

DIRECTORATE OF TECHNICAL EDUCATION,
KAHILIPARA, GUWAHATI-19



DIPLOMA PROGRAMME IN
CHEMICAL ENGINEERING
NEW SYLLABUS

3RD SEMESTER

COURSE STRUCTURE OF 3rd SEMESTER (CHEMICAL)

Sl No	Code No	Subject	Study Scheme			Evaluation Scheme										
			Contact hour/week			Theory						Practical			Total Marks (Theory+Practical)	Credit
			L	T	P	ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test(PT) #	Practical Assessment(PA)@	Pass (PT+PA)			
							TA	HA	Total (TA+HA)							
1	Co-301	Computer Application & Programming	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
2	Hu-302	Engineering Economics & Accountancy	3			70	10	20	30	33/100	-	-		100	3	
3	Me/Ch-301	Environmental Education	3			70	10	20	30	33/100	-	-		100	3	
4	EL/ET-304	Fundamentals of Electrical & Electronics Engg	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
5	Me-304	Elements of Mechanical Engg	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
6	Ch-301	Principle of Unit Operation-I	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5	
7	Ch-310	Professional Practice - 1	1		2	-	-	-	-	-	25	25	17/50	50	2	
			19	1	14											
		Total	34 hrs/week										Total	850	25	

1. Course Title–Computer Application & Programming (All Branches)

1. **Course title: Computer Application & Programming**

2: **Course Code –Co-301**

3: **Semester- 3rd**

4: **Aim of the Course :**

- To give basic concepts related to organization of a computer
- To give fundamental terminologies in networking
- To develop simple programs in C.

5: **Course Outcome:**

On completion of the course students will be able to:

- Explain the basics of a computer hardware and software
- Solve problems related to number systems
- Define basics of Operating System
- Familiarize with networking components
- Write simple C programs

6: **Prerequisites for the Course:** Have basic idea about a computer and its functions.

7: **Teaching Scheme (in hours):**

Teaching Scheme			
L	T	P	Total hours per week
3	0	3	6

8: **ExaminationScheme :**

	Theory (T)	Sessional (TS)	Practical (P)	Practical Sessional (PS)
Full Marks	70	30	25	25
Pass Marks	33		17	

9: Detailed Course Content:

Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
1	Computer Architecture: Brief history, Charles Babbage Machine, Von Neumann Architecture, block diagram, memory & its different types, I/O devices, Role of O.S., computer languages, translator software, editor. Data, different types of data, information and its characteristics	<ol style="list-style-type: none">1. Define a computer and identify its parts.2. Define computer memory & describe its different types.3. Define computer languages & translators.4. Describe the characteristics of information.	8
2	Number System and codes: Different number system- decimal, binary, octal, hexadecimal number system, their conversion, 1's and 2's Complement, subtraction using complements. Different codes- ASCII, BCD, Ex-3, Gray. Conversion from Gray to binary and vice-versa, BCD addition.	<ol style="list-style-type: none">5. Define decimal, binary, octal & hexadecimal number systems.6. Convert between different number systems.7. Define 1's & 2's complements.8. Subtract using 1's & 2's complements.9. Describe some different codes.	8

Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
3	<p>Introduction to Operating System:</p> <p>Definition, single user and multi-user OS, different function performs by OS, various popular OS like DOS, Windows, UNIX/LINUX. DOS and UNIX commands.</p>	<p>10. Define operating system.</p> <p>11. Operate different commands of DOS, Windows & UNIX/LINUX.</p>	5
4	<p>Computer Network and the Internet:</p> <p>Definition, necessity of network, different types of network-LAN, MAN, WAN, network topology, transmission media, different network devices like NIC, hub, bridge, switch, gateway. Introduction to the internet, Internet services, browser, search engine.</p>	<p>12. Define network.</p> <p>13. Describe different types of network.</p> <p>14. Define network topology.</p> <p>15. Describe different network devices.</p> <p>16. Define internet & describe different internet services.</p> <p>17. Explain use of different browsers & search engines.</p>	6
5	<p>Introduction to C programming:</p> <p>Fundamentals of programming-Algorithm & Flowchart, source code and object code., Basic structure of C programs, Executing a C program, Constants, Variables, and data types. Operators and expression, Input Output function like printf, scanf, getchar, putchar, gets, puts, Decision making and branching using IF..Else, Switch, looping using for, while, and do-while, array.</p>	<p>18. Write algorithm and flow charts for simple programs</p> <p>19. Define basic terminology of C language.</p> <p>20. Write small program using C language.</p> <p>21. Write diversified solutions using C language.</p> <p>22. Differentiate between IF..Else and Switch statement.</p>	15
	Internal Assessment		3

10: Distribution of Marks:

Unit	Topic	Type of Question			Total Marks
		Objective	Short	Descriptive	
1	Computer Architecture	6	5	5	16
2	Number System and codes	4	2	8	14
3	Introduction to Operating System	4	2	4	10
4	Computer Network and the Internet	5	3	6	14
5	Introduction to C programming	6	3	7	16
		25	15	30	70

11: Table of specification :

Unit	Topics (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Computer Architecture	8	19	✓			
2	Number Systems & Codes	8	19	✓		✓	
3	Introduction to Operating Systems	5	12	✓			
4	Computer Network & the Internet	6	15	✓		✓	
5	Introduction to C Programming	15	35	✓		✓	
Total		Σ b=42	100				

K = Knowledge C =Comprehension A =Application HA =Higher Than

Application (Analysis, Synthesis, Evaluation)

$$c = \frac{b}{\Sigma b} * 100$$

Detailed Table of Specifications

Unit	Topics	Objective				Short					Descriptive				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Computer Architecture	7			7	5				5	4				4
2	Number Systems & Codes	4			4	2				2	4		4		8

3	Introduction to Operating Systems	4		4	2			2	4			4
4	Computer Network & the Internet	5		5	3			3	3		4	7
5	Introduction to C Programming	5		5	3			3	3		4	7
Total		25		25	15			15	18		12	30

K = Knowledge C = Comprehension A = Application HA = Higher Than Application T = Total

10. Intellectual Skills :

- Logical reasoning
- Relating programming concepts in problem solving

11. Motor Skills :

- Learn to use and handle a computer and its peripherals.

List of Lab Exercises :

I. Basic commands for computer system maintenance.

II. Preparation of Documents

Introduction to Word processing, Opening a document, preparing documents, inserting diagrams and tables, Editing document- (a) Character, word and line editing, (b) Margin Setting, Paragraph alignment, (c) Block Operations, (d) Spell Checker, (e) Saving a document, (f) Mailmerge.

III. Information Presentation through Spread Sheet

Application of Spread Sheet, Structure of spreadsheets, preparing table for simple data and numeric operations, using formulae and functions in excel operations, Creation of graphs, Pie charts, bar charts.

IV. Preparation of presentation

Creation of electronic slides on any topic, Practice of animation effect, presentation of slides.

V. Programming in C

Editing a C program, defining variables and assigning values to variables Arithmetic and relational operators, arithmetic expressions and their evaluation Practice on in input/output function like getch, putchar, gets, puts, scanf, printf etc. Programming exercise on simple if statement, If..else statement, switch statement Programming exercise on looping with do-while, while, for loop and array.

2. Course Title– Engineering Economics and Accountancy (All Branches)

1. Course Title : **ENGINEERING ECONOMICS AND ACCOUNTANCY**
2. Course Code: **Hu – 302**
3. Semester: **3rd**
4. Aim of the Course:

1. To introduce the students to some important economic and accounting terms.
2. To acquaint the students with some economic laws and with the functions of money, bank etc.
3. To make the students capable of recording business transaction under double entry system.
4. To introduce the students about financial statements.

5. Course Outcomes:

On completion of the course on EEA, students will be able to

- CO₁ = Define some important economic and accounting terms.
- CO₂ = explain some basic economic laws.
- CO₃ = Describe overall economic environment.
- CO₄ = explain double entry system of book keeping.
- CO₅ = record business transactions under double entry system of book keeping
- CO₆ = define financial statements.

1. **Teaching Scheme (in hours)**

Lecture	Tutorial	Practical	Total
42 hrs	3 hrs	--	45 hrs

2. **Examination Scheme:**

Theory				Practical				Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination		Sessional		
70	30	100	33	--	--	--	--	100

3. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
Part – A : Engineering Economics				21 hrs
1.0	Introduction to Economics :	<ul style="list-style-type: none"> i) Definition of Economics, its utility and scope of study ii) Definition of Engineering Economics ii) Meaning and concepts of Utility, Consumption, Value, Price, Goods and National Income, inflation iii) Wants – Definition and characteristics iv) Wealth & Welfare– Definition, meaning and types 	i) explain core economic terms concepts and theories	5
2.0	Demand and Supply :	<ul style="list-style-type: none"> i) Meaning and types of Demand ii) The Law of Demand, its limitations iii) Preparation of Demand Schedule iv) Meaning of Supply ii) The Law of Supply, its limitations iii) Preparation of Supply Schedule 	Define the Laws of Demand and Supply	4
3.0	Production :	<ul style="list-style-type: none"> i) Meaning and factors of production ii) Factors determining efficiency of labour iii) Savings, investment and capital formation iv) Meaning of production function 	<ul style="list-style-type: none"> i) Define factors of production ii) Explain formation of capital 	5
4.0	Money:	<ul style="list-style-type: none"> i) Meaning of money ii) Types of money iii) Functions of money 	i) Understand meaning and functions of money	2

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
5.0	Banking Organization :	i) Central Bank – its functions ii) Commercial banks – its functions	i) Distinguish the functions of different banks	3
6.0	Pricing	i) Objectives of pricing policy ii) price determinants iii) Price discrimination	i) explain pricing policy	2
Part – B : Accountancy				21 hrs
7.0 (A)	Introduction to Book-Keeping and Accounting:	i) Definition & objectives of Book-keeping ii) Need and advantages of Book-keeping iii) Definition of Accounting iv) Difference between Book-keeping and Accounting v) Double Entry System – main features vi) Advantages and disadvantages of Double Entry System	i) Define Double Entry System of Book Keeping ii) State its objectives, features merits and demerits	3
(B)	Introduction to Computerized Accounting System:	i) Components of Computerized Accounting Software ii) Need for Computerized Accounting iii) Difference between Manual Accounting and Computerized Accounting	i) Identify components of computerized accounting software	2
8.0	Transaction:	i) Definition ii) Meaning of Account iii) Classification of Accounts: - Traditional Approach - Modern Approach iv) Meaning of Debit and Credit v) Rules of Debit and Credit	i) State the meaning and rules of Debit and Credit	2

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
9.0	Journal and Ledger	i) Meaning Journal ii) Recording of Transactions in Journal iii) Meaning of Ledger iv) Objectives and utility of Ledger v) Posting and balancing of Ledger vi) Distinction between Journal and Ledger vii) Names of different Books of Accounts	i) Record business transactions under double entry system in books of accounts	4
10.0	Cash Book:	i) Meaning and importance of Cash Book ii) Characteristics and advantages of Cash Book iii) Discount – Trade Discount and Cash Discount iv) Different types of Cash Book: <ul style="list-style-type: none"> - Single Column Cash Book - Double Column Cash Book - Triple Column Cash Book v) Bank Reconciliation Statement – Basic idea	i) Differentiate different types of Cash Book ii) Record transactions in Cash Book	4
11.0	Trial Balance & Errors in Accounting:	i) Meaning and objects of Trial Balance ii) Main features and advantages of Trial Balance iii) Preparation of Trial Balance iv) Types of errors in Accounting	i) Explain meaning and features of Trial balance	3

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
12.0	Components of Final Accounts:	i) Meaning and objectives of Trading Account ii) Contents of Trading Account iii) Meaning and objectives of Profit and Loss Account iv) Contents of Profit and Loss Account v) Meaning of depreciation, revenue expenditure and capital expenditure vi) Contents of Balance Sheet	i) Identify different components of Financial Statements	3
	Class Test			3 hrs
	Total			45 hrs

9. TABLE OF SPECIFICATIONS for Engineering Economics & Accountancy

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Comprehension	Application	HA
1	Introduction to Economics	5	12	5	3	0	0
2	Demand & Supply	4	9	2	4	0	0
3	Production	5	12	6	2	0	0
4	Money	2	5	4	0	0	0
5	Banking Organization	3	7	3	2	0	0
6	Pricing	2	5	2	2	0	0

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Comprehension	Application	HA
7	(A) Introduction to Book-Keeping	3	7	5	0	0	0
	(B) Introduction to Computerized Accounting System	2	5	3	0	0	0
8	Transaction	2	5	2	1	0	0
9	Journal & Ledger	4	9.5	2	2	3	0
10	Cash Book	4	9.5	0	5	2	0
11	Trial Balance & Errors in Accountancy	3	7	5	0	0	0
12	Components of Final Accounts	3	7	2	3	0	0
Total		42 hrs	100	41	24	5	0

K = Knowledge C = Comprehension A = Application

A = Higher than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$

10 Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR EEA

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total
1	Introduction	3	1	0	4	2	2	0	0	4	0	0	0	0	0	8
2	Demand & Supply	0	0	0	0	0	0	0	0	0	2	4	0	0	6	6
3	Production	1	0	0	1	2	0	0	0	2	3	2	0	0	5	8
4	Money	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
5	Banking Organization	1	0	0	1	0	0	0	0	0	2	2	0	0	4	5
6	Pricing	2	2	0	4	0	0	0	0	0	0	0	0	0	0	4
7	Introductory to B K	2	0	0	2	3	0	0	0	3	0	0	0	0	0	5
	Introductory to Comput	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
8	Transact	2	0	0	2	0	1	0	0	1	0	0	0	0	0	3
9	Journal & Ledger	1	0	0	1	0	0	0	0	0	1	2	3	0	6	7
10	Cash Book	0	2	0	2	0	0	0	0	0	0	3	2	0	5	7
11	Trial Balance	3	0	0	3	2	0	0	0	2	0	0	0	0	0	5
12	Components F/Ac	0	0	0	0	0	0	0	0	0	2	3	0	0	5	5
	Total	20	5	0	25	11	3	0	0	14	10	16	5	0	31	70

K = Knowledge

C = Comprehension A = Application

HA = Higher Than Application **Higher than Application (Analysis, Synthesis, Evaluation)**

T = Total

11 Suggested implementation Strategies: Modified syllabus may be implemented with effect from July, 2018 (Starting with the present batch (2018) of 2nd Semester students)

12 Suggested learning Resource:

a. Book list

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Introductory Micro Economics	Sandeep Garg	Dhanpat Rai Publication Pvt. Ltd.
2	Introductory Macro Economics	Sandeep Garg	Dhanpat Rai Publication Pvt. Ltd.
3	Theory and Practice of Accountancy	B. B. Dam R. A. Sarda R. Barman B. Kalita	Capital Publishing Company, Guwahati – 5
4	Book-Keeping & Accountancy	Juneja, Chawla & Saksena	Kalyani Publisher, New Delhi - 110002
5	Tally. ERP 9 For Beginners	Tally Solutions Pvt. Ltd.	Sahaj Enterprises, Bangalore
6			
7			
8			

b. List of Journals

c. Manuals

d. Others

3: Course Title– Environmental Education

ENVIRONMENTAL EDUCATION

Subject Title	:	ENVIRONMENTAL EDUCATION		
Subject Code	:	Me/Ch-301		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test hrs	:	03		
Total hrs	:	48		
Full marks(Theory)	:	70		
Sessional Marks	:	30		
Class hours	L	T	P	
	3	0	0	

Pre requisite :None

Aim of the subject :The aim of the subject is to let the students know about the environment its importance of study, different types of pollution , its effect on environment.

CO-----Course Outcome of the subject.(Outcome based Objective)

After studying the course the students will be able to

- 1) Know the need of the environmental study
- 2) Know the importance of ecology
- 3) Identify the different type of pollution and its impact on the environment
- 4) Know about the environmental sanitation process
- 5) Appreciate the resource conservation like conservation of land forest and timber, wild life, minerals
- 6) Know about the pollution control strategies

COURSE CONTENTS

1.0 General concept

- 1.1 Nature and scope of environmental problems, definition.
- 1.2 Interaction of system.

- 1.3 Environmental disturbances.
- 1.4 Public awareness and action.
- 1.6 Population and economic growth.
- 1.7 Impact of industrialization and urbanization on environment.

2.0 Elements of ecology

- 2.1 Concept of ecosystem
- 2.2 Concept of biosphere and its components.
- 2.3 Energy flow in ecosystem.
- 2.4 Food chain in ecosystem.

3.0 Environmental Pollution

- 3.1 Water pollution types, source and their effects, natural recovery of water bodies, BOD, COD, DO sag curve
- 3.2 Air pollution definition, types, sources and it's effects. Air quality standards. Acid rain, Ozone hole depletion, Greenhouse gases and their effects, Global warming. Vehicular pollution and prevention.
- 3.3 Land pollution, it's types, sources and their effects.
- 3.4 Noise pollution, sources, measurements and it's effects.
- 3.5 Radioactive pollution, types, sources and their effects.

4.0 Environmental Sanitation

- 4.1 Epidemiology- infectious diseases, factors and transmission of diseases.
- 4.2 Sanitary protection.
- 4.3 Occupational health hazards
- 4.4 Solid waste, sources, disposal methods.

5.0 Resource Conservation

- 5.1 Conservation of land, forest and timber, wildlife, minerals
- 5.2 Environmental Management.
- 5.3 Pollution control strategies.
- 5.4 Environmental ethics.

REFERENCES

- 1. Environmental Education by Alan Reid
- 2. An Introduction to Environmental Education by Ezaza & Otienda Atman

Table Of Specification for Environmental Education																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
1	8	General concept	2	2	2	6	2	1	3	0	6	0	2	2	2	6	18
2	9	Ecology	2	1	2	4	2	3	3	0	8	0	2	2	2	6	18
3	10	Environmental Pollution	2	3	3	8	2	2	2	2	8	2	3	2	2	9	25
4	9	Environmental Sanitation	2	2	2	6	2	2	2	0	6	0	2	2	2	6	18
5	9	Resource Conservation	1	1	3	5	1	1	2	2	6	2	2	3	2	7	18

Annexure -I Environmental Education								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(97)
1	General concept	8	17.80	4	5	7	2	18
3)	Ecology	9	20.00	4	6	7	2	18
3	Environmental Pollution	10	22.20	6	8	8	4	25
4	Environmental Sanitation	9	20.00	4	6	6	2	18
5	Resource Conservation	9	20.00	4	4	8	4	18

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5: Course Title– Fundamental of Electrical & Electronic Engineering

1. Course Code :- EI/Et-304
2. Semester :- 3rd
3. Duration of Exam= 3 hrs
4. COURSE OUT COME (CO)

On completion of the course, the student will be able to:

- Define current, voltage, insulator, conductor etc.
- Solve numerical problems using Kirchhoff's law.
- Operate motor and generator.
- Explain briefly the alternating current and transformer
- Explain the use of semiconductor and transistor.
- Guide house wiring
- Explain the fundamental concept of digital electronics correlated to microprocessor with its applications.

CO s and ILOs

<i>CO s</i>	<i>ILO s</i>
CO -1. define current, voltage, insulator, conductor etc	<ol style="list-style-type: none">1. Define conductor, insulator, and semiconductor with examples.2. Define current, voltage, resistance, capacitance3. Describe the Ohm's law4. Solve problems related to Ohm's law
CO-2 Solve numerical problems using Kirchhoff's law	<ol style="list-style-type: none">1. Explain DC network.2. Define and explain the Kirchhoff's current and voltage law3. Solve of critical problems by using Kirchhoff's current and voltage law4. Use of Wheatstone bridge5. Determine of unknown resistance by Wheastone bridge

<i>CO s</i>	<i>ILO s</i>
CO-3 operate motor and generator	<ol style="list-style-type: none"> 1. Define DC generator and motor 2. Explain the construction of DC generator and motor 3. Explain the working principle of DC generator and motor 4. Compare the DC motor and generator 5. Enumerate different types of DC motor and generator 6. Explain use of DC generator and motor
CO -4 Explain briefly the alternating current and transformer	<ol style="list-style-type: none"> 1. Define amplitude, time period, frequency, equation of alternating voltage and current, RMS, average value, instantaneous value, peak factor. 2. Explain RLC circuit 3. Explain inductance of AC circuit 4. Solve numerical problems 5. Explain construction of transformer 6. State operating principle of transformer 7. State type and uses of transformer 8. State step up and step down transformer
CO5- Explain the use of semiconductor and transistor	<ol style="list-style-type: none"> 1. Define semiconductor, energy band, intrinsic and extrinsic semiconductor 2. Doping of semiconductor 3. Explain P-type, N-type semiconductor, 4. Define PN junction diode, forward and reverse biased diode, 5. Explain diode characteristics, application of PN junction diode like Half-wave, Full-Wave rectifier. 6. Explain Transistor: Physical construction of bipolar PNP and NPN transistor. 7. biasing circuit configuration 8. Explain different mode of transistor (CE, CB, CC). 9. State the application of transistor as an amplifier. 10. State elementary ideas of display - LED, LCD, Seven segment display.

