will be able to

- To excite the students about entrepreneurship
- Acquiring Entrepreneurial spirit and resourcefulness
- Understanding the concept and process of entrepreneurship
- Acquiring entrepreneurial quality, competency and motivation
- Learning the process and skills of creation and management of entrepreneurial venture
- Familiarization with various uses of human resource for earning dignified means of living
- Know its contribution in and role in the growth and development of individual and the nation
- Understand the formation of E-cell
- Survey and analyze the market to understand customer needs
- Understand the importance of generation of ideas and product selection
- Learn the preparation of project feasibility report
- Understand the importance of sales and turnover
- Familiarization of various financial and non financial schemes
- Aware the concept of incubation and starts ups

DETAILED SYLLABUS

Contents: Practical

Name of the Topics
Entrepreneurship – Introduction and Process ● Concept, Functions and Importance ● Myths about Entrepreneurship ● Pros and Cons of Entrepreneurship ● Process of Entrepreneurship ● Benefits of Entrepreneur ● Competencies and characteristics ● Ethical Entrepreneurship ● Entrepreneurial Values and Attitudes ● Motivation ● Creativity ● Innovation ● Entrepreneurs - as problem solvers ● Mindset of an employee and an entrepreneur ● Business Failure – causes and remedies ● Role of Networking in entrepreneurship
Business Idea and Banking ● Types of Business: Manufacturing, Trading and Services. ● Stakeholders: sellers, vendors, consumers and competitors ● E- commerce Business Models ● Types of Resources - Human, Capital and Entrepreneurial tools and resources ● Selection,utilization of human resources and professionals, etc. ● Goals of Business; Goal Setting ● Patent, copyright and Intellectual property rights ● Negotiations - Importance and methods ● Customer Relations and Vendor Management ● Size and capital based classification of business enterprises

- Various sources of Information
- Role of financial institutions
- Role of Government policy
- Entrepreneurial support systems
- Incentive schemes for state government
- Incentive schemes for Central Governments

Start ups, E-cell and Success Stories

- Concept of Incubation centre's
- Visit and report of DIC , financial institutions and other relevance institutions
- Success stories of Indian and global business legends
- Field Visit to MSME's
- Study visit to Incubation centers and start ups
- Learn to earn
- Startup and its stages
- Role of Technology – E-commerce and Social Media
- Role of E-Cell
- E-Cell to Entrpreneurship

Pricing and Cost Analysis

- Unit of Sale, Price and Cost - for single product or service
- Types of Costs - Start up, Variable and Fixed
- Income Statement
- Cash flow Projections
- Break Even Analysis - for single product or service
- Taxes
- Financial Business Case Study
- Understand the meaning and concept of the term Cash
- Inflow and Cash Outflow
- Price
- Calculate Per Unit Cost of a single product
- Operational Costs

● Understand the importance and preparation of Income Statement ● Prepare a Cash Flow Projection ● Projections ● Pricing and Factors affecting pricing. ● Launch strategies after pricing and proof of concept
Business Plan Preparation ● Generation of Ideas. ● Business Ideas vs. Business Opportunities ● Opportunity Assessment – Factors, Micro and Macro Market Environment ● Selecting the Right Opportunity ● Product selection ● New product development and analysis ● Feasibility Study Report – Technical analysis, financial analysis and commercial analysis ● Market Research - Concept, Importance and Process ● Market Sensing and Testing ● Marketing and Sales strategy ● Digital marketing ● Branding - Business name, logo, tag line ● Promotion strategy ● Business Plan Preparation ● Social Entrepreneurship as Problem ● Solving - Concept and Importance ● Risk Taking-Concept ● Types of business risks ● Execution of Business Plan

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076550

Semester : V Semester

Subject Title : CHEMICAL PROCESS SIMULATION PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
CHEMICAL PROCESS SIMULATION PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing engineering related experiments in practical classes.

OBJECTIVES:

- Able to handle various unit operation and plant at different condition of process variable using simulator.
- Need of simulator - Application of simulators distributed controlled system - Dynamic Graphic (mimic), Bar graph - Trend and Alarm

GUIDELINES:

- All the Ten experiments given in the list of experiments should be completed and given for the end semester practical examination.
- In order to develop best skills in handling Instruments/Equipment and taking reading in the practical classes, every two students should be provided with a separate experimental setup for doing experiments in the laboratory.
- The external examiners are requested to ensure that a single experimental question should not be given to more than four students while admitted a batch of 30 students during Board Examinations.

LIST OF EXPERIMENTS

Practice the following using process simulator.

- Practice correct start up and shut down procedure of plant.
- Change the P,I,D values and process parameters and observe the change in trend, bar graph and mimics.
- Attend the malfunction occurring in the plant then restoring to its design conditions.