<i>CO s</i>	<i>ILO s</i>
CO-6 guide house wiring	1. Define house wiring 2. Explain different methods of house wiring 3. State the safety and precautionary measure to be taken for electrical shock.
CO-7 Microprocessor	1. Explain the various symbolic representation of logic gates, combinational logic, basic operation of flip-flops, counters and registers. 2. State the fundamental concept of microprocessor and its application in instrumentation, 8085 microprocessor and its operation.

5. Teaching Scheme (in hours/week)

Lecture	Tutorial	Practical	Total
3		3	6

6. Examination Scheme :-

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+ Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1	Introduction	Basics of Electricity: Revision of insulators and conductors and their examples ,Definition and units of voltage, current, resistance, inductance, capacitance, different voltage sources, Ohm's law, series & parallel combination of resistance .	4

Chapter No	Chapter Title	Content	Duration (in hours)
2	DC network	DC network: Kirchhoff's Law, solving network problem to find current and voltage, Wheatstone bridge and Its problem.	5
3	Generator & motor	Faradays laws of electromagnetic induction, Flemings right hand and left hand rule D.C. generator and motor: Construction, operating principle, types, uses.	4
4	AC fundamental	A. C. Fundamentals: Basic terms-cycle, amplitude, time period, frequency, equation of alternating voltage and current, RMS, average value, instantaneous value, peak factor, form factor, simple problem	5
5	AC circuit	R-L-C series circuit: AC through resistance, capacitance, inductance and their combinations, expression for impedance, reactance, current, power factor, simple problem.	4
6	Transformer	Transformer Construction, operating principle, types and uses.	4
7	Semiconductor	Semiconductor: Definition of semiconductor, energy band diagram, intrinsic and extrinsic semiconductor, doping, P-type, N-type semiconductor, PN junction diode, forward and reverse biased diode, diode characteristics, application of PN junction diode like Half-wave, Full-Wave rectifier.	5
8	Transistor	Transistor: Physical construction of bipolar PNP and NPN transistor, biasing circuit configuration (CE, CB, CC). Application of transistor as an amplifier. Elementary ideas of display - LED, LCD, Seven segment display.	5
9	House wiring	9.1 Introduction to house wiring 9.2 Methods of house wiring 9.3 Safety and precautions measures against electrical hazard.	2
Chapter	Chapter Title	Content	Duration (in

No			hours)
10	Microprocessor	1. Symbolic representation of logic gates, combinational logic, basic operation of flip-flops, counters and registers. 2. Fundamental concept of microprocessor and its application in instrumentation, 8085 microprocessor and its operation.	5
11	Class test	Two class test	2

8. Distribution of Marks/ Table of specifications

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Introduction	4	9	3	0	0	
2	DC net work	5	11	3	0	4	
3	Generator & motor	4	9	3	0	5	
4	AC fundamental	5	11	4	3	4	
5	AC circuit	4	9	3	1	4	
6	Transformer	4	9	3	3	1	
7	Semiconductor	5	11	3	1	3	
8	Transistor	5	11	3	2	1	
9	House wiring	2	4	2	0	4	
10	Microprocessor	5	11	4	0	3	

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
11	Class test	2	4				
	Total	$\Sigma b=45$	100	31	10	29	

K = Knowledge C = Comprehension A = Application

HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$

10. Details Table of Specification for Theory

Sl. no	Topic	OBJECTIVE TYPE				SHORT/ DESCRIPTIVE ANSWER TYPE				
		K	C	A	<i>T</i>	K	C	A	HA	<i>T</i>
1	Introduction	1			<i>1</i>	2				<i>2</i>
2	DC net work	1		1	<i>2</i>	2		3		<i>5</i>
3	Generator & motor	1		2	<i>3</i>	2		3		<i>5</i>
4	AC fundamental	2	1	1	<i>4</i>	2	2	3		<i>7</i>
5	AC circuit	1	1	1	<i>3</i>	2		3		<i>5</i>
6	Transformer	1		1	<i>2</i>	2	3			<i>5</i>
7	Semiconductor	1	1	1	<i>3</i>	2		2		<i>4</i>
8	Transistor	1	1	1	<i>3</i>	2	1			<i>3</i>
9	House wiring	1		1	<i>2</i>	1		3		<i>4</i>
10	Microprocessor	1		1	<i>2</i>	3		2		<i>5</i>
	Total				<i>25</i>					<i>45</i>

K = Knowledge C = Comprehension A = Application HA = Higher Than Application

T = Total

N.B.:- 1. The question pattern will be as per the instruction of SCTE or as per existing rules.

2. The objective type questions may be in the form of multiple choice, fill up the blanks, true or false or very short answer type.

3. Optional question (if any) may be from the same topic in the form of either or type like below

QNo. Explain the properties of conductor

Or

Explain the properties of insulator

11. Suggested Implementation Strategies:- Teacher will use Black board, OHP, LCD Projector, Smart board, Video etc for effective teaching learning process .

12. Ref Books:

I. A text book of Electrical Technology Vol – I, B. L. Theraja& A. K. Theraja, S. Chand.

II. Principle of Electronics, V. K. Mehta, S. Chand.

III. Electronic Principle, A.P. Malvino, Tata McGraw-Hill

IV. Electronic Devices & Circuits, Millman&Halkias, Tata McGraw-Hill

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5: Course Title :- Fundamental of Electrical & Electronic Engineering (Practical)

1.Course Title :- **FUNDAMENTAL OF ELECTRICAL & ELECTRONIC ENGINEERING (PRACTICAL)**

2.Course Code :- EI/Et-304

3.Semester :- 3rd

INTELLECTUAL SKILLS

- a. Identify the properties of generator, ammeter, voltmeter, transformer
- b. Interpret the working principle of equipment
- c. Interpret the test results
- d. Follow the IS procedure of testing

MOTOR SKILLS

- a. Measure the quantities accurately
- b. Identify the instruments properly
- c. Handle the equipment carefully.

LIST OF PRACTICAL

(Students are to perform minimum six experiments)

1. Verification of KCL and KVL
2. Study of DC shunt generator.
3. Milli ammeter as a Voltmeter.
4. Milli voltmeter as an ammeter.
5. Study of RLC series circuit.
6. Study of single phase transformer.
7. Determination of semi-conductor diode characteristic.
8. Study of transistor configuration (CE,CB,CC) (Project base)

9. Study of transistor as an amplifier. (Project base)
10. Hands on activity on house wiring (Mini project work on simple house wiring involving one light point, one fan point, one power socket, one MCB on a wooden or ply board



6.Course Title– Element of Mechanical Engineering.

Subject Title	:	Elements of Mechanical Engineering		
Subject Code	:	Me-302		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test hrs	:	03		
Total hrs	:	48		
Full marks(Theory)	:	70		
Sessional Marks	:	30		
Class hours		L	T	P
		3	0	3

TOPIC ANALYSIS

SL.No	Major Topics	Hours Allotted	Weightage of Marks	Marks of questions of type		
				Obj	Short	Long
1	Introduction	02	04	2	2	-
2	Properties and Laws of Gases	04	10	3	3	4
3	Properties of Steam	07	15	3	4	8
4	Generation of Steam	06	13	3	3	7
5	Steam Engine	05	12	3	3	6
6	Internal Combustion Engine	07	14	3	5	6
7	Steam Turbines	06	12	3	3	6
8	Gas Turbines	04	09	3	2	4
9	Transmission Of Motion And Power	04	08	2	2	4
Total		45	97	25	27	45

CO : Outcome based Course Objectives

After studying the subject the students will be able to

1. Acquire a brief information of the prime mover
2. Solve problems on ideal gases following Characteristics Gas Equation

3. Explain the thermodynamic process Isothermal, Adiabatic and polytropic.
4. Solve problems of steam using steam table
5. Explain the function of a boiler
6. Identify the Mounting and accessories of a boiler
7. Know the function of a steam engine
8. Know the operation of an Internal Combustion Engine
9. Know the principle of steam turbine
10. Acquire the knowledge of information on power transmission systems

ILO (Intended Learning Objectives)

1. Know the information about the source of power
2. Explain the principle of prime mover
3. Know the conversion of thermal energy to mechanical energy
4. Know the Types of prime mover
5. Define Charles Law
6. Define Boyle's Law
7. Derive Characteristics Gas Equation
8. Define Ideal Gas
9. Solve problems on Characteristics Gas Equation
10. Explain Energy equation
11. Know about thermodynamic system, surrounding and environment
12. Define isothermal, Adiabatic, Polytropic process
13. Describe the properties of Steam
14. Explain sensible heat & latent heat of steam
15. Define the enthalpy of steam
16. Know about wet, dry saturated and superheated steam
17. Know the use of steam table for solving problems
18. Define boiler or steam generator

19. Explain the importance of Mountings
20. Explain the function of accessories
21. Know brief about draught, natural and artificial type
22. Know the working principle of steam engine, its parts and functions in brief
23. Calculate the power developed, efficiency and its related small problems
24. Know about the principle of Internal Combustion engine , its type(SI & CI engine)
25. Explain the thermodynamic cycle(Two stroke and four stroke)in SI and CI engine
26. Know the important parts of engines and its functions
27. Estimate the power developed, efficiency and the work done in IC engine
28. Know the working principle of steam turbine
29. Know the function of condenser
30. Know the working of gas turbine cycle and its types
31. Know the type of fuel used in gas turbine cycle
32. Know the application of gas turbine
33. Know about belt and pulley its uses
34. Know the effect of creep, slip, and centrifugal force in belt
35. Calculate the velocity ratio of belt and pulley
36. Know about the power transmission through gears
37. Determination of size of gears according to the velocity ratio
38. Determine the power transmitted by gear train
39. Solve small problems on simple machine

Course Details

1. Introduction: Sources of power, prime movers, types of prime movers, Heat and temperature, conversion of heat into mechanical power—2 hrs
2. Properties and laws of gases: Internal energy, enthalpy, specific volume, specific heats, energy equation, isothermal, adiabatic and polytropic processes of gases—4 hrs

3. Properties of steam: Differences between gas and vapour, sensible heat, latent heat, enthalpy of steam, wet, dry saturated and superheated steam, steam table and its uses, some basic problems---6hrs
4. Generation of steam: Boilers, different classification of boiler, Mainly study of Cochran, Lancashire, and water tube boilers, Boiler mountings and accessories pressure gauge, water level indicator, safety valve, stop valve, feed check valve, blow off cock, fusible plug, manhole, feed pump, injector, feed water heater , air pre heater, steam separator, steam separator, steam trap, all with brief study, Draught natural and artificial draught---- 8hrs
5. Steam engine: Working principle of steam engine, and its classification, names of various parts of steam engine and their function, Estimation of power and its efficiency and related problem.
6. Internal combustion engine: What is I.C. engine , Classification of IC engine, four stroke cycle, two stroke cycle, principle of working of diesel and petrol engine, names and function of the main parts, carburation, ignition , injection, governing, cooling and lubrication , estimation of power and efficiency and its problem, common defects in IC engines and their remedies
7. Steam Turbines: Classification -impulse and reaction turbine, Cycle and principle of working of a simple steam turbine, Condenser functions and types.
8. Gas Turbines: Cycle and principle of working, main components, types of fuel used in gas turbine, application of gas turbine.
9. Transmission of motion and power: Belt and pulley, types of belts, pulleys and drives, velocity ratio, length of belt tension in belts, power transmitted by belt, effect of creep, slip, and centrifugal force, gears, types of gears , elements of spur gear , velocity ratio, determination of sizes of gears, gear trains, power transmitted by gear drive, worm and worm wheel, rack and pinion

6.Course Title– Element of Mechanical Engineering (Practical)

Elements of Mechanical Engineering Laboratory

CO-----Outcome based objectives:

After performing the experiments the students will be able to

- a. Identify the mountings and accessories of a boiler
- b. Know the working principle of a steam engine
- c. Explain the working principle of an SI Engine
- d. Explain the working principle of an CI Engine
- e. Explain the principle of power transmission system

Course Content

Total 48 hrs

1. Study of boilers
 - i) Cochran boiler
 - ii) Lancashire boiler
 - iii) Babcock & Wilcox boiler
 - iv) Locomotive Boiler
2. Study of Steam Engine
 - i) Reciprocating Steam Engine
3. Study of S I & C I Engine
 - i) Two stroke cycle model and valve diagram
 - ii) Four stroke cycle model and valve diagram
4. Study of power transmitting devices
 - i) Belt
 - ii) Gear
 - iii) Pulley
 - iv) Link
5. Viva voce

Course Title : Principles of unit operation -1

1. **Course Code** : Ch-301
2. **Semester** : 3rd
3. **Course Outcome** :

On completion of this course, the students will be able to

- Know about the types of flows and different machineries for calculation of flow rates
- Understand about different fittings and joints and identify the different kinds of valves, pumps
- Understand different kinds of fluid flow measuring instruments and their advantages and disadvantages
- Know about different modes of heat transfer and machineries associated with it.
- Have some idea about different Heat Transfer equipments and Heat Exchangers
- Know about Convection and Radiation type of Heat transfer

COs	ILOs
Types of flow and different machineries for calculation of flow rates	<ol style="list-style-type: none">1. Explain nature of fluid2. Explain the concept of pressure3. Describe different types of manometers4. Explain the mechanism of fluid and laminar and turbulent flow5. Define Viscosity and critical velocity6. Explain Reynolds's experiment and its significance in fluid flow operations7. Explain Bernoulli's equation for fluid flow

<p>Different fittings and joints and identify the different kinds of valves, pumps</p>	<ol style="list-style-type: none"> 1. Explain the basic knowledge about pipes and fittings 2. Describe different types of joints 3. Describe different types of valves 4. Explain Globe valves 5. Explain Gate and Check valves 6. Describe the working principle of pumps and its characteristics and classification 7. Define Centrifugal pump and its principle 8. Define Priming cavitations and N.P.S.H. 9. Describe the principle of reciprocating pumps 10. Classify and describe different types of reciprocating pumps 11. Describe the various Factors for selection of pumps and relative advantages
<p>Different kinds of fluid flow measuring instruments and their advantages and disadvantages</p>	<ol style="list-style-type: none"> 1. Explain the construction of Orifice Meter, Venturi meter and Pitot tube 2. Describe about the operations of Orificemeter, Venturimeter and Pitot tube 3. Explain the relative advantages and disadvantages of different meters on fluid flow

<p>Different modes of heat transfer and machineries associated with it</p>	<ol style="list-style-type: none"> 1. Explain the mechanism of Heat transfer 2. Define Conduction, Convection and Radiation type of Heat transfer 3. Describe Heat transfer by conduction in solid state 4. State and explain Fourier's law of heat Transfer by conduction resistances in series 5. Explain Heat transfer through hollow cylinder
<p>Different Heat Transfer equipments and Heat Exchangers</p>	<ol style="list-style-type: none"> 1. Describe Heat transfer equipment 2. Explain Construction and operation of shell and tube heat exchanger 3. Explain briefly about double pipe heat exchanger 4. Explain Finned tube, Plate type heat exchanger and their field of application 5. How to determine fouling factor (direct, scale) 6. Describe Co-efficient of heat exchanger 7. Explain the Difference among cooler, Condenser and heaters
<p>Convection and Radiation type of Heat</p>	<ol style="list-style-type: none"> 1. Explain the heat flow in fluids

transfer	<ol style="list-style-type: none"> 2. Explain heat flowing through wall and the stagnant layer 3. Calculation of Log Mean Temperature difference 4. Explain the idea of Heat transfer by Radiation 5. Define Radiation Heat Transmission and idea about Stefan Boltzmann equipment 6. Explain Black Body radiation and its application
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4. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3hrs/ week	1hr/week	3hrs/week	7hrs/week

5. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test(PT)#	Practical Assessment(PA)@	Pass (PT+PA)			
	TA	HA					Total (TA+HA)		
70	10	20	30	33/100	25	25	17/50	150	5

6. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Flow of fluid	<ol style="list-style-type: none"> 1.1 Nature of fluid 1.2 Pressure concept 1.3 Different types of manometer (U-tube) 1.4 Inclined tube, Different manometer) 1.5 Mechanism of fluid (laminar Turbulent) 	9

		<p>1.6 Viscosity</p> <p>1.7 Critical velocity</p> <p>1.8 Reynolds's experiment and its significance</p> <p>1.9 Bernoulli's equation for fluid flow</p>	
2.0	Transportation of fluid	<p>2.1 Pipes and fitting</p> <p>2.2 Different type of joints</p> <p>2.3 Different type of valves</p> <p>2.4 Globe valve</p> <p>2.5 Gate and check valves</p> <p>2.6 Pumps - classification and Characteristics</p> <p>2.7 Centrifugal pump-Principle</p> <p>2.8 Priming cavitations and N.P.S.H.</p> <p>2.9 Reciprocating pumps-principle</p> <p>2.10 Classification and description of different types of reciprocating pumps</p> <p>2.11 Other types of pumps-Rotary</p> <p>2.12 Factors for selection of pumps and relative advantages</p>	9
3.0	Fluid flow measuring instruments	<p>3.1 Orifice meter</p> <p>3.2 Venturimeter and Pitot tube Construction</p> <p>3.3 Operation and relative advantages and disadvantages on fluid flow</p>	3
4.0	Heat Transfer	<p>4.1 Mechanism of Heat Transfer</p> <p>4.1.1 Conduction</p> <p>4.1.2 Convection and Radiation</p> <p>4.1.3 Heat transfer by conduction in solid state</p> <p>4.1.4 Fourier's law of heat Transfer by conduction resistances in series and simple numerical Problems</p> <p>4.1.5 Heat transfer through hollow cylinder</p>	5

		4.2 Heat transfer equipment 4.2.1 Construction and operation of shell and tube heat exchange 4.2.2 Double pipe heat exchanger 4.2.3 Finned tube, Plate type and their field of application 4.2.4 Determination of fouling factor (direct, scale) 4.2.5 Co-efficient of heat exchanger 4.2.6 Differentiation among cooler Condenser and heaters	5
		4.3 Heat flow in fluids 4.3.1 Convective heat transfer-heat flowing through wall and the stagnant layer 4.3.2 Calculation of Log Mean Temperature difference (LMDT)	5
		4.4 Heat transfer by Radiation 4.4.1 Radiation Heat Transmission Stefan Boltzmann equipment 4.4.2 Black Body radiation and its application	4

7. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Flow of fluid	7	3	8	18
2	Transportation of fluid	6	2	10	18
3	Fluid flow measuring instruments	6	2	10	18
4	Heat transfer	6	2	8	16
		25	9	36	70

8. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

9. Suggested Learning Resources

9.1 Book list:

- i) Introduction to Chemical engineering by Walter. L. Badger and Julius Banchero, (Tata McGraw Hill).
- ii) Unit operation of Chemical engineering by warren L. McCabe C. Smith and Peter Herriot.

9.2 List of journals:

- i) Journals of fluid Mechanics
- ii) International Journal of heat & mass transfer operation

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks

1. Course Title : PRINCIPLE OF UNIT OPERATION-I (LAB)
2. Course Code : Ch- 301(p)
3. Semester : 3rd
4. Total Hours : 45

Total Marks: 50

5. Skills to be developed-

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

6. Topics-

UNIT	TOPIC/SUB-TOPIC
1	Study of type of pipe fittings
2	Study of different types of valves
3	Study of the construction and operation of- (a) Centrifugal pump (b) Reciprocating pump (c) Diaphragm pump
4	Study of the construction and operation of shell and tube heat exchanger.
5	Reynolds Number. (Determination of flow of fluid by Reynolds Number).
6	Determination of pressure difference by using Manometer.
7	Study of the construction and operation of Venturimeter.
8	Study of the construction and operation of orifice meter.
9	Study of the construction and operation of Rotameter Bernoulli Theorem; study.

1. **Course Title : Professional Practice – I**

2. **Course Code : CH- 310**

3. **Semester – 3rd**

4. **Course Outcome:**

- Learn about the functioning of an industry
- Lecture from resource person on specific topic
- Enthuse into being socially aware and learn the current topics
- Enrich in bringing group activities

COs		ILOs
1	Learn about the functioning of an industry	1. Structured visit to an industry keeping in mind about all the safety and precautionary measures 2. Report submission of the same citing the observations within a stipulated time
2	Lecture from resource person on specific topic	1. Specific interaction with students leading to industry-academia meet 2. Clarification of doubts arising from previous industry visit
3	Enthuse into being socially aware and learn the current topics	1. Group discussion relating to some specific current topics to help better conversation
4	Enrich in bringing group activities	1. Certain group activities leading to better knowhow of a situation

5. **Teaching Scheme (in hours)**

Lecture	Tutorial	Practical	Total
1 hrs/week		2 hrs/week	3 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test(PT)#	Practical Assessment(PA)@			Pass (PT+PA)
	TA	HA	Total (TA+HA)						
-	-	-	-	-	25	25	17/50	50	2

7. ACTIVITIES

7.1 INDUSTRIAL VISITS:

10

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the team work.

Visits to **any two** of the following:

- Nearby Petrol Pump. (Fuel, oil, products specification)
- Water/ Sewage Treatment Plant.
- Refinery (Observation of different unit operations).
- Fertilizer Plant.
- Cement/ Plastic Factory.