Practice the above exercise on the following modules given below using process simulator.

- Fractionation column for the distillation of binary mixture.
- Batch Reactor
- Double pipe Heat exchanger
- Size reduction using Ball mill.
- Level and flow control in different sizes of vessel
- CSTR in series.
- Centrifugal pump
- Fluidized bed column
- Packed bed column
- Flow through pipes.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076560

Semester : V Semester

Subject Title : PROCESS INSTRUMENTATION AND CONTROL PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
PROCESS INSTRUMENTATION AND CONTROL PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing engineering related experiments in practical classes.

GUIDELINES:

- All the Ten experiments given in the list of experiments should be completed and given for the end semester practical examination.
- In order to develop best skills in handling Instruments/Equipment and taking reading in the practical classes, every two students should be provided with a separate experimental setup for doing experiments in the laboratory.
- The external examiners are requested to ensure that a single experimental question should not be given to more than four students while admitted a batch of 30 students during Board Examinations.

LIST OF EXPERIMENTS

1. Study of characteristics of Thermocouple module.
2. Study of characteristics of RTD and Thermistor.
3. Measurement of Pressure using Strain Gauge type Transducer
4. Measurement of Pressure using Bourdon Pressure Transducer
5. Study the linearity of P/I and I/P converter.
6. Level measurement by using Differential Pressure (DP) Transmitter.
7. Study of valve flow coefficients and inherent characteristics of Linear, Equal% and Quick opening.
8. Study of ON- OFF controller using Temperature controller Trainer kit by monitoring the process in SCADA mode or Analog.
9. Study of P, PI and PID controller using Liquid Level controller Trainer kit by monitoring the process in SCADA mode or Analog.
10. Study of P, PI and PID controller using Pressure controller Trainer kit by monitoring the process in SCADA mode or Analog.

LIST OF EQUIPMENTS

1. Temperature sensors like Thermocouple, RTD and Thermistor - 1 No.
2. Strain Gauge type Pressure Transducer - 1 No.
3. Bourdon Pressure Transducer - 1 No.
4. P/I and I/P converter - 1 No.
5. Differential Pressure Transmitter - 1 No.
6. Pneumatic control valve (Linear, Equal % and Quick opening) set up - 1 No.
7. Temperature control Trainer Kit with SCADA or Analog - 1 No.
8. Liquid Level control Trainer Kit with SCADA or Analog - 1 No.
9. Pressure Control Trainer Kit with SCADA or Analog - 1 No.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN PETROCHEMICAL ENGINEERING

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075570

Semester : V SEMESTER

Subject Title : DISTILLATE TESTING PRACTICAL - II

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours/ Wee	Hours/ mester	Internal Assessment	Board Examination	Total	
DISTILLATE TESTING PRACTICAL - II	**4**	**64**	**25**	**100***	**100**	**3 Hrs**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education skill development plays a key role. The skill development can be achieved by hands on experience in handling various instruments, apparatus and equipment in focus of improving new trends in petroleum Refinery .This is accomplished by doing engineering related experiments in practical classes in various laboratories.

OBJECTIVES:

After completion of this laboratory, the students will be able

- To understand methods of testing Petroleum distillates (Gasoline, Kerosene, Lube oil) is done.
- To know how distillates meet the specification to satisfy the end users requirement.
- To aware of the tests carried in Refinery.
- To know the importance of Bromine number, Refractive index for Aromatics
- To understand about carbon residue which is more important for heavier ends for further cracking operation.

GUIDELINES:

- All the Ten experiments given in the list of experiments should be completed and given for the end semester practical examination.

- In order to develop best skills in handling Instruments/Equipment and taking readings in the practical classes, every six students should be provided with a separate experimental setup for doing experiments in the laboratory.

- The external examiners are requested to ensure that a single experimental question should not be given to more than four students while admitting a batch of 30 students during Board Examinations.

LIST OF EXPERIMENTS

- Copper Corrosion test
- Say boltcolor test
- Determination of Reid vapor Pressure
- Determination of Refractive Index
- Carbon residue by Conradson method
- Carbon residue by Rams bottom method
- Determination of Bromine Number
- Determination of Sediments by extraction
- Determination of Kinematic Viscosity
- Determination of Penetration number of Bitumen

LIST OF EQUIPMENTS

1. Copper Corrosion test - 1No.
2. Say bolt color test - 1 No.
3. Reid vapor Pressure - 1 No.
4. Refractive Index - 1 No.
5. Carbon residue by Conradson method - 1 No.
6. Carbon residue by Rams bottom method - 1 No.
7. Bromine Number apparatus - 1 No.
8. Sediments by extraction - 1 No.
9. Kinematic Viscosity - 1 No.
10. Penetration number - 1 No.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075610

Semester : VI

Subject Title : REFINERY MASS TRANSFER

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

Subject	Instruction		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
REFINERY MASS TRANSFER	**6**	**96**	**25**	**100***	**100**	**3 Hours**

*** Examination will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
1	Distillation	18
2	Distillation Equipments	17
3	Extraction and Leaching	18
4	Absorption and Adsorption	18
5	Crystallization	18
Test & Model Exam		7
Total		96

RATIONALE:

Refinery mass transfer is one most important subject in Petrochemical Engineering. The basic concepts of this subject are covered to enable the students to understand the principle of various mass transfer operation and its equipments like The various chapters of Refinery mass transfer like Distillation, Extraction, Leaching, Absorption, Adsorption, Crystallization and Equipments etc, which are used in Refinery industries for purification and separation of products from the feed stocks.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about

- Distillation of binary mixture and Vapour – Liquid behavior in an Ideal plate.
- Overall Material balance of binary mixture in a Distillation Column and Principles of Raoult's Law and multi components system
- Distillation equipments used in refinery and its types.
- Distillation equipments construction and its accessories.
- Necessity of extraction and importance of triangular chart, Extraction equipments and application of extraction
- Principles of leaching, Equipments and its industrial applications.
- Different types of Absorption and Equipments.
- Principles of Adsorption, Equipments and Adsorbents used in industry
- Mechanism of crystallization and its types.
- Different crystallizer equipments and its applications.

DETAILED SYLLABUS

Contents : Theory

Unit	Name of the Topics	Hours
I	**DISTILLATION** **Chapter: 1.1:** Distillation, Principle of Distillation, Raoult's law, Dalton's law, minimum boiling Azeotropes, maximum boiling azeotropes, multi-component systems. Flash distillation of binary mixtures, Continuous distillation with reflux – action on an ideal plate, Combination rectification and stripping. **Chapter: 1.2:** Material balances in plate Columns – Overall Material balance for two component systems, net flow rate, determination of theoretical plates required for a tray tower using McCabe - Thiele method, Optimum reflux ratio (Principles on) ,simple problems – Using Raoult's law, Dalton's Law, No of plates by Mccabe thiele method.	18 Hrs
II	**DISTILLATION EQUIPMENTS** **Chapter: 2.1:** Description with Diagram: Simple distillation, Azeotropic distillation, Extractive distillation Molecular distillation, Steam distillation. **Chapter: 2.2:** Construction of rectifying column (Bubble cap, Sieve plate, Valve trays), Types of down comers, Packed column, Fractionating column with accessories (condenser, partial condenser, and reboiler) and its arrangement.	17 Hrs
III	**EXTRACTION AND LEACHING** **Chapter: 3.1:** Liquid – Liquid Extraction, Liquid Equilibrium, Triangular chart and its use, Choice of solvent for extraction, Industrial application of Extraction - System of three liquid – One pair partially soluble, two pair partially soluble - Co-current, Cross current, Counter current extraction (Principles only), Equipments - description with diagram – mixer settler Cascades, Sieve tray towers, Packed towers, Rotating disc contactor. **Chapter: 3.2:** Principles of Leaching, Preparation of Solid and Industrial Application - Equipments - Description with diagram – Robert diffusion battery, Basket Extractor, Dorr Agitator, Dorr Thickener.	18 Hrs

IV	**ABSORPTION AND ADSORPTION** **Chapter: 4.1:** Gas absorption principles, Equilibrium Solubility of gases in liquids, Two component systems, multi component systems, absorption with chemical reaction. Equipments description with diagram - Packed tower operation, packing, Packing Supports, liquid distributor, entrainment separator, and definition of loading and flooding of packed towers-simple problems to calculate solvent flow rate to tower, composition calculation, HTU. **Chapter: 4.2:** Adsorption, Industrial Application, Vapor phase adsorption systems, adsorption Isotherms (Principles only), concentration vs. adsorbate loading, Break through Curve - Phys cal and Chemical Adsorption (Principles only) - Important Adsorbents - Molecular sieves, Silica gel, Zeolite, Decolorizing Carbons (short note only).	**18 Hrs**
V	**CRYSTALLISATION** **Chapter: 5.1:** Crystallization, Purity of product, Importance of Crystal size, Equilibria and Solubility curve, Preparation of Super saturation, Nucleation – Origins of Crystals in crystallizers, Primary Nucleation, Secondary Nucleation, Fluid Shear Nucleation, Contact Nucleation. **Chapter: 5.2:** Equipments - Description with diagram – Vacuum Crystallizers, draft tube baffles Crystallizers, Crystallization from melts.	**18 Hrs**