7.2 GUEST LECTURE(S):

6

Lectures by Professional/ Industrial Experts/ Student Seminars based on information search to be organized from any three of the following areas:

- Pollution Control
- Refinery
- Fire Fighting/ Safety Precautions and First aids.
- Topics related to Social Awareness such as – Traffic Control System, Career opportunities, Communication in Industry, Yoga- Meditation, Aids awareness and health awareness.

7.3 GROUP DISCUSSION :

6

The students should discuss in a group of 6 to 8 students and write a brief report on the same as a part of team work. Two topics for group discussions may be selected by the faculty members. Some of the suggested topics are –

- Sports
- Current development in science and technology
- Current topics related to Chemical engineering field
- Current News items

7.4 STUDENT ACTIVITIES :

8

The students in a group of 3 to 4 will perform any one of the following activities (others similar activities may be considered Activity :

- Survey of the major pollution causing factors near the institute.
- Solid waste management of the city
- List of various properties and application of following materials
 - Ceramic
 - Rubber
 - Thermo Plastics
 - Thermo setting Plastics

4TH SEMESTER

COURSE STRUCTURE OF 4th SEMESTER (CHEMICAL)

Sl No	Code No	Subject	Study Scheme			Evaluation Scheme										
			Contact hour/week			Theory						Practical			Total Marks (Theory+ Practical)	Credit
			L	T	P	ESE	Sessional(SS)			Pass (ESE+ SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)			
				TA	HA	Total (TA+HA)										
1	CH-401	Applied Chemistry	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
2	CH-402	Industrial Chemical Process-1 (CP-I)	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
3	CH-403	Fuel Furnace & Refractories (FFR)	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
4	CH-404	Thermodynamics & Kinetics	3	1		70	10	20	30	33/100				100	4	
5	CH-405	Principle Of Unit Operation -II	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
6	CH-406	Chemical Engg Drawing-I			6	70	10	20	30	33/100				100	3	
7	CH-410	Professional Practice - II	1		2						25	25	17/50	50	2	
			16	1	20											
		Total	37 hrs/week										Total	850	25	

1. **Course Title : Applied Chemistry (Theory)**

2. **Course Code : Ch-401**

3. **Semester : 4th Semester(Chemical Engg)**

4. **Rationale of the Course:** Modern development of industries requires more understanding of the chemical substances used for engineering and industrial purposes.

Also, theoretical knowledge of chemistry is essential to understand chemical engineering. This part of Chemistry will explain various fundamental aspects of chemistry which will develop basic understanding and skill of engineering students.

5. **Course outcome :** After studying the course, students will be able to

CO.1 Apply the thermodynamic laws to calculate Enthalpies, predict the spontaneity and direction of chemical reactions.

CO.2 Calculate rate constant and Half-life of a chemical reaction.

CO.3 Perform conductometric titrations

CO.4 Prepare colloids to use in industrial fields.

CO.5. Identify different classes of organic compounds by laboratory testing.

CO.6 Synthesize some important organic compounds including petrochemicals

6. **Teaching Scheme (in hours) :**

Theory (Hours)			Practical	Total
Lecture	Tutorial	Class Test	18	70
42	10	3		

7. **Teaching Scheme/week :**

Lecture	Tutorial	Practical	Credit
3	1	3	4

8. **Examination Schedule:**

Theory						Practical				TOTAL	CREDIT
ESA	TA	HA	TA+HA	TOTAL	PASS MARKS	PT	PA	TOTAL	PASS MARKS	150	4
70	10	20	30	100	33	25	25	50	17		

9. Detail course content :

Chapter	Chapter title	Detail course content	ILO	Duration	Marks
1	Thermodynamics	1.1 Introduction to thermodynamics 1.2 First and second law of thermodynamics. 1.3 Carnot cycle and its efficiency 1.4 Internal energy, enthalpy, entropy and their significance. Hess's law. 1.5 Gibbs and Helmholtz free energy, significance of free energy and direction of chemical change.	Students will be able to 1. Use laws of thermodynamics to explain chemical reaction. 2. Derive 1st and 2nd law of thermodynamics. 3. Calculate efficiency of Carnot heat engine and Enthalpies of chemical reactions. 4. Use free energy concept to explain spontaneity of reactions.	9	15
2	Chemical Kinetics	2.1 Reaction rate and rate law, rate constant of a reaction. Molecularity of a reaction. 2.2 Order of reaction, First Order rate equation, Half –life period, 2.3 Energy of activation, Effect of temperature and catalyst on rate constant. Arrhenius equation. 2.4 Role of catalyst, Application of catalyst in industrial reactions.	1. Derive rate constant and Half-life of 1st order reactions. 2. Differentiate Order and Molecularity. 3. Explain the effect of Temperature, pressure and catalyst on rate constants. 4. Use catalyst in industrially important reactions.	8	13
3	Ionic Equilibrium	3.1 Conductance, Specific, equivalent and Molar conductance. Effect of dilution on Conductance. 3.2 Hydrogen Ion concentration, PH scale, Method of determination of PH, calculation of PH. 3.3 Conductometric titration and its application, Buffer solution, applications of Buffer solution.	1. Explain the effect of dilution on specific conductance, Eq. conductance and Molar conductance. 2. Calculate PH of solutions. 3. Use Buffer solutions in Laboratory and Industries. 4. Perform conductometric titrations.	6	10
4	Colloidal Chemistry	4.1 General properties of colloids, Dialysis, Electrophoresis, Tyndal effect, Brownian movement. 4.2 Emulsions, Industrial applications of emulsifying and demulsifying agents. 4.3 Adsorption- Physical and Chemical adsorption, Adsorption isotherms.	1. Varyify the properties of colloids. 2. Prepare colloidal solutions of industrial importance. 3. Differentiate Absorption and adsorption; Physical and Chemical adsorption. 4. Explain Adsorption isotherms.	6	10
5	Organic Chemistry	5.1 Elementary idea of Organic reactions and their mechanism, Inductive effect, Mesomeric effect, Homolytic and Heterolytic fission, Free radical, Carbonium, Carbanion ion, Electrophile, Nucleophile. 5.2 Types of reactions: Substitution, Addition, Elimination, Polymerization	1. Can apply the reaction mechanism to predict the product of reaction. 2. Describe different types of organic reactions. 3. Identify the petroleum products and use them. 4. Describe the process of	13	22

		<p>and rearrangement reactions.</p> <p>5.3 Petroleum, petro Chemicals, Hydrocarbons, Benzene and its homologues.</p> <p>5.4 Alcohols, manufacture of ethanol from starch and molasses. Reactions of ethanol.</p> <p>5.5 Aldehydes and ketones: Preparation from alcohol, General properties of aldehydes and ketones, Addition reactions of carbonyl group, Replacement reaction of carbonyl group, Aldehyde as reducing agent.</p> <p>5.6 Carboxylic acid: Preparation of formic acid, acetic acid, Formation of acid chloride, Etherification, Acid anhydride.</p> <p>5.7 Aromatic hydrocarbon: Nomenclature, structural formula and properties of benzene and Toluene.</p> <p>5.8 Phenols: Nomenclature, structural formula of commercially important Phenols, Preparation, properties and uses of phenols.</p>	<p>manufacture of Ethanol, Phenol, acetic acid etc.</p> <p>5. Suggest the method of conversion of one organic compound to other.</p> <p>6. Identify aromatic compounds and write their structural formula.</p>		
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S r. N o	Topic (a)	Time allotted in hours (b)	Percentag e Weightage ©	Modified Percentage Weightage (d)	K	C	A	H A
1	Thermodynamic s	9	20	21	5	5	5	
2	Chemical Kinetics	8	20	19	4	4	2	3
3	Ionic Equilibrium	6	15	14	3	3	4	
4	Colloidal Chemistry	6	15	15	3	4	3	
6	Organic chemistry	13	30	31	6	6	5	5
Total		Σ 42	100	100				

CH-401 APPLIED CHEMISTRY- TABLE OF SPECIFICATIONS FOR THEORY

Annexure-I

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis, b Synthesis, Evaluation)

$$c = \frac{\Sigma b}{\text{Total}} \times 100$$

Σb

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Thermodynamics	1+1+1	1+1		5	2				2		3	5		8
2	Chemical Kinetics	1+1	1+1		4	2	2	2		6				3	3
3	Ionic Equilibrium	1	1	1	3	2	2			4			3		3
4	Colloidal Chemistry	1+1+1		1+1+1	6		2+2			4					
6	Organic chemistry	1+1+1	1+1+1+1		7	3	2	2		7			3	5	8
					25					23					22

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

**K = Knowledge C = Comprehension A = Application HA = Higher Than Application
T = Total**

10.List of books:

- 1.Engineering Chemistry by Jain& Jain- Dhanpat Rai Publication Company
- 2.A text book of Organic chemistry by Arun Bahl and B.S.Bahl
3. Chemistry for class XII (part 1 & 2) by NCERT.



Course Title : Applied Chemistry Practical

- 1. Course Code** : Ch-401
- 2. Semester** : 4th Semester
- 3. Objective:** At the end of the program the student will be able to identify the elements and Functional groups present in Organic Sample.
- 4. Teaching Scheme:**

Hours/Week	Hours/Semester
3	18

5. Distribution of Marks:

Units	Topics	Marks
1	Preparation of Lassaigne Filtrate	05
2	Identification of elements- Nitrogen,Sulphur,Halogens	10
3	Identification of Functional groups – Amino,Carboxylic,Phenolic,Amido,Thio-amido	10

6. Detailed Course Content:

Units	Topics	Duration (in hours)
1	Preparation of Lassaigne Filtrate	03
2	Identification of Elements	06
3	Identification of Functional groups	09

Practical books:

- 1.Practical Organic Chemistry by O.P .Agarwal ,Goel Publishing House,Meerat
- 2.Practical Organic Chemistry, Class12,CBSE

Course Title: INDUSTRIAL CHEMICAL PROCESS-I

1. Course Code : Ch-402

2. Semester : 4th

4. Course Outcome (CO)

On completion of the course the students will be able to:

- Describe Unit Process and Unit Operation.
- Describe different sources of water (Industrial & Municipal) supply and its applications.
- Describe different acids produced in an acid industry. Demonstrate their manufacturing processes with applications.
- Describe the manufacturing process of sodium carbonate or soda ash and sodium hydroxide or caustic soda. Explain different types of electrolytic cells.

COs		ILOs
1	Describe Unit Process and Unit Operation.	<ol style="list-style-type: none"> 1. Define unit process and unit operation with examples. 2. Define polymerization with examples. 3. Define nitration with examples. 4. Define sulphonation with examples. 5. Define chlorination with examples. 6. Define isomerization with examples. 7. Define hydrogenation with examples. 8. Define hydration with examples. 9. Define dehydration with examples.

2	Describe different sources of water (Industrial & Municipal) supply and its applications.	<ol style="list-style-type: none">1. Define water.2. Explain about industrial application of water.3. Explain about source of water, water surface, underground water and water cycle.4. Explain about impurities present in water.5. Define hard and soft water.6. Explain the effects of natural water on boilers.7. Explain the removal of bad effects of water.8. Give details about requirements of boiler feed water.9. Explain the removal of dissolved oxygen and carbon dioxide from water.10. Give a demonstration on preparation of industrial water.11. Give details about requirements and specification for municipal water.12. Explain about the requirements and specification of drinking water.13. Illustrate the treatment of industrial waste water and sewage treatment.14. Explain the outlines of biological oxygen demand and chemical oxygen
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		demand and total dissolved solids
3	Describe different acids produced in an acid industry. Demonstrate their manufacturing processes with applications.	<ol style="list-style-type: none"> 1. Define sulphuric acid. 2. Explain about the sources of sulfur. 3. Explain about mining of sulfur. 4. Explain the process of manufacturing of sulfuric acid by contact process. 5. Explain the process of manufacturing of sulfuric acid by chamber's process. 6. Explain the physical and chemical properties of sulphuric acid. 7. Explain about applications of sulphuric acid. 8. Define hydrochloric acid. 9. Explain the manufacturing of hydrochloric acid. 10. Explain the physical and chemical properties of hydrochloric acid. 11. Explain about applications of hydrochloric acid. 12. Define nitric acid. 13. Explain the manufacturing of nitric acid by ammonia synthesis method. 14. Illustrate the properties of nitric acid. 15. Explain about the applications of nitric acid.

4	<p>Describe the manufacturing process of sodium carbonate or soda ash and sodium hydroxide or caustic soda. Explain different types of electrolytic cells.</p>	<ol style="list-style-type: none"> 1. Define sodium carbonate or soda ash. 2. Explain about the raw materials of sodium carbonate. 3. Explain about the manufacturing of sodium carbonate by Le-Blanc process. 4. Explain about the manufacturing of sodium carbonate by Solvay process. 5. Illustrate the physical and chemical properties of sodium carbonate. 6. Explain applications of sodium carbonate. 7. Define sodium hydroxide or caustic soda. 8. Explain the manufacturing of caustic soda by electrolytic process. 9. Explain different types of electrolytic cells used and their advantages and disadvantages. 10. Explain diaphragm cell. 11. Explain mercury cell. 12. Explain the physical and chemical properties of caustic soda.
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5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment(PA)@			Pass (PT+PA)
	TA	HA	Total (TA+HA)						
70	10	20	30	33/100	25	25	17/50	150	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Definition of Unit Process and Unit Operation with examples of each.	1.1 Outlines of Different unit Processes with examples of each- 1.1.1 Polymerization 1.1.2 Nitration 1.1.3 Sulphonation 1.1.4 Chlorination 1.1.5 Isomerization 1.1.6 Hydrogenation 1.1.7 Hydration 1.1.8 Dehydration	2
2.0	Water (Industrial & Municipal) Supply	2.1 Definition of Water 2.2 Different industrial applications of water 2.3 Source of water, surface water and underground water and water cycle. 2.4 Impurities present in water - Physical. 2.5 Chemical and biological impurities 2.6 Hard water and soft water Definition 2.7 Temporary hardness and permanent hardness of water. 2.8 Removal of temporary hardness by boiling. 2.9 Removal of Permanent hardness by 2.9.1 Lime soda process (hot and cold) 2.9.2 Zeolite and Permutit Process	18

		<p>2.9.3 Ion-exchange process</p> <p>2.10 Bad Effects of natural water on boilers</p> <p>2.10.1 Scaling</p> <p>2.10.2 Sludging</p> <p>2.10.3 Foaming</p> <p>2.10.4 Priming</p> <p>2.10.5 Corrosion</p> <p>2.10.6 Caustic Embrittlements</p> <p>2.11 Methods of removing these bad effects</p> <p>2.12 Requirement and specification for boiler Feed Water</p> <p>2.13 Preparation of boiler feed water</p> <p>2.14 Removal of dissolved oxygen and dissolved carbon dioxide</p> <p>2.15 Preparation of Industrial Process Water by</p> <p>2.15.1 Sedimentation Process</p> <p>2.15.2 Filtration Process</p> <p>2.15.3 Co-agulation Process</p> <p>2.15.4 Sterilization by Bleaching powder</p> <p>2.15.5 Sterilization by chlorine</p> <p>2.16 Requirement and specifications for Municipal water</p> <p>2.17 Requirement and specifications for drinking water</p> <p>2.18 Treatment of Industrial Waste water and sewage disposal</p> <p>2.18.1 Lagooning</p> <p>2.18.2 Screening</p> <p>2.18.3 Sedimentation</p> <p>2.18.4 Artificial filtration</p> <p>2.18.5 Land fill or land treatment</p> <p>2.19 Outlines of :</p> <p>2.19.1 Biochemical oxygen Demand</p> <p>2.19.2 Chemical oxygen Demand</p> <p>2.19.3 Total Dissolved Solids</p>	
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3.0	Acid Industry	3.1 Sulfuric acid- definition 3.2 Sources of sulfur 3.3 Mining of sulfur 3.4 Method of manufacturing sulfuric acid by contact process. 3.5 Method of manufacturing sulfuric acid by chambers process. 3.6 Properties of sulfuric A (Physical and Chemical Properties) 3.7 Uses of sulfuric A 3.8 Hydrochloric Acid - definition 3.9 Manufacturing of Hydrochloric acid from sulfuric acid. 3.10 Physical and chemical properties of Hydrochloric acid 3.11 Use of Hydrochloric acid 3.12 Nitric acid - definition, 3.13 Method of manufacturing of nitric acid by Ammonia Synthesis Method. 3.14 Properties of Nitric acid 3.15 Use of Nitric acid	10
4.0	Alkali - Industry	4.1 Sodium Carbonate or soda ash definition 4.2 Raw materials 4.3 Manufacturing Process of Sodium Carbonate by Le-Blanc Process 4.4 Manufacture of Soda ash by Solvay process 4.5 Chemical and Physical properties of sodium carbonate 4.6 Uses of sodium carbonate. 4.7 Sodium Hydroxide or caustic soda (definition) 4.8 Manufacturing of caustic soda by chemical process 4.9 Manufacture of Castile soda by electrolytic process. 4.10 Different types of electrolytic cells used and their advantages and disadvantages 4.11 Diaphragm cell-details of the cell 4.12 Mercury cell - details of the cell 4.13 Physical and chemical properties	10

		of Caustic soda 4.14 Uses of Caustic soda 4.15 Conclusion	
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8. Distribution of Marks :

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1.0	Unit Processes	3	X	7	10
2.0	Water	10	5	10	25
3.0	Acid Industries	6	2	12	20
4.0	Alkali Industry	6	2	7	15
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested Implementation Strategies :**10.1 Book list :**

- i) Shreve's: Chemical process industries By George T Austin. Mc Grow Hill International Edition's.
- ii) Dryden's outlines of Chemical technology By M. Gopala Rao and Marshall Sitting
- iii) A textbook of Engineering Chemistry By S.S.Dara.

10.2 List of Journals:

- i) International Journal of Chemical and process plant safety
- ii) Journal of lost, prevention in the process Industry
- iii) Chemical New Journal
- iv) Chemical Engineering Journal

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks

1. **Course Title : INDUSTRIAL CHEMICAL PROCESS-I
(LABORATORY)**

2. **Course Code : 402 (P)**

Full Mark -50

3. **Semester : 4th**

4. **Total Hours : 45**

5. **Skills to be developed-**

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments(whenever required)
- iii) Verify the principles
- iv) Read and interpret graphs(where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (whenever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

6. **Topic:-**

a) Water analysis:

- i) Determination of Temporary hardness and Permanent hardness of water ETDA method
- ii) Determination Total dissolved solids present in water
- iii) Determination of Turbidity of water
- iv) Determination of Dissolved Oxygen present in water
- v) Determination of Hydrogen ion concentration (Ph Measurement)
- vi) Determination of Chlorine Content in water
- vii) Determination of Colors of water
- viii) Determination of COD of water sample
- ix) Determination of BOD of water sample
- x) Determination of Fluoride present in water

b) Preparation of distilled water.

Course Title : FUEL, FURNACE AND REFRACTORIES

1. **Course Code** : Ch-403

2. **Semester** : 4th

3. **Course Outcome:**

On completion of this course, the students will be able to

- Describe fuels and their impact on human kind.
- Describe solid fuel; its different types; its advantages and disadvantages; coal properties.
- Explain liquid fuel, its different types; liquid fuel characteristics; Atmospheric and Vacuum distillation; Cracking.
- Describe solid fuel and its different types.
- Elaborate renewable and nonrenewable energy; solar energy; wind energy; biochemical energy; nuclear reactor; hydropower project.
- Have thorough understanding of furnace, its working principle and industrial application.
- Have brief idea on refractories; its manufacturing process; characteristics of good refractories; its different types

CO s		ILO s
1	Describe fuels and their impact on human kind	<ol style="list-style-type: none"> 1. Describe fuel and its sources. 2. Classify different types of fuels. 3. Describe calorific value of a fuel. 4. Describe Bomb Calorimeter and its practical application.

2	Describe solid fuel; its different types; its advantages and disadvantages; coal properties.	<ol style="list-style-type: none"> 1. Define Solid Fuel; describe different types of solid fuel and its advantages and disadvantages. 2. Describe origin of Coal. 3. Describe composition and classification of coal. 4. Describe coal properties and pulverization. 5. Describe analysis of coal. 6. Describe carbonization of coal.
3	Explain liquid fuel, its different types; liquid fuel characteristics; Atmospheric and Vacuum distillation; Cracking	<ol style="list-style-type: none"> 1. Describe Liquid Fuel and its composition. 2. Describe different types of liquid fuel. 3. Illustrate origin of Petroleum. 4. Explain liquid fuel characteristics: <ul style="list-style-type: none"> ✓ Viscosity. ✓ API gravity ✓ Flash Point & Fire point ✓ Pour point & Cloud point ✓ Knocking & Anti-knocking properties ✓ Octane Number ✓ Diesel Index ✓ Cetane Number ✓ Smoke point ✓ Aniline point

		<ol style="list-style-type: none"> 5. Describe Atmospheric and Vacuum distillation, and their products used as fuel. 6. Describe Cracking-Thermal, Catalytic & Hydro-Cracking of Petroleum.
4	Describe solid fuel and its different types.	<ol style="list-style-type: none"> 1. Describe Gaseous fuel and its classification. 2. Describe composition various gaseous fuel. 3. Explain Uses of gases. 4. Describe Natural gas. 5. Describe LPG. 6. Describe Producer gas. 7. Describe Carbureted Water Gas. 8. Describe Coke-Oven Gas 9. Explain Combustion of gaseous fuel
5	Elaborate renewable and nonrenewable energy; solar energy; wind energy; biochemical energy; nuclear reactor; hydropower project.	<ol style="list-style-type: none"> 1. Explain renewable energy and its importance. 2. Differentiate between Renewable and Non-Renewable sources of fuel. 3. Describe solar energy and its applications. 4. Describe wind energy and its applications.