Reference Books:

1. "W.L. Mc Cabe & J.C. Smith" "Unit operation of chemical Engg", 6th Edition, Tata McGraw Hill.
2. "W.L. Badger & J.T. Banchero" "Introduction to Chemical Engg",Tata McGraw Hill.
3. "R.E. Treybal" "Mass Transfer Operation", Tata McGraw Hill.
4. "Robert H. Perry – and D.W. Green" "Perry's Chemical Engineers Hand book", 7th Edition, Tata McGraw Hill.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076620

Semester : VI Semester

Subject Title : INDUSTRIAL SAFETY AND POLLUTION CONTROL

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
INDUSTRIAL SAFETY AND POLLUTION CONTROL	**6**	**96**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	INDUSTRIAL ACCIDENT AND SAFETY	18
II	FIRE AND ITS PREVENTION	18
III	PROCESS PLANT HAZARDS	18
IV	PREVENTIVE AND PROTECTIVE MEASURES	18
V	POLLUTION CONTROL	17
Test & Model Exam		7
Total		**96**

RATIONALE:

This subject helps the students to understand the basic principles of plant safety and various safety measures adopted in chemical plants. Also helps to understand various occupational hazards existing in chemical industries. The subject aims at providing students the knowledge of various pollutants with respect to air, water and particularly emissions. The knowledge of students, mode of treatment and analysis techniques for different pollutants will also be imparted. Industrial safety is gaining importance with time and this subject will also cover chemical hazards.

OBJECTIVE:

On completion of the syllabus the student must be able

- To understand the importance of safety in process industries by taking two case studies.
- To understand the evaluation of various toxicants in the working area.
- To acquire the knowledge about Fires, causes and their classification.
- To know the importance of Flash point, Fire Point, LFL & UFL.
- To understand the concepts of Fire balls, Runaway chemical reactions, etc.,
- To Know how to carryout HAZOP study regarding temperature and pressure.
- To know the working principle of various process protective equipments and their importance.
- To understand the various works permit system and their procedure.
- To know the importance of emergency planning and their types.
- To gain knowledge about various personnel protective equipments and their uses.
- To bring about the important aspects in the environmental act 1986.
- To understand the effects of acid rain, Global warming, Ozone depletion and their control measures.
- To know the various chemical and biological treatment of industrial effluent.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**INDUSTRIAL ACCIDENT AND SAFETY** Process Safety – causes of Accidents – unsafe acts and conditions – importance of safety in process industries – Responsibility of supervisor regarding safety – material safety data sheet and its importance- Evaluating workers exposure to volatile toxicants, dusts and noise. Accident prevention - safety training and role of safety training in industry - Case study of accidents in process industry: Bhopal gas tragedy India - Fukushima nuclear disaster Japan.	**18 Hrs**
II	**FIRE AND ITS PREVENTION** Elements of fire and Fire triangle - Different causes of fire - Distinction between fires and explosion - Flash point and fire point - Classification of flammable liquids based on flash point-causes of initiation of fire - Classification of fires according to combustible materials - Causes of electrical fire - Fire alarms and smoke detectors. Fire extinguish techniques - working of Carbon-dioxide fire extinguisher and Dry chemical fire extinguisher.	**18 Hrs**
III	**PROCESS PLANT HAZARDS** Hazard – classification of hazards - causes and prevention of Pressure vessel hazards - Static Electricity hazards and its control - Flammability and Toxicity - Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) - Threshold Limit Value (TLV) - Hazards of temperature – BLEVE - Runaway chemical reaction. MSDS (Material Safety and Data Sheet) for the following chemicals - Ammonia, Benzene, Acetone, Phenol and Toluene.	**18 Hrs**

IV	**PREVENTIVE AND PROTECTIVE MEASURES** Permit to work system - Hot work permit, Confined space vessel work permit, safety precautions while entry into confined spaces and Height work permit - occupational safety and health risks related to maintenance – Lockout / Tagout procedures. Functions of relief valves and safety valves - Breather vent for storage tanks - Function of Flame Arresters - Flare systems - Planning for Emergencies - Personnel protective Equipments and its importance.	**18 Hrs**
V	**POLLUTION CONTROL** Air pollution - sources and types of pollutants - Adverse effects - Air sampling and Monitoring - Ozone depletion – Green house effects - Acid rain and Global warming - Important aspects of Environment Protection Act, 1986. Water pollution - sources and types - constituents of waste water - Important terms used in water treatment - BOD, COD, DO, TDS, and Biodegradability tests - Primary treatment - Coagulation and Flocculation - Secondary (Biological) treatment - Activated Sludge process - Important aspects of the Water (Prevention and Control of Pollution) Act, 1974.	**17 Hrs**