		<ol style="list-style-type: none"> 5. Explain bio-chemical energy as a way of waste to energy conversion. 6. Describe a small hydro power project. 7. Describe a nuclear reactor.
6	Have thorough understanding of furnace, its working principle and industrial application.	<ol style="list-style-type: none"> 1. Define furnace. 2. Describe classification of furnaces. 3. Explain Principle and Industrial application of furnaces. 4. Illustrate Industrial furnace in details. 5. Describe Blast furnace and explain the process chemistry involved in it. 6. Describe Muffle furnace. 7. Describe different electrical furnaces.
7	Have brief idea on refractories; its manufacturing process; characteristics of good refractories; its different types	<ol style="list-style-type: none"> 1. Define refractories. 2. Describe properties required in a refractory and thus explain the characteristics of a good refractory material. 3. Describe classification of refractories. 4. Explain general manufacturing process. 5. Explain acid refractories with special reference to Fireclay refractories and Silica refractories. 6. Describe basic refractories with special

		reference to bauxite and dolomite refractories. 7. Explain neutral refractories with special reference to carbon refractories.
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4. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6 hrs/week

5. Examination Scheme

ESE	Theory			Pass (ESE+S S)	Practical			Total Marks (Theory+Practical)	Credit
	Sessional(SS)				Practical Test (PT)#	Practical Assessment(P A)@	Pass (PT+P A)		
	T A	HA	Total (TA+HA)						
70	10	20	30	33/100	25	25	17/50	150	4

6. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Introduction	1.1 Definition, Sources of fuels 1.2 Classification of fuels 1.3 Calorific value	3
2.0	Solid Fuel	2.1 Types of solid fuel 2.2 Origin of Coal 2.3 Classification of Coal according to the rank 2.4 Pulverization 2.5 Ultimate & Proximate analysis of Coal	6
3.0	Liquid fuel	3.1 Different types 3.2 Three theories behind the origin of Petroleum 3.3 Liquid fuel characteristics: Viscosity 3.4 API gravity 3.5 Flash & Fire point 3.6 Cetane and Octane Number 3.7 Pour & cloud point	7

		<p>3.8 Knocking & ant knocking properties</p> <p>3.9 Diesel Index</p> <p>3.10 Smoke point</p> <p>3.11 Annealing point</p> <p>3.12 (Atmospheric and Vacuum distillation, and their products used as fuel,</p> <p>3.13 Cracking-Thermal, Catalytic & Hydro-Cracking of Petroleum)</p> <p>(Outlines only)</p>	
4.0	Gaseous Fuel	<p>4.1 Classification</p> <p>4.2 Composition</p> <p>4.3 Production & uses of gaseous fuels</p> <p>4.4 Natural Gas</p> <p>4.5 LPG</p> <p>4.6 Producer Gas</p> <p>4.7 Carbureted water gas</p> <p>4.8 Coke-Oven gas</p> <p>4.9 Combustion of gaseous fuel-mechanism</p> <p>4.10 Analysis of the gas</p>	5
5.0	Renewable Energy	<p>5.1 Non-Conventional Energy Sources</p> <p>5.2 Solar Energy</p> <p>5.3 Wind Energy</p> <p>5.4 Bio- Chemical Energy</p> <p>5.5 Small Hydro power</p> <p>5.6 Nuclear Reactor</p>	4
6.0	Furnace	<p>6.1 Introduction:</p> <p>6.2 Definition & Classification</p> <p>6.3 Principle</p> <p>6.4 Construction & Industrial Application of furnaces</p> <p>6.4.1 Blast Furnace</p> <p>6.4.2 Muffle Furnace</p> <p>6.4.3 Electrical Furnace</p>	10



7.0	Refractories	7.1 Introduction : 7.2 Definition 7.3 Classification & general manufacturing Process 7.4 Acid Refractories: 7.4.1 Manufacturing Process 7.4.2 Properties & uses of Fireclay & Silica Refractories 7.5 Basic Refractory's 7.5.1 Manufacturing process properties & uses Bauxite & Dolomite Refractories 7.6 Neutral Refractories 7.6.1 Manufacturing process properties & uses Carbon Refractories	5
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7. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1,2	Introduction, & Solid fuel	6	2	5	13
3	Liquid Fuel	6	2	6	14
4	Gaseous fuel	4	X	7	11
5	Renewable Energy	3	2	8	13
6	Furnace	3	1	6	10
7	Refractories	3	2	4	9
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resource:

10.1 Books list:

- i) Fuel, Furnace and Refraction's By O.P. Gupta, (Khanna Publishers).
- ii) Engineering Chemistry By gain & gain Dhampat Rai Publishing Company.

10.2 List of Journals :

- i) Chemical Engineering Journal
- ii) Journal of oil & gas research
- iii) Bio- Energy News

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



Course Title : FUEL, FURNACE & REFRACTORIES (LAB)

1. **Course Code** : 403 (p) **Full Mark :50**
 2. **Semester** : 4th
 3. **Hours** : 45

4. **Skills to be developed-**

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

5. **Topics**

UNIT	TOPIC/SUB-TOPIC
1	Determination of flash point by - a) Penske martin's apparatus. b) Abel's apparatus. 1 c) Cleveland apparatus
2	Determination of fire point by - Cleveland apparatus.
3	Determination of Kinematic Viscosity at different temperatures by a) Red wood - I Viscometer. b) Red wood - II Viscometer c) Say bolt Apparatus
4	Determination of Pour Point
5	Determination of Smoke Point
6	Determination of Calorific value of coal by Bomb calorimeter.
7	Determination of calorific value of gaseous fuel by banker's calorimeter.
8	Proximate analysis of coal.
9	Analysis of gas sample by Or sat gas analyzer
10	Determination of Reid - vapor pressure
11	Softening point of Bitumen by Ring & Ball Apparatus.
12	Penetration of Bitumen.

Course Title : STOICHIOMETRY THERMODYNAMICS KINETICS

1. **Course Code** : Ch-404

2. **Semester** : 4th

3. **Course Outcome:**

On completion of this course, the students will be able to

- Predict the outcomes of a chemical reaction and express the composition of mixtures and solutions.
- Understand the basic concepts of thermodynamics; apply the laws of thermodynamics; identify compressors and its use in refrigeration cycle.
- Analyze the kinetics and rates of different kinds of chemical reactions.

CO		ILO
1	Predict the outcomes of a chemical reaction and express the composition of mixtures and solutions.	<ol style="list-style-type: none"> 1. Define Unit Operation and Unit Process. 2. Differentiate between <ul style="list-style-type: none"> ✓ Unit Operation and Unit Process ✓ Physical and chemical changes 3. Define law of conservation of mass, ideal gas law and molar unit. 4. Predict the outcomes of a chemical reaction like the mass of the product of a chemical reaction or the volume of a gas. 5. Derive the PVT relationship. 6. Solve basic chemical calculations related to conversions and mole calculations. 7. Express the composition of mixtures and solutions by weight%, volume%, mole%, mole fraction, weight fraction.

2	Understand the basic concepts of thermodynamics; apply the laws of thermodynamics; identify compressors and its uses in refrigeration cycle.	<ol style="list-style-type: none"> 1. Define the fundamentals of thermodynamics. 2. Define various laws of thermodynamics. 3. Describe the applications of the laws of thermodynamics 4. Describe the P-V-T behavior of ideal gases. 5. Define real gas and compressibility factor. 6. Explain compression and expansion theory. 7. Explain the energy equations of reciprocating compressor of various stages. 8. Explain refrigeration, COP and refrigeration capacity. 9. Describe various refrigeration cycles <ul style="list-style-type: none"> ✓ Vapor-compression cycle ✓ Air-refrigeration cycle
3	Analyze the kinetics and rates of different kinds of chemical reactions.	<ol style="list-style-type: none"> 1. Define the reaction rate, rate law, rate constant and order of a reaction. 2. Derive the integrated first order rate equation and half life period. 3. Describe the characteristics of first order rate equation. 4. Describe the application of catalysts to industrial reactions.

4. Teaching Scheme (in hours)

Lecture	Tutorial	Total
3hrs/week	1 hrs/week	4 hrs/week

5. Examination Scheme

ESE	Theory			Pass (ESE+SS)	Practical			Total Marks (Theory+Practical)	Credit
	Sessional(SS)				Practical Test (PT)#	Practical Assessment(PA)@	Pass (PT+PA)		
	TA	HA	Total (TA+HA)						
70	10	20	30	33/100				100	4

6. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Stoichiometry	1.1 Introduction to Stoichiometry 1.2 Physical and chemical changes 1.3 Definition of Unit Operations and Unit Processes 1.4 Differences between the two 1.5 Laws of chemical combination 1.6 Conservation of mass 1.7 Mass & volume relations in chemical reaction 1.8 Mass volume relations in gaseous state 1.9 Molal unit and Ideal gas law 1.10 PVT relationship 1.11 Standard conditions 1.12 Basis of calculation 1.13 Method of expressing composition of mixture & solution i) Weight % ii) Volume % iii) Mole % iv) Mole fraction v) Mass of material / unit volume vi) Mass of material / mass, etc 1.14 i) Simple numerical problems	20

2.0	Thermodynamics	2.1 Laws of thermodynamics & application 2.2 Real gases 2.3 Compressibility factors & PVT properties 2.4 Compression and expansion theory 2.5 Reciprocating compressor - single and multistage with numerical Problem 2.6 Refrigeration and Refrigeration cycle (Air refrigeration and Vapor compression)	10
3.0	Kinetics	3.1 Introduction to kinetics 3.2 Reaction rates and rate laws 3.3 Rate constant of a reaction 3.4 Order of a reaction 3.5 First order rate equation 3.6 Characteristics of first order rate reaction 3.7 Half life period 3.8 Role of catalyst-application of catalyst to industrial reactions	10

7. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Stoichiometry	3	X	X	3
2	„	3	2	7	12
3	„	6	X	9	15
4	„	4	3	X	7
5	Thermodynamics	5	2	10	17
6	Kinetics	4	2	10	16
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.



10. Suggested Learning Resource :**10.1 Book List :**

- i) Engineering Chemistry By Jain & Jain.
- ii) A text book of engineering Chemistry by Dr. S.S. Dara & Dr. S.S. Umare.

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



Course Title : PRINCIPLE OF UNIT OPERATION-II

1. **Course Code** : Ch-405

2. **Semester** :4th

3. **Course Outcome:**

On completion of this course, the students will be able to

- Explain various laws associated with distillation and its types.
- Explain the mechanism of absorption; diffusion and different absorption equipments.
- Distinguish and identify the different leaching and extraction processes.
- Describe the objective of drying, various driers and explain the analytical problem solving approach in humidity related problems.

	CO	ILO
1	Explain various laws associated with distillation and its types.	1. Define distillation. 2. Describe vapor liquid equilibrium. 3. Define Raoult's law, Henry's law and relative volatility. 4. Describe the methods used for distillation <ul style="list-style-type: none"> ✓ flash distillation ✓ fractional distillation. 5. Describe the distillation towers/columns. 6. Describe <ul style="list-style-type: none"> ✓ bubble-cap plate ✓ sieve plate.

2	Explain the mechanism of absorption; diffusion and different absorption equipments.	<ol style="list-style-type: none"> 1. Explain gas absorption phase equilibrium 2. Explain diffusion through gas. 3. Describe various absorption equipments <ul style="list-style-type: none"> ✓ Packed Towers ✓ Plate Towers ✓ Agitated Vessels ✓ Centrifugal Absorbers ✓ Spray Towers.
3	Distinguish and identify the different leaching and extraction processes.	<ol style="list-style-type: none"> 1. Explain the objective of leaching; factors affecting the rate of leaching. 2. Describe various equipments for leaching <ul style="list-style-type: none"> ✓ Boll man extractor ✓ Dorr agitator ✓ Rotocel extractor ✓ Pachuca tank. 3. Difference between leaching and extraction. 4. Describe liquid-liquid extraction and its objective. 5. Explain the extraction equipments <ul style="list-style-type: none"> ✓ mixer-settlers ✓ spray tower ✓ sieve tray tower

		<ul style="list-style-type: none"> ✓ packed tower ✓ rotating disk contactor ✓ Pulse column
4	Describe the objective of drying, various driers and explain the analytical problem solving approach in humidity related problems.	<ol style="list-style-type: none"> 1. Explain the necessity and principles of drying. 2. Define <ul style="list-style-type: none"> ✓ Absolute humidity ✓ Relative humidity ✓ Humid heat. 3. Define <ul style="list-style-type: none"> ✓ Adiabatic saturation temperature ✓ Bound moisture ✓ Free moisture ✓ Dew point ✓ Equilibrium moisture content ✓ Critical moisture content 4. Define <ul style="list-style-type: none"> ✓ dry bulb temperature ✓ wet bulb temperature 5. Describe the different driers <ul style="list-style-type: none"> ✓ tray drier ✓ rotary drier etc.

4. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6 hrs

5. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment(PA)@			Pass (PT+PA)
	TA	HA	Total (TA+HA)						
70	10	20	30	33/100	25	25	17/50	150	4

6. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Distillation	1.1 Introduction 1.2 vapor liquid equilibrium 1.3 Raoult's law 1.4 Henry's law 1.5 Relative volatility 1.6 Flash distillation 1.7 Fractional distillation 1.8 Different types of equipments 1.9 Details of bubble- Cap column 1.10 Sieve tray	18
2.0	Absorption	2.1 Mechanism of absorption 2.2 Diffusion through gas 2.3 Description of absorption 2.4 Equipment application 2.5 Different materials used in absorption column.	5
3.0	Leaching and Extraction	3.1 Objective of leaching 3.2 Different equipments and their application 3.3 Comparison of leaching and extraction 3.4 Object of extraction 3.5 Different equipments and their description	8
4.0	Drying	4.1 Purpose of drying 4.2 principles of drying 4.3 Definition of absolute humidity of air	9

		4.3 Relative humidity 4.4 Moisture content-free moisture and bound moisture 4.5 Dew point 4.6 Dry bulb and wet bulb temperature 4.7 Construction and operation of different driers 4.8 Tray drier 4.9 Rotary drier	
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7. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Distillation	7	2	10	19
2	Absorption	5	2	11	18
3	Leaching & Extraction	7	2	9	18
4	Drying	6	3	6	15
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested Learning Resources

10.1 Book list:

- i) Introduction to Chemical engineering by Walter. L. Badger and Julius Banchero, (Tata McGraw Hill).
- ii) Unit operation of Chemical engineering by warren L. McCabe C. Smith and Peter Herriot.

10.2 List of Journals :

- i) International journal of heat& mass transfer
- ii) Chemicals News Journals

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks

Course Title : PRINCIPLE OF UNIT OPERATION II (LAB)

1. **Course Code** : Ch -405 (P) **Full Mark -50**
 2. **Semester** : 4th
 3. **Total Hours** : 45 hrs

4. **Skills to be developed-**

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments(whenever required)
- iii) Verify the principles
- iv) Read and interpret graphs(where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (whenever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

5. **Topics-**

UNIT	TOPIC/SUB-TOPIC
1	Distillation:
1.1	Determination of boiling point for different compositions and plotting of equilibrium curves from the experimental data.
1.2	Study of the construction and operation of a bubble cap distillation tower
1.3	Determination of initial boiling point (IBP) and final boiling point (FBP) of petroleum.
2	Extraction:
	Study of the construction and operation of a packed extractor.
3	Drying:
3.1	Study of atmospheric tray dryer.
3.2	Study of Vacuum tray dryer.
3.3	Study of a spray dryer

Course Title : CHEMICAL ENGINEERING DRAWING-I (LAB)

1. **Course Code** : Ch-406

2. **Semester** : 4th

4. **Course Outcomes(COs)**

On completion of the course, the student will be able to :

- Define pipe and pipe fittings and draw them.
- Distinguish different pipe joints and draw them.
- Develop an understanding of different valves and draw them.
- Develop an understanding of welded joints and draw them.

COs	ILOs
CO-1 Define pipe and pipe fittings and draw them.	<ol style="list-style-type: none"> 1. Draw a pipe showing I.D & O.D. 2. Draw fittings for joining two pipes 3. Draw fittings for changing the direction of lines. 4. Draw fittings for changing the diameter of lines. 5. Draw fittings for connecting branch lines. 6. Draw fittings for stopping the end of a line.
CO-2 Distinguish different pipe joints and draw them.	<ol style="list-style-type: none"> 1. Explain different pipe joints with their purpose. 2. Draw hydraulic joints, union joints,

	<p>sleeve joints.</p> <p>3. Draw expansion joints and corrugated expansion fittings.</p>
CO-3 Develop an understanding of different valves and draw them.	<p>1. Explain different valves with their purpose.</p> <p>2. Draw plug cock and globe valve.</p> <p>3. Draw gate valve and check valve.</p> <p>4. Draw automatic control valve.</p>
CO-4 Develop an understanding of welded joints and draw them.	<p>1. Define welded joints & draw different types.</p> <p>2. Draw welded vessel.</p>

5. Teaching Scheme :

Lecture/practical	Tutorial	Total
6 hours per week		6 hours per week

6. Examination Scheme

ESE	Theory			Pass (ESE+SS)	Practical			Total Marks (Theory+Practical)	Credit
	Sessional(SS)				Practical Test (PT)#	Practical Assessment(PA)@	Pass (PT+PA)		
	TA	HA	Total (TA+HA)						
70	10	20	30	33/100	-	-	-	100	4

6. Detailed Course Content

UNIT	TOPIC/SUB-TOPIC
1	Pipe and pipe fitting : (Assembly) <ol style="list-style-type: none"> 1.1) Fittings for joining two pipes. 1.2) Fittings/ for changing the direction of lines. 1.3) Fittings for 'changing the diameter of lines. 1.4) Fittings for connecting branch lines. 1.5) Fittings for stopping the end of a lines.
2	Pipe Joints : (Assembly) <ol style="list-style-type: none"> 2.1) Hydraulic joints, union joints, sleeve joints.



2.2) Expansion Joints, corrugate expansion fittings.

3 Valves :

3.1) Plug cock and globe valve.

3.2) Gate valve and check valve.

3.3) Automatic control valve.

4 Welded joints :

4.1) Welded joints.

4.2) Welded Vessel.

7. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Pipes and pipe fitting	7	3	10	20
2	Pipes joints	6	X	9	15
3	Valves	6	2	7	15
4	Welded Joints	6	4	10	20
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resources

10.1 Book List:

- i) Introduction of Chemical Engineering By walter .L .Badger & Julius Banchemo.
- ii) Unit operation of Chemical Engineering By Warren L. McCabe. C Smith and Peter Harriot.

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks

Course Title : Professional Practice – II

1. **Course Code** : CH- 410

2. **Semester** – 4th

3. **Course Outcome:**

- Describe about the functioning of an industry
- Lecture from resource person on specific topic
- Develop personal and social awareness
- Develop software skills

COs		ILOs
1	Describe about the functioning of an industry	1. Structured visit to an industry keeping in mind about all the safety and precautionary measures 2. Report submission of the same citing the observations within a stipulated time
2	Lecture from resource person on specific topic	1. Specific interaction with students on hygiene, safety, etc.
3	Develop personal and social awareness	1. Group activities relating to personal well being for all round development
4	Develop software skills	1. Certain courses leading to better knowhow modern chemical process maintenance

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
1 hrs/week		2 hrs/week	3 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test(PT)#	Practical Assessment(PA)@			Pass (PT+PA)
	TA	HA	Total (TA+HA)						
-	-	-	-	-	25	25	17/50	50	2

7. ACTIVITIES**7.1 INDUSTRIAL VISITS:****6**

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the team work.

Two industrial visits may be arranged in the following areas/ industries:

- Manufacturing organization for observing various manufacturing processes including heat transfer processes, unit operations
- LPG/ Oxygen bottling plant
- Material testing laboratories in industries or reputed organizations
- Plastic material processes units

7.2 GUEST LECTURE(S):**6**

Lectures by Professional/ Industrial Experts/ Student Seminars based on information search to be organized from any three of the following areas:

- Uses of bio-degradable materials for conservation of environment.
- Selection of pumps, valves for optimum result.
- Surface treatment processes like galvanization, etc.
- Industrial hygiene
- Solid waste management
- Ceramics
- Safety Engineering and waste elimination.

7.3 INDIVIDUAL ASSIGNMENTS:**6**

Any two from the list suggested-

- Select 5 different secondary fuels and explain their manufacturing process and application.
- Collection of 3-4 water samples from the locality and test their water properties.
- Effluent treatment process of an industry
- Test free moisture content of any 5 materials.
- Assignments on catalyst, compressors, renewable energy, unit process.