Reference books:

1. “Handbook of industrial safety and health”, Trade & Technical Press Limited.
2. “William Handley” “Industrial Safety Handbook”, Tata McGraw Hill.
3. “Howard H Fawcett and William Samuel Wood” “Safety and accident prevention in chemical operations”, Inter science Publishers.
4. “S.P. Mahajan” “Pollution Control in Process Industries”, Tata McGraw Hill.
5. “K. S. N. Raju” “Chemical Process Industry Safety”, Tata McGraw Hill.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075631

Semester : VI

Subject Title : Energy Resources and Management

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
Energy Resources and Management	**6**	**96**	**25**	**100***	**100**	**3 Hrs**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	ENERGY PRODUCTION	18
II	FURNACE	18
III	RENEWABLE ENERGY RESOURCES	18
IV	GLOBAL AND NATIONAL ENERGY SCENARIO	18
V	WATER MANAGEMENT	17
Test & Model Exam		7
Total		**96**

RATIONALE:

The exponential growth of Engineering and Technology has benefited the mankind with extreme sophistication and comfort. The Petrochemical industry in India is poised for explosive growth in the coming years. Over all chemical engineers could make very important contributions for the improvement and maintenance of the quality of life. The various chapters of Energy Resources and like Energy Production from renewable and non-renewable, global scenario, furnaces and waste water treatment.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about

- Three sources of Conventional Energy Production
- The improvement of the fuel.
- Furnaces that employ the fuels to harness Energ
- Methods of achieving fuel economy.
- Importance of Renewable energy
- Sources and its harvesting methods
- Energy scenario for sustainable development.
- Energy conservation act
- Utilities, Management of Water from available resources
- Recovery and reuse, abating of contamination of Water Table, controlling of sudden influx.

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**ENERGY PRODUCTION** Solid fuels - Characterisation of coal - Grindability Indes - Pulverisation – Carbonisation of coal-Briquetting of coal - Liquid fuels - types improving. Octane Number by blending and reforming (principles only) - Colloidal fuel – benzol - Power alcohol, Biodiesel. Gaseous fuels – types – production of CNG and LNG - combustion efficiency of gaseous fuels - comparitive study of solid, liquid and gaseous fuel.	18 Hrs
II	**FURNACE** Introduction – Broad classification of furnace – Muffle furnace – Fuel economy of furnace – Detailed study of factors affecting fuel economy in the furnace – use of waste heat as a secondary heat source – Waste Heat Boilers – Recuperation – Radiation and convection recuperation – Regenerator – Control of furnace atmosphere.	18 Hrs
III	**RENEWABLE ENERGY RESOURCES** Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Wind Energy Conversion, Potential, Nature of the wind, Wind Data and Energy Estimation, Site selection, Types of wind turbines, Biomass Energy: Principles of Bio-Conversion, Anaerobic / aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas.	18 Hrs

IV	**GLOBAL AND NATIONAL ENERGY SCENARIO** Over view of conventional & renewable energy sources, need, potential &development of renewable energy sources, types of renewable energy systems, Energy Strategy for the Future , Global and Indian Energy scenario, Energy for sustainable development, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems The Energy Conservation Act, 2001 and its Features	**18 Hrs**
V	**WATER MANAGEMENT** Water treatment procedures – rain water harvesting - Demineralised water – water conservation and recycling - Waste water treatment :Effluent Treatment for toxic and non- toxic , Chemicals – Disposal of effluent, Sludge - Drainage systems for sudden outflow and flooding - Water for mains	**17 Hrs**

Reference Books:

1. "Gupta O.P" "Elements of Fuels, Furnaces and Refractories", 4th Edition, Khanna Publishers.
2. "Godfrey Boyle" "Renewable Energy", Oxford University Press.
3. "Chetan Singh Solanki" "Renewable Energy Technologies: A Practical Guide For Beginners", PHI Learning Pvt. Limited.
4. "Metcalf & Eddy" "Wastewater Engineering", Tata McGraw Hill.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4076632

Semester : VI

Subject Title : Natural Gas Engineering

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
NATURAL GAS ENGINEERING	6	96	25	100*	100	3 Hrs

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

TOPICS AND ALLOCATION OF HOURS

Unit	Topic	Hours
1	Properties And Composition Of Natural Gas	18
2	Estimation And Production Of Natural Gas	18
3	Gas From Condensate Oil Fields	18
4	Acid Gas Treating Of Natural Gas	18
5	Dehydration Of Natural Gas And NGL Recovery	17
6	Test & Revision	7
Total		96

RATIONALE:

The process of making the oil and gas available in the huge quantities needed to sustain our industrial economy and maintain our standard of living is quite challenging. Petroleum engineers are trained to face these challenges. Oil and gas must be discovered: its quantity and production potential must be assessed: optimal extraction methods must be established to maximize recovery; and it must be transported from the point of production to the refinery and then stored. All these processes need to be carried out in an environmentally benign manner. Petroleum engineers must be multi-faceted in order to cover all these various aspects.

OBJECTIVES:

On Completion of the units of syllabus contents the students must be able to understand the following:

- Understand the basic concept and application of natural gas engineering.
- Formulating, communicating and implementing solutions to engineering problems in a variety of professional environment.
- Understand the Importance, properties and composition of natural gas.
- Estimate and production of natural gas.
- Understand Principles and production of acid gas treating of natural gas.
- Understand Processing of condensate well fluids.
- Know about different types of dehydration of natural gas and NGL recovery.
- Learn the Natural gas processing, gas compression, Gas gathering, operation and trouble shooting of natural gas pipelines.

DETAILED SYLLABUS

Contents : Theory

UNIT	NAME OF TOPICS	Hours
I	**PROPERTIES AND COMPOSITION OF NATURAL GAS** Natural gas origin - Composition of natural gas - Sources of Natural gas - Thermodynamics Properties, Specific gravity, Pseudo critical Properties, viscosity - Compressibility factor and chart for natural gas - Heating value and flammability limit of natural gas - Source of information for natural gas engineering and its applications.	**15 Hrs**
II	**ESTIMATION AND PRODUCTION OF NATURAL GAS** Estimation of gas reserves by volumetric method: Isopach, isowall map, material balance method, model studies method – Production of natural gas - LPG treatment process - Pressure decline method - Problems in the production of natural gas - Field separation – Vertical separations, Horizontal separations.	**14 Hrs**
III	**GAS FROM CONDENSATE OIL FIELDS** Processing of condensate well fluids - High pressure gas and gas sales system, Reabsorption in condensate system, distillation in stabilization - Cycling of gas condensate reservoirs - Sweep patterns - Katy cycling pla - Gathering and transmission, and natural gas liquefaction.	**14 Hrs**
IV	**ACID GAS TREATING O NATURAL GAS** Acid gas removal: Metal oxide process- Iron oxide proces , Zinc oxide process - Slurry process - Chem Sweet process, sulfa check process - Amine process, girbotol process - Carbonate washing process - Methanol based process - rectisol process, ifp process, potassium phosphate process, alkazid process, hotpotassiumcarbonate process, giamarco vetrocoke process, molecular sieve and membrane waste process - Sulphur recovery process - Claus process, sulphur production by redox process.	**15 Hrs**

V	DEHYDRATION OF NATURAL GAS AND NGL RECOVERY	15 Hrs
	Dehydration: Glycol dehydration - Solid desiccant dehydration, refrigeration cooling of gas desiccant dehydration, membrane – vortex dehydration process, supersonic dehydration process. NGL Recovery: shrinking process- Refrigeration process - mechanical cascade refrigeration process, mixed refrigeration process, self refrigeration process, cryogenic refrigeration process - ortloff gas sub cooled process, ortloff residue split vapour pressure - Lean oil absorption process-Solid bed adsorption and membrane separation process - NGL fractionation.	

Reference Books:

1. “Katz and Lee” “Hand Book of Natural Gas Engineering”, Tata McGraw Hill.
2. “Lyons, W.C” “Standard Handbook of Petroleum and Natural Gas Engineering”, Vol. 2, Gulf Professional Publishing,Elsevier Inc.
3. “Katz D.L. and Lee, R.L” “Natural Gas Industry-A Review of World Resources and Industrial Applications”, Butterworth.
4. “During, M.M” “The Natural Gas Industry-A Review of World Resources and Industrial Applications”, Butterworth.
5. “Saied Mokhatab, William A. Poe, and James G.Speight” “Hand book of Natural Gas Transmission and Processing”, Gulf Professional Professional Publishing, Elsevier Inc.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petro-Chemical Engineering (FT)

Subject Code : 4076633

Semester : VI SEMESTER

Subject Title : ENVIRONMENTAL ENGINEERING AND SOLID WASTE MANAGEMENT

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
ENVIRONMENTAL ENGINEERING AND SOLID WASTE MANAGEMENT	**6**	**96**	**25**	**100***	**100**	**3 Hrs.**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

TOPICS AND ALLOCATION OF HOURS

Unit	Topic	Hours
1.	Environmental Legislation	18
2.	Air Pollution & its Control Measures	18
3.	Water Pollution & its Control Measures	18
4.	Solid Waste Management	18
5.	Noise Pollution	17
6	Test & Revision	7
Total		96

RATIONALE:

The exponential growth of Engineering and Technology has benefited the mankind with extreme sophistication and comfort. India's government has set in place polices and special economic zones to promote investment in its petrochemical sector and several key domestic companies have unveiled ambitious expansion plans for the next few years. The chapters of Environmental Engineering deals with the various factors of environment like Air pollution, Water pollution, Noise pollution , Soil pollution, and Standards of environment , etc, provides the auxiliary operations carried out in preventing the Environment from pollution.