OR

Conduct any one of the following activities through active participation of students and write report

- i. Rally for energy conservation / tree plantation.
- ii. Survey for local social problems such as mal nutrition, unemployment, cleanliness, illiteracy, etc.
- iii. Conduct aptitude, general knowledge test, IQ test.
- iv. Arrange **any one** training in the following areas:
 - a. Yoga
 - b. Use of Fire fighting equipments
 - c. First aid
 - d. Maintenance of Domestic appliances.

7.4 MODULAR COURSES (OPTIONAL)

6

A course module should be designed in the following areas for maximum 12 hrs, Batch size – minimum 15 students.

Course may be organized internally or with the help of external organizations.

- AUTO-CAD basic idea
- Pipes and joints fitting techniques
- Personality Development
- Entrepreneurship development

7.5 3-D DESIGN USING SOFTWARE

6

Introductory classes be arranged on AUTO-CAD and report of the same should be submitted by individual student.



5TH SEMESTER



COURSE STRUCTURE OF 5thSEMESTER (CHEMICAL)

S I N O	Cod e No	Subject	Study Scheme			Evaluation Scheme										Cr ed it
			Contact hour/week			Theory					Practical			Total Marks (Theory+Practical)		
			L	T	P	E S E	Sessional(SS)		Pass (ESE+S S)	Practical Test (P T) #	Practical Assessment (PA) @	Pass (PT+P A)				
				T A	H A	Tota l (TA+HA)										
1	CH-501	Instrumentation	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
2	CH-502	Industrial Chemical Process-II	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
3	CH-503	Petro Chemicals	3	1		70	10	20	30	33/100	-	-		100	4	
4	CH-504	Principle of Unit Operation-III	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
5	CH-505	Chemical Engg Drawing-II			6						100	50	50/150	150	3	
6	CH-510	Professional Practice - III	1		2						25	25	17/50	50	2	
7		Optional (any 1)														
A	CH-506	Fertilizer Technology	3	1		70	10	20	30	33/100				100	4	
B	Ch-507	Petroleum Technology	3	1		70	10	20	30	33/100				100	4	
			16	2	17											
		Total	35 hrs/ week											Total	850	25

1. **Course Title** : INSTRUMENTATION

2. **Course Code** : Ch-501

3. **Semester** : 5th

4. **Course Outcome:**

- Define basic principles of measurement and describe different types of measuring instruments
- Briefly learn what is a Sensing Elements and their role as primary detector
- Define the working of Transducers and its classification
- Describe the various means for Indicating and Recording
- Describe various instruments used in measurement of Temperature and their construction
- Describe different types of Pressure measurement and working principle of the instruments used
- Describe different methods of Liquid level measurement
- Study the means of Flow measurement and calculation of the same
- Study few other Special methods of Measurement

COs		ILOs
1	Define basic principles of measurement and describe different types of measuring instruments	1.1 Define the aims of measurement 1.2 Classify the methods of measurement 1.3 Define functions of instruments 1.4 Classify instruments according to its types 1.5 Learn about the errors in measuring instrument 1.6 Define the Static and dynamic characteristics of instruments
2	Briefly learn what is a Sensing Elements and their role as primary	1. Define Thermal detectors and their uses 2. Describe about the uses of Hydro-

	detector	pneumatic sensor
3	Define the working of Transducers and its classification	<ol style="list-style-type: none"> 1. How is Transducer used in measurement 2. Define the Actuating mechanism of a Transducer 3. Classify Transducer according to their working mechanism
4	Describe the various means for Indicating and Recording	<ol style="list-style-type: none"> 1. Describe the different means of Indicating 2. Describe the different means of Recording 3. Different Operating mechanism in indicator and recorders 4. Describe the symbols and identifications used for instruments
5	Describe various instruments used in measurement of Temperature and their construction	<ol style="list-style-type: none"> 1. Explain the different kinds of Temperature scales 2. Describe the working and construction of expansion thermometer 3. Define Thermistors and their uses 4. Define a Resistance thermometer 5. Define Thermocouples, Laws of thermoelectricity and brief about the construction and operations of radiation pyrometer and optical pyrometer
6	Describe different types of Pressure measurement and	<ol style="list-style-type: none"> 1. Define Differential pressure, Atmospheric pressure, Absolute pressure and Vacuum

	working principle of the instruments used	<ol style="list-style-type: none"> Describe the working principles and construction of Manometer and Pressure-elements Describe the working, construction and ranges of absolute pressure measuring instruments and brief about their field of application
7	Describe different methods of Liquid level measurement	<ol style="list-style-type: none"> Explain direct and indirect liquid level measurement methods. Describe the Electrical conductivity method of liquid measurement What are Capacitive level meters and Capacitance probe
8	Study the means of Flow measurement and calculation of the same	<ol style="list-style-type: none"> Describe the Principle of measurement of flow Describe the construction and operation of various flow measuring instruments Describe various differential pressure meter viz., orifice meter, venturimeter and pitot tube and calculate the flow from the readings Describe variable area meter viz., Rota meter, Vortex flow meter Describe Ultrasonic type flow meter
9	Study few other Special methods of Measurement	<ol style="list-style-type: none"> Various ways of measuring hydrogen ion concentration Determination of dissolve oxygen content

		in a given sample 3. Define Gas chromatography and the parameters it measures
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5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6 hrs

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment(PA)@			Pass (PT+PA)
	TA	HA	Total (TA+HA)						
70	10	20	30	33/100	25	25	17/50	150	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Basic principles of Measurement	1.7 Definition and aim of measurement 1.8 Classification of methods of measurement, functions of instruments 1.9 Types of instruments 1.10 Errors in measuring instrument 1.11 Instrument Error Combination 1.12 Static and dynamic characteristics of instruments	5
2.0	Sensing Elements	2.1 Introduction 2.2 Mechanical member as primary detector 2.3 Thermal detectors 2.4 Hydropneumatic sensor	2

3.0	Transducers	3.1 Transducer in measurement 3.2 Actuating mechanism 3.3 Transducer classification	1
4.0	Indicating and Recording means	4.1 Indicating means 4.2 Recording means 4.3 Operating mechanism in indicator and recorders 4.4 Symbols and identifications used for instruments	2
5.0	Temperature Measurement	5.1 Temperature scales 5.2 Thermometer 5.3 Working and construction of expansion thermometer (Mercury & glass, alcohol, bimetallic & pressure spring Thermometer) 5.4 Thermistors 5.5 Resistance thermometer 5.6 Thermocouples 5.7 Laws of thermo-electricity 5.8 Construction and operations of radiation pyrometer and optical pyrometer	10
6.0	Pressure Measurement	6.1 Differential pressure 6.2 Atmospheric pressure 6.3 Absolute pressure 6.4 Vacuum-definitions and units 6.5 Working principles and construction of Manometer, Pressure-elements (diaphragm and pressure-spring elements) 6.6 Their description and operation 6.7 Working and construction of absolute pressure measuring instruments-their ranges and field of application	8
7.0	Liquid level measurement	14.1 Direct liquid level measurement (Bob, tape, sight-glass, floats) 14.2 Indirect Liquid level measurement (bubbler, diaphragm, box & air trap system)	4

		14.3 Electrical conductivity method 14.4 Capacitive level meters 14.5 Capacitance probe	
8.0	Flow Measurement	8.1 Principle of measurement of flow 8.2 Construction and operation of flow measuring instruments 8.3 Differential pressure meter viz orifice meter 8.4 Venturimeter & pitot tube 8.5 Including simple numerical problems 8.6 Variable area meter viz Rota meter 8.7 Vortex flow meter 8.8 Ultrasonic type flow meter	5
9.0	Special methods of Measurement	18.1 Measurement of Hydrogen ion concentration 18.2 Dissolve oxygen meter 18.3 Gas chromatography	3

8. Distribution of Marks :

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Basic principles of measurement	3	X	10	13
2	Sensing elements	2	X	X	2
3	Transducers	X	3	X	3
4	Indicating and recording means	2	3	X	5
5	Temperature Measurements	4	X	10	14
6	Pressure Measurements	4	X	6	10
7	Liquid level measurements	4	3	X	7
8	Flow Measurements	3	X	5	8
9	Special methods of measurements	3	X	5	8
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resources :**10.1 Book list:**

- i) Industrial instrumentation & control By S.K. Singh.
- ii) Outlines of Chemical instrumentation & process control by Dr. A. Suryanarayan.

10.2 List of journals:

- 10.1 International Journal of Instrumentation technology
- 10.2 Flow measurements and Instrumentation Journal

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : INSTRUMENTATION LABORATORY

2. **Course Code** : Ch- 501 (P)

Full Marks :50

3. **Semester** : 5th

4. **Skills to be developed-**

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

5. **Topics-**

UNIT	TOPIC/SUB-TOPIC
1.0	Temperature measuring instrument : Study of the construction and working principle of the following temperature measuring instruments and determination a) Mercury in glass thermometer (high temperature range) b) Alcohol thermometer c) Bimetallic thermometer d) Pressure spring thermometer e) Thermocouple
2.0	Flow Measuring Instrument :
2.1	Study of construction and operation and determination of flow rate through a pipe by- a) Orifice meter b) Venturi meter c) Pitot tube d) Rotameter
3.0	Pressure measuring Instruments : a) Study of the construction and operation of a pressure gauge (Bourdon tube) b) Determination of pressure by a gas Chromatograph.
4.0	Measurement of gas composition by gas Chromatograph.
5.0	Measurement of Ph valve by Ph meter
6.0	Measurement of TDS and DO.

1. **Course Title** : INDUSTRIAL CHEMICAL PROCESS-II
2. **Course Code** : Ch-502
3. **Semester** : 5th

4. Course Outcome (CO)

On completion of the course the students will be able to:

- Describe soaps and detergents.
- Describe plastics, its different types, different fabrication process.
- Explain hydrogenation of fats and oils.

COs		ILOs
1	Describe soaps and detergents.	1.1 Define soap and their raw materials. 1.2 Explain the differences among fatty oils (Vegetable and animal oil). 1.3 Explain the difference between mineral oil and essential oil. 1.4 Illustrate some applications of glycerol. 1.5 Explain the characteristics of detergents, 1.6 Explain synthetic detergents. 1.7 Give the difference between soap and synthetic detergent. 1.8 Describe the raw materials for detergents. 1.9 Explain the manufacturing of detergents. 1.10 Explanation of applications of detergents.

2	Describe plastics, its different types, different fabrication process.	<ol style="list-style-type: none">1. Define Plastic.2. Define polymerization.3. Give difference between addition and condensation.4. Explain about thermoplastic and thermosetting polymers.5. Illustrate the raw materials for the production of plastic.6. Describe the manufacturing process of plastics.7. Explain Properties and applications of:-<ul style="list-style-type: none">• Polyethylene• Polypropylene• Polymethyl metacryolate• Polyvinyl chloride• Polystyrene• Phenol formaldehyde resin• Urea formaldehyde• Melamine formaldehyde• Epoxy resin8. Describe different fabrication process for product of plastics.9. Explain the working principle of extruder.10. Explain the working of injection molding.11. Explain the working of compression molding.
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3	Explain hydrogenation of fats and oils.	<p>3.1 Define Vegetable oil.</p> <p>3.2 Describe the chemical nature of vegetable oil.</p> <p>3.3 Describe consistency of oil.</p> <p>3.4 Describe different hydrogenation product of Vegetable oil and their applications in manufacturing Vanaspati type material and higher alcohol.</p> <p>3.5 Illustrate the production of oil from oil seeds with the help of a block diagram.</p> <p>3.6 Describe different process and operations involved in hydrogenation of oils.</p> <p>3.7 Describe the properties of hydrogenation of oils.</p> <p>3.8 Describe the properties of hydrogenated oil.</p>
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5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3hrs/week		3hrs/week	6 hrs/week



6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)			
	TA	HA							Total (TA+HA)
70	10	20	30	33/100	25	25	17/50	150	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Soap and detergent	1.11 Introduction 1.12 Differences among fatty oils (Vegetable and animal oil) 1.13 Mineral oil and essential oil 1.14 Difference between oil and fat 1.15 Raw materials for soap 1.16 Recovery of glycerol and uses 1.6 Characteristics of a detergent 1.7 Names of synthetic detergent 1.8 Difference between soap and synthetic detergent 1.9 Raw materials for detergent manufacture 1.10 Manufacture of detergent and uses	10
2.0	Plastics	2.1 Polymerization 2.2 Addition and condensation 2.3 Thermoplastic and Thermosetting polymers 2.4 Definition of Plastic 2.5 Raw materials for the production of plastic 2.6 Manufacturing process of plastics 2.7 Properties and application of:- 2.7.1 Polyethylene 2.7.2 Polypropylene	15

		2.7.3 Polymethyl metacrylate 2.7.4 Polyvinyl chloride 2.7.5 Polystyrene 2.7.6 Phenol formaldehyde resin 2.7.7 Urea formaldehyde 2.7.8 Melamine formaldehyde 2.7.9 Epoxy resin 2.8 Different fabrication process for product of plastics 2.9 Working principles of extruder 2.10 Injection moulding m/c 2.11 Compression moulding m/c etc	
3.0	Hydrogenation of Fats and Oils	3.9 Introduction- Vegetable oil 3.10 Their chemical nature 3.11 Consistency of oil 3.12 Different hydrogenation product of Vegetable oil and their applications in manufacturing Vanaspati type material and higher alcohol (names only) 3.13 Production of oil from oil seeds with the help of block diagram 3.14 Different process and operations involved in hydrogenation of oils 3.15 Properties of hydrogenation of oils 3.16 Properties of hydrogenated oil	15

8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Soaps &	9	3	12	24
2	Plastics	9	3	12	24

3	Hydrogenation of fats & oil	7	3	12	22
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resources**10.1 Book list :**

- i) Dryden's outlines of Chemical technology By M.Gopala Rao & Marshall Sitting.
- ii) Shreve's Chemical process industries by George T Austin. Mc Grow Hill Instruments Edition's.
- iii) A textbook of Engineering Chemistry By S.S. Dara.

10.2 List of Journals:

- i) International Journal of Chemical & process plant Safety
- ii) Chemical News Journal

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : **INDUSTRIAL CHEMICAL PROCESS-II (LAB)**
 2. **Course Code** : **Ch-502 (p)** **Full Mark :50**
 3. **Semester** : **5th**
 4. **Hours** : **45**

5. Skills to be developed-

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

6. Topics-

UNIT	TOPIC/SUB-TOPIC
1	FATS & OILS ANALYSIS 1.1) Analysis of vegetable oil in respect of a) Acid Value b) Saponification value c) Iodine Value
2	ADHESIVE : 2.1) Preparation of glue & adhesive
3	CEMENT : Testing of cement, composition and properties.



1. **Course Title** : PETROCHEMICALS
2. **Course Code** : Ch-503
3. **Semester** : 5th

4. **Course Outcome** :

On completion of this course,

- The course provides an introduction with the petrochemical industry.
- The course develops knowledge of different types of petrochemicals.
- It explains the various types of manufacturing processes of petrochemicals.
- It provides knowledge on synthetic detergents, insecticides which includes their manufacturing process, properties and uses.
- It describes the manufacturing of different petrochemicals along with their properties and uses.
- It provides knowledge on different monomers along with its manufacturing process.
- The course describes the manufacturing process, properties and uses of various plastics, resins, rubber, varnishes and fibers.

COs	ILOs
An introduction with the petrochemical industry	1. Describe the history and future prospect of petrochemicals 2. Explain the Petro chemical industry in India
Knowledge of different types of petrochemicals	1. Explain the different types of petrochemicals 2. Define Aliphatic petrochemicals 3. Define Aromatic petrochemicals 4. Describe Inorganic petrochemicals
Various types of manufacturing processes of petrochemicals.	1. Describe the types of manufacturing processes of petrochemicals

	<ul style="list-style-type: none"> • Cracking and Reforming • Steam reforming and Hydrogenation • Dehydrogenation • Alkylation • Polymerization • Isomerization
Knowledge on synthetic detergents, insecticides which includes their manufacturing process, properties and uses	<p>1.Explain the manufacturing process, properties and uses of</p> <ul style="list-style-type: none"> • Synthetic detergents • Sulphonates <p>2.Describe the manufacturing process, properties and uses of</p> <ul style="list-style-type: none"> • DDT • Gamaxene • Bleaching powder
Manufacturing of different petrochemicals along with their properties and uses	<p>1.Describe the manufacturing processes Properties and uses of</p> <ul style="list-style-type: none"> • Ethylene • Acetylene • Butadiene • Benzene • Toluene • Xylene

<p>Different monomers along with its manufacturing process.</p>	<p>1.Explain the manufacturing process of different monomers like</p> <ul style="list-style-type: none"> • Ethylene oxide • Vinyl chloride • Styrene • Methanol • Formaldehyde
<p>Manufacturing process, properties and uses of various plastics, resins, rubber, varnishes and fibers</p>	<p>1.Explain the manufacturing processes of plastic, Properties & uses of</p> <ul style="list-style-type: none"> • PVC • Polythene • Resins • Urea formaldehyde • Phenol formaldehyde • Melamine formaldehyde • Poly butyl alcohol <p>2. Explain the manufacturing processes of rubber, Properties & uses of</p> <ul style="list-style-type: none"> • SBR • Poly Butadiene • Poly Chloroprene <p>3.Explain the manufacturing processes, properties and uses of different varnishes</p> <p>4.Describe the manufacturing processes, properties and uses of different fibers like</p> <ul style="list-style-type: none"> • Polyester fibre • Polyamide fibre

5. Teaching Scheme (in hours)

Lecture	Tutorial	Total
3 hrs/week	1 hr/week	4 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)		
	TA	HA					Total (TA+HA)	
70	10	20	30	33/100	-	-	100	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1	Introduction	1.1 History and future prospect of petrochemicals 1.2 Petrochemical industry in India.	3
2	Type of Petro chemicals	2.1 Aliphatic 2.2 Aromatic 2.3 Inorganic	3
3.0	Process of manufacturing of Petrol-chemicals	3.1 Cracking and reforming 3.2 Steam reforming, hydrogenation 3.3 Dehydrogenation 3.4 Alkylation 3.5 Polymerization 3.6 Isomerization	4
4.0	Synthetic detergents	4.1 Synthetic detergents 4.2 Sulphonates	4

5.0	Insecticides	Manufacturing process Properties and uses- 5.1 DDT 5.2 Gamaxene 5.3 Bleaching Power	3
6.0	Manufacture of Petrochemicals	Manufacturing processes Properties and uses of 6.1 Ethylene 6.2 Acetylene 6.3 Butadiene 6.4 Benzene 6.5 Toluene 6.6 Xylene	4
7.0	Monomers	Manufacturing process of 7.1 Ethylene oxide 7.2 Vinyl chloride 7.3 Styrene 7.4 Methanol 7.5 Formaldehyde	4
8.0	Plastics and Resins	Manufacturing processes of plastic, Properties & uses of 8.1 PVC 8.2 Polythene 8.3 Resins 8.4 Urea formaldehyde 8.5 Phenol formaldehyde 8.6 Melamine formaldehyde 8.7 Polybutyl alcohol	5
9.0	Rubber	Manufacturing processes of 9.1 SBR 9.2 Polybutadiene 9.3 Polychloroprene properties and uses	4



10.0	Varnish	10.1 Manufacturing processes, properties and uses of different Varnishes	2
11.0	Fibres	Manufacturing processes properties and uses of- 11.1 Polyester fibre 11.2 Polyamide fibre	4

8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1,2	Introduction & type of petrochemicals	X	X	10	10
3	Posses of Manufacturing of petrochemicals	5	X	X	5
4,5	Synthetic Detergents & Insecticides	5	X	8	13
6,7	Manufacture of Petrochemicals & Monomers	5	3	4	12
8,9	Plastic, Resins & Rubbers	5	3	7	15
10,11	Varnish and Fibers	5	3	7	15
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resource :

10.1 Book list :

- i) A text book on Petrochemicals by Dr. B.K. Bhaskar Rao.

10.2 List of Journals :

- i) Journal in applied petrochemicals Research
- ii) International Journals of Chemicals & Petrochemicals.

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : PRINCIPLES OF UNIT OPERATION –III
2. **Course code** : Ch-504
3. **Semester** : 5th
4. **Course Outcome:**

On completion of this course, the students will be able to

- Assimilate the fundamentals of evaporation and different evaporators used in chemical industries.
- Perceive the principle of crystallization and different crystallizer used in chemical industries.
- Explain filtration, its principle and application in chemical industries.
- Elaborate adsorption, its two types, its industrial application; different types of adsorbents.
- Comprehend the fundamentals of sedimentation and settling; their scope in industrial application.