OBJECTIVES:

On completion of the units of the syllabus the students must be able to know about

- Environmental Legislation.
- Knowledge about international treaty.
- Need for renewable energy sources.
- Alternate sources of energy.
- Air pollution & its effects
- Air pollution preventive measures.
- Extraction equipments
- Sources of water pollution
- Preventive measures of water pollution
- Soil pollution & its sources
- Disposal of solid waste
- Standards for noise level
- Measures of noise pollution.

DETAILED SYLLABUS

Contents: Theory

UNIT	NAME OF TOPICS	Hours
I	**ENVIRONMENTAL LEGISLATION** Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Montreal Protocol, Kyoto agreement, Rio declaration. Environmental Protection act , Air & Water Pollution Control Acts & Rules (Salient Features only) – Functions of State / Central Pollution Control Boards – Environmental Management System: ISO 14 000 (Salient Features only) **CLEAN TECHNOLOGY AND ENERGY** Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco - Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in Industry.	**18 Hrs**
II	**AIR POLLUTION & ITS CONTROL MEASURES** Causes of air pollution – types & sources of air pollutants – Climatic & Meteorological effect on air pollution concentration – formation of smog & fumigation – Green house effect & Global Warming : Concepts of El Nino. Collection of Gaseous Air Pollutants – Collection of Particulate Pollutants – Analysis of Air Pollutants like: Sulphur dioxide – Nitrogen oxide – Carbon monoxide – Oxidants & Ozone – Hydrocarbons – Particulate Matter. Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods**:** on, Settling Chambers, Cyclones, Filtration, Scrubbers, and Electrostatic Precipitators.	**18 Hrs**

III	**WATER POLLUTION & ITS CONTROL MEASURES** Origin of wastewater — Type of water pollutants and their effects Biological Pollution (point & non-point sources) – Chemical Pollutants Toxic Organic & Inorganic Chemicals – Oxygen demanding substances – Physical Pollutants Thermal Waste – Radioactive waste – Physiological Pollutants: Taste affecting substances – other forming substances. Adverse effects on Human Health & Environment, Aquatic Life, Animal life, Plant life — Water Pollution Measurement Techniques – Water Pollution Control Equipments & Instruments – Indian Standards for Water Pollution Control.	**18 Hrs**
IV	**SOLID WASTE MANAGEMENT** Fundamentals of solid waste Management – Classification of solid wastes- Storage, collection and transportation of solid waste – - Biomedical waste and health aspects- Chemical Industries solid waste- classification of chemical industries solid waste- disposal of all types of solid wastes- incineration, landfill and Bio chemical process- its advantages & disadvantages -control measures of industrial waste- - Recycling of industrial waste- E-Waste management –Generation of value added products from solid wastes.	**18 Hrs**
V	**NOISE POLLUTION** Intensity, Duration – Types of Industrial Noise – effects of Noise – Noise Measuring & Control – Permissible Noise Limits, simple problems.e	**17 Hrs**

Reference Books:

1. “S S Dara” “Environmental Chemistry and Pollution Control”, S. Chand & Company Limited.
2. “Jonathan and Amos Turk” “Environmental Science”.
3. “Metcalf & Eddy” “Waste water Engineering”, Tata McGraw Hill.
4. “H M Dix” “Environmental pollution”, Wiley–Blackwell.
5. “Pollution Control Acts, Rules and Notifications Issued There under”, 5th Edition, Central Pollution Control Board.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4076640

Semester : VI

Subject Title : MASS TRANSFER PRACTICAL

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
MASS TRANSFER PRACTICAL	4	64	25	100*	100	3 Hrs

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE:

In Diploma level engineering education to skill development especially working with instruments and Equipment's play a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing engineering related equipment's in practical classes.

OBJECTIVES:

- After completing all the experiments of the practical the student will be able to understand.
- Verification of Rayleigh equation. Determine vaporization efficiency of steam distillation .Construct equilibrium curve of a tertiary system. Determine drying character tics and crystallization behavior and solubility characteristics.