CO s		ILO s
1	Assimilate the fundamentals of evaporation and different evaporators used in chemical industries.	<ol style="list-style-type: none"> 1. Define evaporation 2. Explain Single & multiple-effect evaporators. 3. Describe construction (With diagrams) operation and application of different evaporators: <ul style="list-style-type: none"> ❖ Horizontal tube ❖ Vertical tube ❖ Film type ❖ Short tube & Long tube. 4. Explain different feeding techniques - their advantages Capacity and economy

		of evaporators.
2	Perceive the principle of crystallization and different crystallizer used in chemical industries.	<ol style="list-style-type: none"> 1. State principles of crystallization 2. Outline the classification of crystallizers used in chemical industries 3. Explain construction and operation of: <ul style="list-style-type: none"> ❖ Batch Crystallization (Tank and agitated) ❖ Continuous crystallizer (Swanson Walker Crystallizer) ❖ Other types of crystallizer (Krystal Crystallizer and Vacuum crystallizer).
3	Explain filtration, its principle and application in chemical industries.	<ol style="list-style-type: none"> 1. State filtration and its scope. 2. Narrate different filter medium and filtering aids 3. Solve problems on constant rate and constant pressure filtration 4. Explain operation and industrial application of different types of filters: <ul style="list-style-type: none"> ❖ Plate and frame filter press ❖ Rotary drum filter ❖ Rotary vacuum filter ❖ Moore filter



4	Elaborate adsorption, its two types, its industrial application; different types of adsorbents.	<ol style="list-style-type: none"> 1. Define adsorption 2. State application of adsorption 3. Narrate types of adsorbents 4. Specify parameters affecting the adsorption rate. 5. Explain physical adsorption and chemisorptions 6. Narrate different adsorption materials and their industrial application
5	Comprehend the fundamentals of sedimentation and settling; their scope in industrial application.	<ol style="list-style-type: none"> 1. State sedimentation and settling 2. Specify purpose 3. Narrate methods of operation 4. Describe different equipment for settling and sedimentation 5. Explain Gravity sedimentation and thickening equipment (Dorr thickener) and its application.

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)			
	TA	HA					Total (TA+HA)		
70	10	20	30	33/100	25	25	17/50	150	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Evaporation	1.1 Introduction 1.2 Single & multiple -effect evaporators 1.3 Construction (With diagrams) operation and application different evaporators like Horizontal tube 1.4 Vertical tube 1.5 Film type 1.6 Short tube & Long tube 1.7 Different feeding techniques-their advantages Capacity and economy of evaporators	10
2.0	Crystallization	2.1 Principles of crystallization 2.2 Classification 2.3 Construction and operation of Batch Crystallization (Tank and agitated) 2.4 Continuous crystallizer (Swanson Walker Crystallizer) 2.5 Other types of crystallizer (Krystal Crystallizer and Vacuum crystallizer); their field of application	10

3.0	Filtration	3.1 Introduction 3.2 Definition and Scope 3.3 Different medium and filtering aids 3.4 Construction 3.5 Operation and industrial application of different types of filters like-Plate and frame filter press 3.6 Rotary drum filter 3.7 Rotary vacuum filter 3.8 Moore filter	10
4.0	Adsorption	4.1 Introduction 4.2 Application of adsorption 4.3 Types of adsorbents 4.4 Parameters affecting the adsorption rate 4.5 Physical adsorption and chemisorptions 4.6 Different adsorption materials and their industrial application	5
5.0	Sedimentation and Settling	5.1 Introduction 5.2 Purpose 5.3 Methods of operation 5.4 Different equipments for settling and sedimentation 5.5 Gravity sedimentation and thickening -equipment (Dorr thickener) and its application	5

8. Distribution of marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Evaporation	5	3	10	18
2	Crystallization	5	2	10	17
3	Filtration	7	2	9	18
4	Adsorption	5	X	7	12
5	Sedimentation and Settling	3	2	X	5
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resources**10.1 Book list:**

- i) Introduction to Chemical engineering by Walter.L.Badger and Julius Banchemo, (Tata Mc Graw Him).
- ii) Unit operation of Chemical engineering by warren L.McCabe C. Smith and Peter Harriot.

10.2 List of journals :

- i) International Journal of heat & mass transfer
- ii) Chemical news journal

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : PRINCIPLES OF UNIT OPERATION III(LAB)
 2. **Course Code** : Ch- 504 (p) **Full Marks :50**
 3. **Semester** : 5th
 4. **Hours** : 45

5. **Skills to be developed-**

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

6. **Topics-**

UNIT	TOPIC/SUB-TOPIC
1	Filtration
1.1	Study of the construction and operation of filter press
2	Crystallization ;
2.1	Study of Swenson Walker Crystallizer
3	Evaporation
3.1	Study of the construction and operation of Single effect evaporator.
3.2	Study of the construction operation and an industrial application of multiple effect evaporator
4	Adsorption
4.1	Study the construction, operation and industrial use of water purification by adsorption.
4.2	Study the construction, operation and uses of gas mixture recovery unit by adsorption.
5	Sedimentation
5.1	Determination of sedimentation rate by setting method
5.2	To study construction of hydraulic classifier
5.3	Study about Dorr thickener.

1. **Course Title** : CHEMICAL ENGINEERING DRAWING II (LAB)
2. **Course Code** : Ch- 505 (P)
3. **Semester** : 5th

4. **Course Outcomes(COs)**

On completion of the course the students will be able to

- Draw free hand and scale diagrams of shell and tube heat exchanger (single, multipass).
- Draw free hand sketch of evaporators.
- Draw free hand sketch of filters.
- Draw free hand sketch of columns.
- Draw free hand sketch of dryers.
- Draw free hand sketch of controllers.

COs	ILOs
CO-1 Draw free hand and scale diagrams of shell and tube heat exchanger (single, multipass).	<ol style="list-style-type: none"> 1. Explain shell and tube exchanger and its uses. 2. Draw free-hand diagram of shell and tube exchanger (single and multipass). 3. Draw scaled diagram of shell and tube exchanger (single and multipass).
CO-2 Draw free hand sketch of evaporators.	<ol style="list-style-type: none"> 1. Explain different types of evaporators. 2. Draw free-hand sketch of tubular evaporators.
CO-3 Draw free hand sketch of filters.	<ol style="list-style-type: none"> 1. Explain different types of filters. 2. Draw free hand-sketch of

	<ol style="list-style-type: none">a. Plate and frame filter.b. Rotary filter.c. Drum filter.
CO-4 Draw free hand sketch of columns.	<ol style="list-style-type: none">1. Explain distillation and absorption columns.2. Draw free-hand sketch of<ol style="list-style-type: none">a. Fractional distillation columnb. Absorption column with details of packingc. Scaled drawing of a bubble cap column with details of bubble cap plate.
CO-5 Draw free hand sketch of dryers.	<ol style="list-style-type: none">1. Explain different types of dryers.2. Draw free hand sketch of<ol style="list-style-type: none">a. Tray drierb. Drum drierc. Rotary drier
CO-6 Draw free hand sketch of controllers.	<ol style="list-style-type: none">1. Explain different types of controllers.2. Draw free hand sketch of<ol style="list-style-type: none">a. Temperature controller.b. Pressure controller.c. Flow controller.d. Liquid level controller.



5. Teaching Scheme (in hours)

Lecture/ Practical		Total
Lecture/ Practical	Tutorial	
6 hrs/week		6 hrs/ week

6. Examination Scheme

ESE	Theory			Pass (ESE+SS)	Practical			Total Marks (Theory+Practical)	Credit
	Sessional(SS)				Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)		
	TA	HA	Total (TA+HA)						
					100	50	50/150	150	3

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Shell & tube heat	1.1 Shell and tube heat exchanger single pass multipass (Scale drawing)	5
2.0	Evaporator	2.1 Evaporators-Free hand sketching of tubular evaporators	5
3.0	Filtration	3.1 Filtration-Free hand sketching of 3.1.1 Plate and frame filter press 3.1.2 Rotary filter 3.1.3 Drum filter	5
4.0	Distillation & absorption Column	4.1 Free hand sketch of a 4.1.1 Fractional distillation column 4.1.2 Absorption column with details of packing 4.1.3 Scaled drawing of a bubble cap Column with details of bubble cap plate	10
5.0	Dryers	5.1 Free hand sketch of a 5.1.1 Tray drier 5.1.2 Drum drier 5.1.3 Rotary drier	5
6.0	Control Equipments	6.1 Free hand sketch of different control equipment 6.1.1 Temperature controller 6.1.2 Pressure controller 6.1.3 Flow controller 6.1.4 Liquid level controller	10

8. Distribution of marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Shell & tube heat exchanger	6	3	6	15
2	Evaporator	3	3	6	12
3	Filtration	5	X	5	10
4	Distillation & absorption Column	6	X	6	12
5	Dryers	2	X	5	7
6	Control Equipments	3	3	8	14
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resource**10.1 Book list:**

- i) Introduction of Chemical Engineering By walter.L.Badger & Julius Banchero.
- ii) Unit operation of Chemical Engineering By Warren L .McCabe. C Smith and Peter Harriot.
- iii) Outlines of Chemical Instruments & Process Controller By Dr. A. Suryanarayan

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : FERTILIZER TECHNOLOGY
2. **Course Code** : Ch-506
3. **Semester** : 5th

4. Course Outcome:

- Briefly introduce about the role of fertilizer in modern day
- Describe the production of Ammonia
- Describe the production of Sulphuric Acid
- Describe the production of Nitrogen based fertilizers

COs		ILOs
1	Briefly introduce about the role of fertilizer in modern day	<ol style="list-style-type: none"> 1. Describe the role of fertilizers in agriculture 2. Give a picture of the growth of fertilizer industry and present state of fertilizer industry in India 3. Describe different kinds of fertilizers
2	Describe the production of Ammonia	<ol style="list-style-type: none"> 1. Describe the process of Removal of sulphur compounds and production of ammonia 2. Describe various methods for the production of hydrogen from different feed stocks
3	Describe the production of Sulphuric Acid	<ol style="list-style-type: none"> 1. Describe briefly about the wet and dry processes of Sulphuric Acid production 2. Describe the major equipment used in the sulphuric acid plant and

		mention their material of construction
4	Describe the production of Nitrogen based fertilizers	<ol style="list-style-type: none"> 1. Give a brief introduction about the production of Urea, Ammonium Sulphate, Ammonium Nitrate 2. Provide a detailed discussion with flow sheet of various industrial processes available for the production of the above

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3hrs/week	1hr/week		4 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)		
	TA	HA					Total (TA+HA)	
70	10	20	30	33/100			100	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Introduction	1.1 Role of fertilizers in agriculture 1.2 Growth of fertilizer industry and present state of fertilizer industry in India 1.3 Different kinds of fertilizers	3
2.0	Production of Ammonia	2.1 Process 2.2 Removal of sulphur compounds	8

		2.3 Various methods for the production of hydrogen from different feed stocks 2.4 Removal of carbon di-oxide from various synthetic mixtures 2.5 Final purification of synthetic mixture gas by methanation nitrogen wash etc	
3.0	Production of Sulphuric Acid	3.1 Introduction 3.2 Processes (wet and dry) 3.3 Brief description of major equipment used in the sulphuric acid plant with their material of construction	5
4.0	Production of Urea	4.1 Introduction 4.2 Detailed discussion with flow sheet of various industrial processes available for the production of urea	5
5.0	Production of Ammonium Sulphate	5.1 Introduction 5.2 Detailed discussion with flow sheet of industrial process for the production of ammonium sulphate	7
6.0	Production of Nitric Acid	6.1 Introduction 6.2 Detailed discussion with flow sheet of various industrial processes available for the production of nitric acid	7
7.0	Production of Ammonium Nitrate	8.1 Introduction 8.2 Detailed discussion with process flow sheet of processes for the production of ammonium nitrate 8.3 Role of various activities used in ammonium nitrate production for stabilizing the product	5



8. Distribution Course Content

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Introduction	4	X	X	4
2	Production of Ammonia	4	3	5	12
3	Production of Sulphuric Acid	3	X	8	11
4	Production of Urea	3	X	8	11
5	Production of Ammonium Sulphate	4	3	5	12
6	Production of Nitric Acid	3	3	5	11
7	Production of Ammonium Nitrate	4	X	5	9
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested Learning Resource:**10.1 Book List :**

- i) Dryden's outlines of Chemical technology By M. Gopala Rao & Marshall Sitting.
- ii) Shreve's Chemical process industries By George T Austin

10.2 List of Journals:

- i) Chemical Engineering Journal

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks

1. **Course Title** : PETROLEUM TECHNOLOGY
2. **Course Code** : Ch-507
3. **Semester** : 5th
4. **Course Outcome (CO):**

On completion of the course, the student will be able to:

- Draw a complete picture about the nature of petroleum, its chemical composition and properties;
- Develop an understanding on different rock properties;
- Have an understanding of the different exploration and extraction methods based on the location of the drilling site;
- Have a brief idea about the different methods selected for petroleum exploration and also an understanding of important working mechanisms of Drilling/ Well casing/ well completion.

COs	ILOs
CO 1: Draw a complete picture about the nature of petroleum, its chemical composition and properties.	1. Detailed explanation about the classification of petroleum and its chemical and physical properties.
CO 2: Develop an understanding on different rock properties.	1. Explain about the source of petroleum and its migration and accumulation. 2. State the properties of reservoir rocks and porosity. 3. Explain in details the permeability, fluid saturation, and the structural traps. 4. Discuss about the stratigraphic

	combination of various rocks.
CO 3: Have an understanding of the different exploration and extraction methods based on the location of the drilling site.	<ol style="list-style-type: none"> 1. Explain in details about the geological and geophysical exploration methods, 2. State the magnetic, seismic and geochemical methods of prospecting. 3. In-depth explanation and discussion of cable-tool drilling, rotary drilling.
CO 4: Have a brief idea about the different methods selected for petroleum exploration and also an understanding of important working mechanisms of Drilling/ Well casing/ well completion.	<ol style="list-style-type: none"> 1. State and explain the functioning of well logging, different kinds of logs involved and devices used. 2. Discuss the different types of well cementing techniques, casing types and specifications. 3. Explain open hole, perforated completions and permanent types. 4. State different reservoir driving mechanisms, capillary forces and combination drives. 5. Explain techniques of oil recovery, and the principles of polymer flooding.

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3hrs/week	1hr/week		4 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)		
	TA	HA					Total (TA+HA)	
70	10	20	30	33/100			100	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	The nature of Petroleum	1.1 Chemical composition 1.2 Properties of liquid petroleum 1.3 Gaseous petroleum (natural gas)	3
2.0	Concepts of Petroleum geology and basic rock properties	2.1 Source of petroleum 2.2 Migration and accumulation oil 2.3 Reservoir rock properties 2.4 Porosity 2.5 Permeability and fluid saturation 2.6 Traps-structural 2.7 Stratigraphic 2.8 Combination	5
3.0	Petroleum exploration methods	3.1 Direct indication 3.2 Geological 3.3 Exploration 3.4 Methods 3.5 Geophysical exploration gravitational 3.6 Magnetic 3.7 Seismic and geochemical methods of prospecting	5
4.0	Drilling Methods	4.1 Cable tool drilling-introduction- i) Equipments and basic technique ii) Current application of cable tools 4.2 Rotary Drilling-introduction i) Composition ii) Function and general nature of rotary drilling fluid	7

5.0	Well Logging	5.1 Driller's log 5.2 Sample log mud log 5.3 Electric log 5.4 Radio log 5.5 Miscellaneous logging devices 5.6 Core analysis and drill stem testing	4
6.0	Oil well cementing and casing practices	6.1 Primary oil well cementing technique 6.2 Squeeze 6.3 Cement types 6.4 Casing types and specifications	6
7.0	The well completion	7.1 Open hole completions 7.2 Conventional perforated completions 7.3 Sand exclusion type 7.4 Permanent types	5
8.0	Reservoir Studies	8.1 Reservoir driving mechanisms 8.2 Depletion drive external gas 8.3 Water drive gravity segregation 8.4 Capillary forces and combination drives 8.5 Improving oil recovery by fluid injection-water flooding 8.6 Polymer flooding (principles only)	5

8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	The nature of Petroleum	4	3	X	7
2	Concepts of Petroleum geology and basic rock properties	3	3	8	14
3	Petroleum exploration methods	3	3	6	12
4	Drilling Methods	4	X	9	13

5	Well Logging	3	X	X	3
6	Oil well cementing and casing practices	3	X	6	9
7	The well completion	3	X	X	3
8	Reservoir Studies	2	X	7	9
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resource :

10.1 Book list :

- i) Modern petroleum technology by G.D. Hobson & W. pohl
- ii) Petroleum Engineering By Cart Gatlin
- iii) Oil well drilling technology by Mc Cray & Colc
- iv) Modern Petroleum refineries By B.K.B. Rao.

10.2 List of journals:

- i) Journal of petroleum Engineering & Technology

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title : Professional Practice – III**
2. **Course Code : CH- 510**
3. **Semester – 5th**
4. **Course Outcome:**
 - Study about the functioning of an industry as a team effort.
 - Lecture from resource person on specific topic
 - Search and report various topics assigned
 - Embed presentation skills

COs		ILOs
1	Study about the functioning of an industry as a team effort.	<ol style="list-style-type: none"> 1. Visit of an industry and grouping up in teams to study various aspects 2. Collective report submission of the same citing the observations
2	Lecture from resource person on specific topic	<ol style="list-style-type: none"> 1. Meeting leading to resources persons citing various demands of human resource of an industry 2. Having a feedback of those industries which were visited earlier
3	Search and report various topics assigned	<ol style="list-style-type: none"> 1. Information search through manufacturer's catalogue, websites, magazine, books, etc and thereafter submit a report
4	Embed presentation skills	<ol style="list-style-type: none"> 1. Specified seminar topics with reports are to be submitted so as to improve the presentation skills

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
1 hrs/week		2 hrs/week	3 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test(PT)#	Practical Assessment(PA)@	Pass (PT+PA)		
	TA	HA					Total (TA+HA)	
-	-	-	-	25	25	17/50	50	2

7. ACTIVITIES**7.1 INDUSTRIAL VISITS:****12**

Structured industrial visits be arranged and report of the same shall be submitted by the individual students, to form a part of the team work. The industrial visit may be arranged in the following areas/industries

- Sugar factory
- Paint industry
- Chemical industry
- Dairy Plant

7.2 GUEST LECTURE(S):**10**

Lectures by Professional/ Industrial Experts to be organized from any two of the following areas:

- Interview Techniques
- Alternate fuels- CNG/LPG, Biodiesel, Ethanol, Hydrogen
- Piping Technology
- Modern Drilling Techniques.

7.3 INFORMATION SEARCH**10**

Information search can be done through manufacturer's catalogue, websites, magazine, books, etc and submit a report on any one topic.

Following topics are suggested:

- Types of pumps- characteristics and application
- Heat Exchangers
- Gaseous Fuels- manufacturing, uses and advantages
- Modern Refractories
- Refrigeration process
- Temperature measuring tools used in industries
- List of Products obtain from crude oil and its applications
- Filters

7.4 SEMINAR

13

Seminar topic should be related to the subjects of fifth semester. Each student should submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 min)

Mini Project/ Activities: (any one)

- Prepare a model out of card board/ wood/ thermocol/ metal such as:
 - i. Liquid level measurement
 - ii. Rotary Drilling
 - iii. Oil Migration
 - iv. Rotary Drum Filter
- Soap Making
- Plastic molding



6TH SEMESTER



COURSE STRUCTURE OF 6thSEMESTER (CHEMICAL)

Sl No	Code No	Subject	Study Scheme			Evaluation Scheme										
			Contact hour/week			Theory						Practical			Total Marks (Theory+ Practical)	Credit
			L	T	P	ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)			
TA	HA	Total (TA+HA)														
1	Hu-601	Industrial management & Entrepreneurship	3			70	10	20	30	33/100				100	3	
2	CH-601	Automatic Process Control (APC)	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
3	CH-602	Industrial Chemical Process-III (ICP-III)	3	1		70	10	20	30	33/100				100	4	
4	CH-603	Principle Of Unit Operation-IV (PUO-IV)	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
5	CH-611	Project & Seminar		1	6						100	50	50/150	150	3	
6	CH-612	Grand Viva		2							50		17/50	50	2	
7	CH-610	Professional Practice - IV	1		2						25	25	17/50	50	2	
8		Optional (any one)														
A	CH-604	Petroleum Refining	3			70	10	20	30	33/100				100	3	
B	CH-605	Paper Technology	3			70	10	20	30	33/100				100	3	
			16	2	16											
		Total	34										Total	850	25	

Course Title :Industrial Management and Entrepreneurship

1. Course Code: **Hu – 601**
2. Semester: **VI**
3. **Aim of the Course:**
 1. To acquaint the students with managerial activities
 2. To provide introductory knowledge of Cost Accounting
 3. To introduce students with industrial legislation
 4. To explain the scope for self-employment
 5. To compare and contrast different forms of business organization
 6. To identify the opportunities to start a small scale industry

4. Course Outcomes:

On completion of the course on IME, students will be able to

- CO₁ = explain managerial activities.
- CO₂ = describe leadership qualities and decision making process.
- CO₃ = state the elements of costs.
- CO₄ = explain important industrial laws.
- CO₅ = define different forms of business organisations
- CO₆ = identify entrepreneurial abilities for self employment through small scale industries.

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
42 hrs	3 hrs	--	45 hrs

6. Examination Scheme:

Theory				Practical				Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination	Sessional			
70	30	100	33	--	--	--	--	100

7. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
				42 hrs
1.0	Introduction to Management :	i) Meaning and Concept ii) Functions of Management iii) Principles of Management	i) Explain functions and principles of management	3
2.0	Leadership Decision Making & Communication :	i) Definition of Leader ii) Functions of a leader iii) Decision making – Definition iv) Decision making process v) Communication – definition, importance & types	i) Develop leadership qualities ii) Demonstrate decision making abilities	4
3.0	Introduction to Cost :	i) Definition and classification of Cost ii) Elements of Cost iii) Break Even Analysis	i) State elements of costs ii) Explain Break Even Analysis	3
4.0	Human Resource Management:	i) Meaning of manpower planning ii) Recruitment and Selection procedure iii) Payment of wages – factors determining the wage iv) Methods of payment of wages – Time rate and Piece rate v) Labour Turnover – definition, its causes, impact and remedy	i) State selection procedure of employees ii) Distinguish Time rate and Piece rate system of wage payments iii) Explain causes and	5

			impact of labour turnover	
5.0	Industrial Legislation :	<ul style="list-style-type: none"> i) Need of Industrial legislation ii) Indian Factories Act – 1948 – Definition of Factory, main provisions regarding health, Safety and Welfare of Workers iii) Industrial Dispute Act – 1947 – Definition of Industrial dispute, Machineries for settlement of Industrial dispute in India 	i) Identify the needs and importance of industrial laws	5
6.0	Production Management :	<ul style="list-style-type: none"> i) Meaning of Production ii) Production Management – definition, objectives, functions and scope iii) Inventory Management, Basic idea 	i) State the objectives and functions of Production management	3
7.0	Marketing Management:	<ul style="list-style-type: none"> i) Meaning and functions of marketing ii) e- Commerce iii) Channels of distribution iv) Wholesale and retail trade 	i) state the functions of wholesalers and retailers	2
8.0	Entrepreneur and Entrepreneurship:	<ul style="list-style-type: none"> i) Definition of Entrepreneur and Entrepreneurship ii) Qualities required by an entrepreneur iii) Functions of an entrepreneur iv) Entrepreneurial motivation 	i) State the qualities and functions of an entrepreneur	3
9.0	Forms of Business Organization:	<ul style="list-style-type: none"> i) Sole Trader – meaning, main features, merits and demerits ii) Partnership – definition, features, merits and demerits 	<ul style="list-style-type: none"> i) Differentiate different forms of Business organization ii) compare and 	5

		iii) Joint Stock Company – Definition, types, features, merits and demerits	contrast features, merits and demerits of different business organizations.	
10.0	Micro and Small Enterprises:	i) Definition of Micro & Small enterprises ii) Meaning and characteristics of Micro and Small enterprise iii) Scope of SSI with reference to self-employment iv) Procedure to start SSI – idea generation, SWOT analysis v) Selection of site for factories	i) Define micro and small enterprises ii) Explain the procedure to start a small enterprise	4
11.0	Support to Entrepreneurs	a) Institutional support: i) Introduction ii) Sources of information and required application forms to set up SSIs iii) Institutional support of various National & State level organizations – DIC, NSIC, IIE, MSME - DI, Industrial Estates b) Financial support: i) Role of Commercial banks, RRB, IDBI, ICICI, SIDBI, NEDFi, and State Financial Corporations ii) Special incentives and subsidies for Entrepreneurship Development in the North East	i) identify the supporting agencies to entrepreneurs ii) Explain the role of financial support organizations	5
	Class Test			3 hrs
	Total			45 hrs

(9) TABLE OF SPECIFICATIONS for Industrial Management & Entrepreneurship

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Compre-hension	Application	HA
1	Introduction to Management	3	7	2	3	0	0
2	Leadership & Decision Making	4	9.5	3	4	0	0
3	Introduction to Cost	3	7	3	2	0	0
4	Human Resource Management	5	12	6	2	0	0
5	Industrial Legislation	5	12	4	4	0	0
6	Production Management	3	7	3	2	0	0
7	Marketing Management	2	5	4	0	0	0
8	Entrepreneur & Entrepreneurship	3	7	3	2	0	0
9	Forms of Business Organization	5	12	3	5	0	0
10	Micro & Small Enterprises	4	9.5	4	3	0	0
11	Support to Entrepreneurs	5	12	4	4	0	0
Total		42	100	39	31	0	70

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$

10. Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR IME

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand Total
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	Management	1	0	0	1	1	0	0	0	1	0	3	0	0	3	5
2	Leader & Decision	1	0	0	1	2	1	0	0	3	0	3	0	0	3	7
3	Cost	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
4	HRM	2	1	0	3	1	1	0	0	2	3	0	0	0	3	8
5	Laws	3	0	0	3	0	0	0	0	0	1	4	0	0	5	8
6	Product Manage	2	1	0	3	1	1	0	0	2	0	0	0	0	0	5
7	Market	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
8	Entrepreneurship	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
9	Forms of BO	2	1	0	3	0	0	0	0	0	1	4	0	0	5	8
10	MSME	2	0	0	2	0	0	0	0	0	2	3	0	0	5	7
11	Support to Entp.	3	0	0	3	1	0	0	0	1	0	4	0	0	4	8
	Total	20	5	0	25	12	5	0	0	17	7	21	0	0	28	70

K = Knowledge C = Comprehension A = Application

HA = Higher Than Application Higher than Application (Analysis, Synthesis, Evaluation) Total

10. Suggested implementation Strategies: Modified syllabus may be implemented with effect from January, 2020 (Starting with the present batch (2018) of 2nd Semester students)

11. Suggested learning Resource:

a. **Book list :**

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Industrial Management	S.C. Jain H.S. Bawa	DhanpatRai& Co. (P) Ltd. New Delhi- 110006
2	Business Organisation and Entrepreneurship Development	S.S. Sarkar R.K. Sharma Sashi K. Gupta	Kalyani Publishers, New Delhi-110002
3	Entrepreneurial Development	S. S. Khanka	S. Chand & Co. Ltd. New Delhi- 110055
4	Business Methods	R.K. Sharma Shashi K Gupta	Kalyani Publishers, New Delhi
5	Entrepreneurship Development and Management	Dr. R.K. Singhal	S.K. Kataria& Sons, New Delhi- 110002
6	Business Administration & Management	Dr. S. C. Saksena	SahityaBhawan, Agra
7			
8			

- b. List of Journals
- c. Manuals
- d. Others



Course Title: AUTOMATIC PROCESS CONTROL

1. **Course Code** : Ch-601

2. **Semester** : 6th

4. **Course Outcome (CO):**

On completion of the course, the student will be able to:

- Define the science of automatic process control;
- Distinguish Controlling elements, Transmission systems and Final control elements and their application;
- Demonstrate the working mechanism of different process controls employed for temperature, pressure, liquid level control;
- Develop an understanding and working mechanisms of the automatic valves employed in various industries.

COs	ILOs
CO 1: Define the science of automatic process control.	1. Detailed explanation about the elements of servo mechanism, loop feedback control, open control loop. 2. Understanding of different process variables, set point control types of controllers and on-off controllers.
CO 2: Distinguish Controlling elements, Transmission systems and Final control elements and their application.	1. Explain about the concept of working and construction of self-operated controller, Level controller, Pneumatic controller 2. State about the functioning of Hydraulic controller-its function and working

	<p>Principles Electrical controller, thermo static valves.</p> <p>3. Explain in details about Pneumatic, Hydraulic and Electrical transmissions.</p>
CO 3: Demonstrate the working mechanism of different process controls employed for temperature, pressure, liquid level control.	<ol style="list-style-type: none"> 1. Explain in details about Function of final control elements in process control and Different type of automatic control valves. 2. State about Sliding stem and rotating shaft control valve and Working principles and construction of Pneumatic, Hydraulic & Electrical control valve actuator. 3. Explain about the Final control elements and power failure. 4. In-depth explanation and discussion of Effects and precautions to be considered.
CO 4: Develop an understanding and working mechanisms of the automatic valves employed in various industries.	<ol style="list-style-type: none"> 1. State and explain the Control of fluid flow, pressure, furnace pressure, and Liquid level control and Control of Thermal process. 2. Explain about the Major features and advantages of distributed control.

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit	
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)			
	TA	HA					Total (TA+HA)		
70	10	20	30	33/100	25	25	17/50	150	4

7. Detailed Course Contents

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Science of Automatic Control	1.1 Elements of servo mechanism 1.2 Simple single loop feed-back control system 1.3 Open control loop 1.4 Definition of different process variables 1.5 Desired value or set point control or manipulated variables 1.6 Types of control action and properties of P, I. and D. Single loop regulator system 1.7 On- off controller	10
2.0	Controlling Elements	2.1 Working and construction of self operated controller (pressure regulator 2.2 Level controller 2.3 Thermo static valves) 2.4 Pneumatic controller - its function and working principles 2.5 Hydraulic controller-its function and working Principles Electrical controller -its function and working principles	10

3.0	Transmission System	3.1 Pneumatic transmission 3.2 Hydraulic transmission 3.3 Electrical transmission	9
4.0	Final Control Elements	4.1 Function of final control elements in process control 4.2 Different type of automatic control valves 4.3 Sliding stem and rotating shaft control valve 4.6 Working principles and construction of Pneumatic, Hydraulic & Electrical control valve actuator 4.7 Final control elements 4.8 Power failure 4.9 Effects and precautions to be considered	4
5.0	Application of control Engineering	5.1 Control of fluid flow 5.2 Control of pressure 5.3 Control of furnace pressure 5.4 Liquid level control 5.5 Control of Thermal process	5
6.0	Distributed digital control System	6.1 Introduction 6.2 Major features and advantages of distributed control	2

8. Distribution of Marks:

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type	Short Question	Descriptive Question	
1	Science of Automatic Control	5	3	10	18
2	Controlling Elements	8	X	6	14
3	Transmission System	2	3	7	12
4	Final Control	5	X	X	5
5	Application of control Engineering	3	3	5	11
6	Distributed digital	2	X	8	10

	control System				
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested Learning Resources**10.1 Book List:**

- i) Industrial instrumentation & control By S.K. Singh.
- ii) Outlines of Chemical instrumentation & process control by Dr. A. Suryanarayan
- iii) Automatic process control By Donald P.Eckman

10.2 List of Journals :

- i) Journal of Control and Instrumentation

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : AUTOMATIC PROCESS CONTROL (LAB)
 2. **Course Code** : Ch- 601(P) **Full Mark :50**
 3. **Semester** : 6th
 4. **Hours** : 45

5. Skills to be developed-

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

6. Topics-

UNIT	TOPIC/SUB-TOPIC
1	Details of equipments of flow control elements
2	Details of equipments of temperature control elements
3	Details of equipments of pressure control elements
4	Details of equipments of level control elements
5	Experiments done with feed back
6	Theory of gas chromatograph



1. **Course Title** : **INDUSTRIAL CHEMICAL PROCESS III**
2. **Course Code** : **Ch-602**
3. **Semester** : **6th**

4. Course Outcome (CO)

On completion of the course the students will be able to:

- Describe manufacturing of pulp & paper (Kraft's process), describe different types of paper.
- Describe different types of fertilizers, describe NPK fertilizers with applications.
- Describe Lime manufacturing process, their raw materials and applications.
- Describe manufacture of ordinary Portland cement (Dry & Wet process). Illustrate the chemical properties of Portland Cement., their composition; properties and uses.
- Describe sugar and its raw materials. Demonstrate the manufacturing process of sugar.
- Describe leather, its raw materials and different types.
- Describe glass manufacturing process, its raw materials and properties.
- Describe adhesives, classifications of adhesives. Describe uses of adhesives in different structural materials.

COs		ILOs
1	Describe manufacturing of pulp & paper (Kraft's process), describe different types of paper.	1.1 Describe the raw materials of pulp and paper. 1.2 Describe manufacturing of pulp. 1.3 Describe manufacturing of paper by Kraft's process. 1.4 Describe different types of paper.

2	Describe different types of fertilizers, describe NPK fertilizers with applications.	<ol style="list-style-type: none"> 1. Define fertilizers. 2. Describe different types of fertilizers. 3. Define nitrogenous fertilizer. 4. Define phosphatic fertilizer. 5. Define potassium fertilizer. 6. Define mixed fertilizer. 7. Describe the production of ammonium Sulphate. 8. Describe the production of ammonium nitrate. 9. Describe the production of urea. 10. Describe super phosphate. 11. Describe triple super phosphate. 12. Describe NPK Fertilizers.
3	Describe Lime manufacturing process, their raw materials and applications.	<ol style="list-style-type: none"> 1. Define lime. 2. Describe raw materials of lime. 3. Describe manufacturing of lime. 4. Describe applications of lime.
4	Describe manufacture of ordinary Portland Cement (Dry & Wet process). Illustrate the chemical properties of Portland Cement., their composition; properties and uses.	<ol style="list-style-type: none"> 1. Describe manufacturing of ordinary Portland cement (Dry & Wet process). 2. Describe the functions and properties of different ingredients present in Portland cement. 3. Describe the process of setting and hardening of cement. 4. Illustrate the chemical properties of Portland cement. 5. Describe cement composition and their properties and applications.

5	Describe sugar and its raw materials. Demonstrate the manufacturing process of sugar.	<ol style="list-style-type: none">1. Describe sugar and its raw materials.2. Describe manufacturing of sugar with flow sheet.3. Explain the principles of manufacturing sugar from sugarcane.4. Explain refining and purification of sugar.
6	Describe leather, its raw materials and different types.	<ol style="list-style-type: none">1. Describe the raw materials of leather.2. Describe different types of hides and methods of softening of leather.3. Describe the tanning process- vegetable and chemical tanning.4. Describe different types of leather.5. Explain drying and finishing of leather.
7	Describe glass manufacturing process, its raw materials and properties.	<ol style="list-style-type: none">1. Define glass.2. Describe manufacturing of glass.3. Explain the preparation of glass in a glass furnace.4. Describe different methods of finishing glass goods.5. Describe different types of glass.6. Describe raw materials of glass and their properties.

8	Describe adhesives, classifications of adhesives. Describe uses of adhesives in different structural materials.	<ol style="list-style-type: none"> 1. Define adhesives. 2. Describe classifications of adhesives. 3. Describe different natural and synthetic adhesives of commercial importance. 4. Explain chemical nature of adhesives. 5. Illustrate special properties and applications of adhesives. 6. Describe advantages of adhesive bonding. 7. Describe applications of adhesives in different structural materials.
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5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week	1 hr/week		4 hrs/week

6. Examination Scheme

Theory					Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)			
	TA	HA					Total (TA+HA)		
70	10	20	30	33/100			100	4	

7. Detailed Course Contents

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Pulp & paper	1.5 Introduction 1.6 Raw materials 1.7 Manufacture of Pulp 1.8 Manufacture of paper (Kraft's process) 1.9 Different types of paper	5
2.0	Fertilizer	2.1 Introduction 2.2 Different types of fertilizers 2.2.1 Nitrogenous 2.2.2 Phosphatic 2.2.3 Potassium 2.2.4 Mixed 2.3 Nitrogenous Fertilizer 2.3.1 Production of Ammonium Sulphate 2.3.2 Ammonium Nitrate and 2.3.3 Urea their application as fertilizer 2.4 Phosphetic Fertilizer-raw materials 2.4.1 Production of Phosphetic acids 2.4.2 Super Phosphate 2.4.3 Triple Super Phosphate 2.5 NPK Fertilizer – Production and uses	8
3.0	Lime	3.1 Raw materials 3.2 Manufacture of lime 3.3 Uses	2
4.0	Cement	4.1 Manufacture of ordinary Portland Cement (Dry & Wet process) 4.2 Functions and properties of different ingredients present in Portland Cement 4.3 Setting and hardening of cement, 4.4 Chemical properties of Port- land Cement 4.5 Other varieties of cement- composition; properties and uses	5

5.0	Sugar	5.1 Introduction 5.2 Raw materials 5.3 Sugar manufacture flow sheet explanation 5.4 Principles of manufacturing sugar from sugarcane 5.5 Refining and purification of sugar 5.6 By-products	5
6.0	Leather	8. Introduction 9. Raw materials 10. Different types of hides and methods of softening 11. Tanning process-vegetables and chemicals tanning 12. Types of Leather 13. Drying and finishing of leather	5
7.0	Glass	7. Manufacture of Glass 8. Preparation of Glass in a glass Furnace 9. Spraying of glass annealing etc 10. Different methods of finishing glass goods 7.5 Different types of glass-their raw materials and properties	5
8.0	Adhesive	8.1 Introduction 8.2 Definition of Adhesives, 8.3 Classifications of adhesives 8.4 Names of different natural and synthetic adhesives of commercial importance 8.5 Their chemical nature 8.6 Special properties and applications 8.7 Advantages of adhesive bonding 8.8 Uses of adhesives in different structural materials	5



8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Pulp & paper	3	4	6	13
2	Fertilizer	5	2	6	13
3	Lime	3	X	7	10
4	Cement	5	X	5	10
5	Sugar	3	X	7	10
6	Leather	3	X	5	8
7,8	Glass & Adhesive	3	3	X	6
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resource**10.1 Book list:**

- i) Dryden's outlines of Chemical technology By M.Goapala Rao & Marshall Sitting.
- ii) Shreve's Chemical process industries by George T Austin. Mc Grow Hill Instruments Edition's.

10.2 List of Journals:

- i) Chemical Engineering Journal.

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : PRINCIPLE OF UNIT OPERATION – (IV)
2. **Course Code** : Ch-603
3. **Semester** : 6th

4. Course Outcome:

After completion of this course, the students will be able to

- Define size reduction; identify and select suitable and appropriate equipment for size reduction based on the properties of materials being used.
- Describe mechanical separation and its types; demonstrate the working principle and operational method of different separators.
- Describe mixing as separation technique and understand the properties of liquids, solids and gases based on the modes of experiments conducted on them.
- Describe different types of conveying equipments and explain different materials required for conveying.

CO		ILO
1	Define size reduction; identify and select suitable and appropriate equipment for size reduction based on the properties of materials being used.	<ol style="list-style-type: none"> 1. Explain size reduction and its necessity. 2. Explain energy and power requirements for size reduction and crushing efficiency. 3. Define Kick's law, Rittinger's law and Bond's law. 4. Classify size reduction equipment. 5. Describe different size reduction equipments <ul style="list-style-type: none"> ✓ Jaw crusher ✓ Ball mill ✓ Hammer mill ✓ Tube mill ✓ Double mill

2	Describe mechanical separation and its types; demonstrate the working principle and operational method of different separators.	<ol style="list-style-type: none"> 1. Explain the necessity of mechanical separation. 2. Classify different methods of mechanical separation. 3. Explain particle-size measurement by screen analysis, screen effectiveness and capacity. 4. Describe different types of screening equipments <ul style="list-style-type: none"> ✓ Grizzlies ✓ Trommels ✓ Vibrating screens ✓ Revolving screens. 5. Describe working principle and construction of <ul style="list-style-type: none"> ✓ Froth flotation. ✓ Suspended batch centrifuge for centrifugal separation. ✓ Cyclone separator. ✓ Electrostatic separator for electrostatic separation. ✓ Magnetic drum separator for electromagnetic separation. 6. Explain filtration and its types. 7. Describe working principle and construction of pressure filter- Plate and frame filter press.
3	Describe mixing as separation technique and understand the properties of liquids, solids and gases based on the modes of experiments	<ol style="list-style-type: none"> 1. Explain mixing as separation technique. 2. Explain mixing of liquids with liquids by impellers, propellers, turbines, paddles, agitated vessel.

	conducted on them.	<ol style="list-style-type: none"> 3. Explain mixing of gases with liquids by mechanically agitated vessel. 4. Explain mixing of viscous masses by double arm kneader, banbury mixers, pug mills, muller mixers. 5. Explain mixing of solids with solids by ribbon blenders, tumblers.
4	Describe different types of conveying equipments and explain different materials required for conveying.	<ol style="list-style-type: none"> 1. Describe belt conveyors and chain conveyors for transportation. 2. Describe screw conveyors and pneumatic conveyors. 3. Describe range of materials required for handling conveyors.

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	6 hrs/week

6. Examination Scheme

ESE	Theory			Pass (ESE+SS)	Practical			Total Marks (Theory+Practical)	Credit
	Sessional(SS)		Total (TA+HA)		Practical Test (PT)#	Practical Assessment (PA)@	Pass (PT+PA)		
	TA	HA							
70	10	20	30	33/100	25	25	17/50	150	4

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Size reduction	1.1 Introduction 1.2 Purpose of size reduction 1.3 Mechanisms of size reduction 1.4 Energy and power requirements of size reduction 1.5 Rittinger's law 1.6 Bond's law classification of size reduction equipment 1.7 Description and working of different size reduction equipments viz Jaw crusher ball-mill tube-mill double-roll-crusher 1.8 Hammer-mill	15
2.0	Mechanical Separation	2.1 Purpose of separation 2.2 Different methods of separation 2.3 Screening and types of screens description of screening equipments 2.4 Froth floatation 2.5 Centrifugal settling process cyclone separators 2.6 Electrostatic and electromagnetic separation 2.7 Filtration 2.8 Filter press	15
3.0	Mixing	3.1 Object of mixing 3.2 Important properties of materials which influence mixing (i) Mixing of liquid with liquid (ii) Mixing of gaseous with liquid (iii) Mixing of Viscous masses (iv) Different types of mixing equipments their /construction and operations	5

4.0	Conveying	4.1 Description of different types of conveying equipment viz. belt conveyors ,chain conveyors, etc 4.2 Screw conveyors, pneumatic conveyors, Materials of constructing of different conveyers for handing different materials	5
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8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1	Size reduction	6	3	10	19
2	Mechanical Separation	7	2	9	18
3	Mixing	6	2	10	18
4	Conveying	6	2	7	15
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resources

10.1 Book list

- i) Dryden's outlines of Chemical technology By M.Gopala Rao & Marshall Sitting.
- ii) Shreve's Chemical process industries by George T Austin. Mc Grow Hill Instruments Edition's.
- iii) Mechanical operation for Chemical Engineering By C.M. Narayanan B.C. Bhattacharya.