GUIDELINES:

- All the ten experiments given in the list of experiment should be completed and given for the end semester practical examinations.
- In order to develop but best skills in handling instruct/equipment and taking reading in the practical classes. Every two students should be providing with a separate experimented setup for doing experiments in the laboratory.
- The external examiners are requested to ensure that a single experimented question should not be given to more than four students while admitted a batch of 30 students during board examination.

LIST OF EXPERIMENTS

1. Simple Distillation
2. Determination of Vapour- Liquid Equilibrium
3. Steam Distillation
4. Liquid-Liquid Extraction
5. Soxhlet Extraction
6. Drying Characteristic solid
7. Crystallization by Cooling
8. Crystallization by Evaporation
9. Decolourization by Adsorption
10. Diffusivity Measurements

LIST OF EQUIPMENTS

1.	Simple Distillation Apparatus	- 1 No.
2.	Vapour Liquid Equilibrium Apparatus	- 1 No.
3.	Steam Distillation Apparatus	- 1 No.
4.	Liquid-Liquid Extraction Apparatus	- 1 No.
5.	Soxhlet Extractor	- 1 No.
6.	Drier	- 1 No.
7.	Crystallization by Cooling Apparatus	- 1 No.
8.	Crystallization by Evaporation Apparatus	- 1 No.
9.	Decolourization by Adsorption Equipment	- 1 No.
10.	Diffusivity Measurements Apparatus	- 1 No.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4076650

Semester : VI

Subject Title : CHEMICAL CAD PRACTICAL

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examination	Total	
CHEMICAL CAD PRACTICAL	**4**	**64**	**25**	**100***	**100**	**3 Hrs**

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

OBJECTIVES:

- In this practical subject, the students are required to learn the basic
- Concepts of AutoCAD like screen interface, various commands and co-ordinate system used.
- This practical subject will also impart them requisite knowledge of creating 2D objects using various draw commands.
- The students will also learn to draw the isometric drawings and isometric projections.
- The students will also learn the 3D fundamentals and 2D to 3D conversions.

LIST OF EXPERIMENTS

Using all Auto cad commands for plotting (2D dimensional) chemical equipments - different views- dimensioning - 3D fundamentals - 2D to 3D conversion.

EXERCISES

A) Practice to draw the following Chemical Engineering Equipment with 2D using AutoCAD commands.

1. Fractionation column
2. Batch Reactor
3. Shell and tube Heat exchanger
4. Long tube Evaporator
5. Rotary Drum Filter
6. Simple piping layout with 2D

B) Practice to draw the following Chemical Engineering Equipment with 3D using AutoCAD commands.

1. Spray Drier
2. Agitated batch crystallizer
3. Simple piping layout in isometric view.
4. Set up Process Instrumentation Diagram (P&ID) of Distillation column.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : Diploma in Petrochemical Engineering (FT)

Subject Code : 4075660

Semester : VI

Subject Title : PROJECT WORK AND INTERNSHIP

TEACHING AND SCHEME OF EXAMINATION:

No. of Weeks per Semester: 16 Weeks

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examination	Total	
PROJECT WORK AND INTERNSHIP	**6**	**96**	**25**	**100***	**100**	**3 Hrs**

Minimum Marks for Pass is 50 out of which minimum 50 marks should be obtained out of 100 marks in the Board Examination alone.

OBJECTIVES:

- To develop the creative talents in the students.
- The project work should involve less cost, easy manufacturing technique and suitable to the real life situations.
- The project work should be useful to the mankind.
- To give the students a taste of real life problem solving and thus simulate industrial environment within the polytechnic.
- To develop those abilities that cannot be developed by normal class room situations such as group work, sharing responsibility, initiate, creativity etc.

INTERNAL ASSESSMENT:

The Internal Assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Details of assessment	Period of assessment	Max. Marks
First Review	6th week	10
Second Review	12th week	10
Attendance	Entire semester	5
Total		**25**

EVALUATION FOR BOARD EXAMINATION:

The Internal Assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Details of Mark allocation	Max. Marks
Demonstration / Presentation	**25**
Report	**25**
Viva Voce	**30**
Internship report	**20**
Total	**100**

NOTE:

- The topic for project work must be formulation of chemicals, design work, experimental work and material, energy balance or design calculations of a specific unit process / operation.
- The selection of Project work should be carried out in V semester itself.
- The Project committee's approval should be obtained prior to the executing of project.
- Periodical assessment should be carried out from V semester.
- The students' batch size should not exceed 6 Nos.
- The students should maintain a logbook of the work carried out by them.
- The internal assessment marks will be given based on the work carried out by the students as per the logbook.
- The power point presentation must be done during the Board examination Viva-Voce.