10.2 List of Journals:

- i) Chemical Engineering Journal

12. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = $10 \times 1 = 10$ marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks.



1. **Course Title** : UNIT OPERATION IV (LAB)
 2. **Course Code** : Ch-603 (p) **Full Mark : 50**
 3. **Semester** : 6th
 4. **Hours** : 45

5. **Skills to be developed-**

Intellectual skills-

- i) Proper observation and study
- ii) Proper selection of measuring instruments (wherever required)
- iii) Verify the principles
- iv) Read and interpret graphs (where necessary)
- v) Use results in practical problems.
- vi) Make observation notes and draw diagrams.

Motor skills-

- i) Proper handling of machineries and equipments.
- ii) Observe reactions (wherever necessary)
- iii) Note results
- iv) Draw graphs or calculate results/outcomes (as needed)

6. **Topics-**

UNIT	TOPIC/SUB-TOPIC
1.0	Study of the construction and operation of Jaw Crusher.
2.0	Study of the construction and operation of Double-roll Crusher.
3.0	Study of the construction and operation of Ball-Mill.
4.0	Sieve analysis of a given sample.
5.0	Study of the construction and operation of a Hammer mill.
6.0	Study of the construction and operation of a Paddle mixer.
7.0	Study of the construction and operation of Wilfley table
8.0	Study of the construction and operation of froth floatation cell



1. **Course Title** : **PETROLEUM REFINING ENGINEERING**
2. **Course Code** : **Ch-604**
3. **Semester** : **6th**

4. Course Outcome:

- Briefly introduce and narrate the history of Petroleum industry
- Define Crude Oil, its sources and its properties
- Describe the different pretreatments required for refining of petroleum
- Study the different test of crude oil and its product to know its properties
- Describe in details the production of petroleum products
- Define the uses and requirement of Vacuum Distillation Unit
- Define manufacturing of Lubrication oil
- Define manufacturing of Wax and the various grades of the produced wax and their uses
- Define specification of Petroleum
- Define Cracking of Petroleum and its necessity
- Elaborate what you mean by Solvent Refining
- Explain different treatments of Petroleum Products
- Elaborate the Safety, Prevention and Maintenance procedures in a refinery

COs		ILOs
1	Briefly introduce and narrate the history of Petroleum industry	<ol style="list-style-type: none"> 1. Provide a general overview on the history of the petroleum Industry with special reference to India 2. Classify different oil refineries of India according to their refining capacities 3. Briefly study about the different oil fields of Assam

2	Define Crude Oil, its sources and its properties	<ol style="list-style-type: none"> 1. Describe the theories of origin of Crude oil 2. What are the various sources of Crude oil 3. What is the chemical composition of crude 4. Define the physical appearance of crude 5. Classify crude according to various parameters
3	Describe the different pretreatments required for refining of petroleum	<ol style="list-style-type: none"> 1. Define desalting and dehydration of crude 2. Define various desalting methods viz., mechanical, chemical and electrical desalting 3. Define Pour point depression
4	Study the different test of crude oil and its product to know its properties	<ol style="list-style-type: none"> 1. Study the different properties of crude oil and its products and define different tests and know about their significance
5	Describe in details the production of petroleum products	<ol style="list-style-type: none"> 1. Define fractionation of crude 2. Define the working of an Atmospheric distillation unit 3. Define Bubble cap columns and different types of plates 4. Elaborate the different products

		obtained from the Atmospheric distillation unit
6	Define the uses and requirement of Vacuum Distillation Unit	<ol style="list-style-type: none"> 1. Define Vacuum Distillation Unit 2. Brief about the products from Vacuum Distillation unit and their study about their uses
7	Define manufacturing of Lubrication oil	<ol style="list-style-type: none"> 1. Describe the manufacturing process of lubricating oil 2. How is lube oil treated 3. What are the various additives added to lube
8	Define manufacturing of Wax and the various grades of the produced wax and their uses	<ol style="list-style-type: none"> 1. Describe the manufacturing process of Wax 2. What are the various grades of wax 3. Give a detailed note on their specification 4. What are the end uses of wax
9	Define specification of Petroleum	<ol style="list-style-type: none"> 1. Give details about the specification of different products of petroleum
10	Define Cracking of Petroleum and its necessity	<ol style="list-style-type: none"> 1. Define secondary process of petroleum refining 2. Define different types of cracking 3. Define Delayed Coking unit with special reference to its by-products and their uses

		<ol style="list-style-type: none"> 4. Define Fluidized Catalytic Cracking unit and mention the products obtained from it 5. Define Hydrocracking unit
11	Elaborate what you mean by Solvent Refining	<ol style="list-style-type: none"> 1. Describe Solvent refining and their extraction process 2. Study about the refining of Kerosene by Edlehan process
12	Explain different treatments of Petroleum Products	<ol style="list-style-type: none"> 1. What are the chemical treatments used for petroleum products citing examples of Sulfuric acid Treatment, Clay Treatment, etc 2. Define Merox sweetening process and Contact process etc to remove sulfur from crude and its products
13	Elaborate the Safety, Prevention and Maintenance procedures in a refinery	<ol style="list-style-type: none"> 1. What are safety measures to be taken in a refinery 2. Describe about fire protection in a refinery 3. Give details about maintenance of equipments used in a refinery



5. Teaching Scheme (in hours)

Lecture	Tutorial	Total
3 hrs/week		3 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credi t
ES E	Sessional(SS)			Practica l Test (PT)#	Practical Assessmen t (PA)@	Pass (PT+PA)		
	T A	H A	Total (TA+HA)				Pass (ESE+SS)	
70	10	20	30	33/100			100	3

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1	Introduction and History of petroleum Industry	1.1 History of the petroleum Industry with special reference to India 1.2 Different oil refineries of India and their capacities 1.3 Oil fields of Assam	3
2	Crude Oil	2.1 Crude Oil Definition 2.2 Source of Crude oil (Origin of Crude oil theories) 2.3 Composition of crude (chemical composition) 2.4 Physical appearance of crude 2.5 Classification of crude	3
3	Different pretreatments of petroleum	3.1 Pretreatment of crude by desalting and dehydration 3.2 Mechanical, Chemical and Electrical desalting procedure 3.0 Pour point depression	3

4	Different Properties and test of crude oil/product	4.1 Different Properties of crude oil/products and different tests and significance 4.2 Reid vapor pressure, octane number, cetane number, smoke point, power point, Flash point fire point, viscosity, viscosity- index, calorific value, diesel-index, carbon residue etc	3
5	Production of petroleum	5.1 Fractionation of crude 5.2 Atmospheric distillation unit 5.3 Bubble cap columns, different types of plates 5.4 Different products obtained from the Atmospheric distillation unit 5.5 Definition of different products and their uses (LPG) gasoline, Kerosene Light-diesel oil, High speed diesel oil etc	4
6	Vacuum Distillation	6.1 Vacuum Distillation Unit 6.2 Products from vacuum Distillation unit and their uses	3
7	Lubrication oil	7.1 Manufacturing Process of lubricating oil 7.2 Treatment of lube oil 7.3 Various additives added to lube	3
8	Wax	8.1 Manufacturing Process of Wax 8.2 Grades of wax and specification 8.3 Uses of wax	3
9	Specification of Petroleum	9.1 Specification of Different petroleum Products	3
10	Cracking of Petroleum	10.1 Secondary process (Cracking) 10.2 Thermal Cracking and Catalytic Cracking 10.3 Delayed Coking unit, By products obtained from D.C.U., Coke etc 10.4 Fluidized Catalytic Cracking unit and products obtained from it 10.5 Hydro raking unit	3



11	Solvent Refining	11.1 Solvent refining and extraction process 11.2 Refining of Kerosene by Edeleanu process. (Extraction by sulfur dioxide)	3
12	Different Treatments of Petroleum Products	12.1 Chemical Treatment of petroleum products 12.2 Sulfuric acid Treatment 12.3 Clay Treatment 12.4 Merox sweetening process, Contact process etc to remove sulfur from crude and its products.)	3
13	Safety, Prevention and Maintenance	13.1 Safety in the refinery 13.2 Fire protection in the refinery 13.3 Maintenance of equipments	3

8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1,2	History of petroleum industry and crude oil	5	X	4	9
3,4	Different pretreatments of petroleum & Different Properties and test of crude oil/product	5	X	6	11
5,6	Production of petroleum & Vacuum Distillation	4	X	7	11
7,8	Lubrication oil & Wax	5	3	5	13
9,10	Specification of Petroleum & Cracking of Petroleum	4	3	5	12
11,12	Solvent Refining &	2	X	9	11

	Different Treatments of Petroleum Products				
13	Safety, Prevention and Maintenance	X	3	X	3
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resources :**10.1 Book list:**

- i) Modern petroleum Refineries process By B.K. Bhaskar Rao.
- ii) Petroleum Refinery Engineering By W.I Nelson.

10.2 List of Journals:

- i) Journal of oil and gas research
- ii) Journal of petroleum Engineering and Technology

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : PAPER TECHNOLOGY
2. **Course Code** : Ch-605
3. **Semester** :6th
4. **Course Outcome (CO):**

On completion of the course, the student will be able to:

- Gain information about the pulp and paper industry;
- Have a detailed overview of the basic constituents used in Paper manufacturing industries;
- Attain in-depth knowledge of pulping, bleaching, sizing and coloring processes;
- Develop an understanding of the whole procedure of paper making and provide an analytical approach towards the treatment of the raw materials involved in paper making.

COs	ILOs
CO 1: Gain information about the pulp and paper industry	1. Detailed explanation about growth and development of pulp and paper industry.
CO 2: Have a detailed overview of the basic constituents used in Paper manufacturing industries.	<ol style="list-style-type: none"> 1. Explain about cellulose, lignin and it's various types; 2. Define chemical and physical properties along with lignin isolation; 3. Explain about the chemical constituents and physical properties of pulp wood.

<p>CO 3: Attain in-depth knowledge of pulping, bleaching, sizing and coloring processes.</p>	<ol style="list-style-type: none">1. Define pulping by different processes;2. Detailed explanation about chemical, sulphite, alkaline, mechanical, semi-chemical pulping;3. Define the process of bleaching and it's properties along with the various requirements for different pulps;4. Explain the various dyes used for coloring along with their properties and the various factors of coloring affecting dyeing.
<p>CO 4: Develop an understanding of the whole procedure of paper making and provide an analytical approach towards the treatment of the raw materials involved in paper making.</p>	<ol style="list-style-type: none">1. Define fiber preparation.2. Explain the use of pulpers, beaters, refiners and define them.3. Explain sheet formation.4. Define paper machine, its construction and operation; along with wet pressing and drying of paper.5. Explain internal sizing and different types.6. Define the various sizing process and commercial grade papers.7. Explain surface sizing, and various properties and types.8. Define the various equipments used and the detailed processes associated with them.



5. Teaching Scheme (in hours)

Lecture	Tutorial	Total
3 hrs/week		3 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credi t
ES E	Sessional(SS)		Pass (ESE+SS)	Practica l Test (PT)#	Practical Assessmen t (PA)@	Pass (PT+PA)		
	T A	H A					Total (TA+HA)	
70	10	20	30	33/100			100	3

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Introduction	1.1 Growth and development of pulp and paper industry	2
2.0	Cellulose and lignin	2.1 Its sources; different types of cellulose 2.2 Chemical Properties and physical structure, Isolation of lignin 2.3 Physical Properties and chemical constituents	3
3.0	Pulp Wood	3.1 Physical properties of wood 3.2 Chemical components	2
4.0	Pulping	4.1. Introduction to pulping by different processes 4.1.1 Chemical pulping 4.1.2 Sulphite pulping 4.1.3 Alkaline pulping 4.1.4 Mechanical pulping 4.1.5 Semi chemical pulping	5

5.0	Bleaching	5.1 Process of bleaching and its properties 5.2 Bleaching requirements for different pulps	3
6.0	Fiber Preparation	6.1 Use of Beaters and pulpers and refiners 6.2 Description of Beaters and pulpers and refiners	5
7.0	Sheet formation	7.1 Paper machine 7.2 Its operation and construction Formation of an paper machine wire 7.3 Wet pressing 7.4 Drying of paper	5
8.0	Internal Sizing	8.1 Introduction to sizing 8.2 Definition of sizing process 8.3 Types of sizing agent used 8.4 Commercial grades of sized papers	5
9.0	Surface Sizing	9.1 Effects of surface on properties of paper 9.2 Types of surface sizing agents used 9.3 Its processes and description of equipments used for surface sizing	5
10.0	Coloring	10.1 Different dye stuff used for coloring with their properties 10.2 Method of coloring factors affection dyeing	5

8. Distribution of Marks

Chapter No.	Chapter Title	Types of Question			Total Marks
		Objective Type (Compulsory)	Short Question	Descriptive Question	
1,2	Introduction & Cellulose and lignin	3	2	X	5
3	Pulp Wood	3	X	X	3
4	Pulping	4	3	5	12
5	Bleaching	4	X	X	4
6	Fiber Preparation	3	2	6	11
7	Sheet formation	1	X	6	7
8	Internal Sizing	3	X	6	9

9	Surface Sizing	1	2	6	9
10	Coloring	3	X	7	10
		25	9	36	70

9. Suggested implementation of Teaching:

- Course related presentations and video discussion in class.
- Lecture and Notes
- Class Test, Viva.

10. Suggested learning Resource**10.1 Book list:**

- i) Shreve's: Chemical process Industries By George T Austin. Mc Grow Hill International Edition's.
- ii) Drydens outline of Chemical technology By M.Gopala Rao & Marshall Sitting
- iii) A textbook of Engineering Chemistry By S.S. Dara.

10.2 List of Journals:

- i) Chemical news journal
- ii) International journal of Chemical and process plant safety

11. Question Pattern:

- Objective type question of type fill up the blanks or of very short type or combination of all = 10 questions = 10 x 1 = 10 marks.
- Short questions of 2 or 3 marks per question = 15 marks
- Descriptive questions of 5 marks or above (max 10 marks per question) = 45 marks



1. **Course Title** : PROJECT & SEMINAR

2. **Course Code** : Ch- 611

3. **Semester** : 6th

4. **Course outcome:**

- Students will be able to learn about the different aspects of a chemical industry and study its feasibility.

COs	ILOs
<p>Students will be able to learn about the different aspects of a chemical industry and study its feasibility</p>	<p>1. Students will study about market survey, site selection, different processes involved, raw materials, organization and manpower requirements and economy of the project, Feasibility study of a chemical industry.</p> <p>2. Prepare a report on a process industry with special emphasis on the following points.</p> <ul style="list-style-type: none"> i) Feasibility of the industry with reference to the availability of raw materials and market demand. ii) Different processes or techniques available for selection of a particular process with reasons thereof. iii) Detailed description of the selected process with flow sheet diagram.

	<p>iv) Materials and equipment needed in the process Plant layout.</p> <p>v) Location of the plant with reasons.</p> <p>vi) Manpower requirement</p> <p>vii) Conclusion.</p>
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5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
	1hr/week	6hrs/week	7hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test(PT)#	Practical Assessment(PA)@	Pass (PT+PA)		
	TA	HA					Total (TA+HA)	
				50	100	50/150	200	5

7. Detailed Course Content

They will have to prepare a report on a process industry where they will be able to know about market survey, site selection, different processes involved, raw materials, organization and manpower requirements and economy of the project, Feasibility study of a chemical industry. Students will then prepare a report on a process industry with special emphasis on the following points.

- viii)** Feasibility of the industry with reference to the availability of raw materials and market demand.
- ix)** Different processes or techniques available for selection of a particular process with reasons thereof.
- x)** Detailed description of the selected process with flow sheet diagram.

- xi)** Materials and equipment needed in the process Plant layout.
- xii)** Location of the plant with reasons.
- xiii)** Manpower requirement
- xiv)** Conclusion.

Course Title : Professional Practice – IV

1. **Course Code : CH- 610**

2. **Semester – 6th**

3. **Course outcome:**

- Learn about functioning of an industry
- Acquire information from different resource persons on specific topic
- Group discussions among the students on different topics
- Seminars on given topic to share knowledge
- Mini projects on related topics
- Prepare models on relevant topics
- Enrich in bringing group activities

COs	ILOs
Learn about functioning of an industry	<ol style="list-style-type: none"> 1. The industrial visit should be arranged in the following areas/industries: (any two) <ul style="list-style-type: none"> • Refrigeration and air condition manufacturing workshop • Food Processing unit • Cosmetic Manufacturing unit • Drinking Water bottling Plant • Paper industry 2. Report submission of the same citing the observations within a stipulated time

<p>Acquire information from different resource persons on specific topic</p>	<ol style="list-style-type: none"> 1. Lectures by Professional/Industrial Experts should be organized from any 4 of the following areas, <ul style="list-style-type: none"> • Gas-solid separation techniques employed in industries. • Nanotechnology • Environmental pollution and control • Biotechnology • Packing Technology • Alternate fuels • Total Productive Maintenance 2. A brief report is to be submitted on the guest lecture by each student as a part of team work.
<p>Group discussions among the students on different topics</p>	<ol style="list-style-type: none"> 1. The students should discuss in group of 6 to 8 students and write a brief report on the same, as a part of team work on the following topics <ul style="list-style-type: none"> • CNG Vs LPG as a fuel. • Rain water harvesting. • Disaster management. • Safety in day to day life. • Energy saving in institute • Impact of plastic in modern

	world.
Seminars on given topic to share knowledge	<ol style="list-style-type: none"> 1. Seminar topic should be related to the subjects of sixth semester/Topics from guest lectures. 2. Each student should submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 min for a group of 2 students)
Mini projects on related topics	<ol style="list-style-type: none"> 1. Students should submit a mini projects on any one of the following topics <ul style="list-style-type: none"> • Thermocouple based temperature controller. • Design and drawing of simple water purifier • Bio-fertilizer • Recycling of waste plastic
Prepare models on relevant topics	<ol style="list-style-type: none"> 1. Models of material handling route systems or modular course on any one of the suggested or alike relevant topic be undertaken by a group of students (min 10) <ul style="list-style-type: none"> • Soap making • Candle and Chalk making

	<ul style="list-style-type: none"> • Plastic molding • Drinking water testing
Enrich in bringing group activities	1. Certain group activities leading to better knowhow of a situation

5. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
1 hrs/week		2 hrs/week	3 hrs/week

6. Examination Scheme

Theory				Practical			Total Marks (Theory+Practical)	Credit
ESE	Sessional(SS)		Pass (ESE+SS)	Practical Test(PT)#	Practical Assessment(PA)@	Pass (PT+PA)		
	TA	HA					Total (TA+HA)	
-	-	-	-	25	25	17/50	50	2

7. ACTIVITIES

7.1 INDUSTRIAL VISITS:

8

Structured industrial visits be arranged and report of the same shall be submitted by the individual students, to form a part of the team work. The industrial visit may be arranged in the following areas/industries: (any two)

- Refrigeration and air condition manufacturing workshop
- Food Processing unit
- Cosmetic Manufacturing unit
- Drinking Water bottling Plant
- Paper industry

7.2 GUEST LECTURE(S):

8

Lectures by Professional/Industrial Experts to be organized from any 4 of the following areas. The brief report to be submitted on the guest lecture by each student as a part of team work.

- Gas-solid separation techniques employed in industries.

- Nanotechnology
- Environmental pollution and control
- Biotechnology
- Packing Technology
- Alternate fuels
- Total Productive Maintenance
-

7.3 GROUP DISCUSSION: 4

The students should discuss in group of 6 to 8 students and write a brief report on the same, as a part of team work. The topic of discussion may be selected by the faculty members. Some of the suggested topics are (any one)-

- CNG Vs LPG as a fuel.
- Rain water harvesting.
- Disaster management.
- Safety in day to day life.
- Energy saving in institute
- Impact of plastic in modern world.

7.4 SEMINAR 8

Seminar topic should be related to the subjects of sixth semester/Topics from guest lectures. Each student should submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 min for a group of 2 students)

7.5 MINI PROJECTS: (IN A GROUP OF 4-5 STUDENTS) 6

- Thermocouple based temperature controller.
- Design and drawing of simple water purifier
- Bio-fertilizer
- Recycling of waste plastic

7.6 MODELS OF MATERIAL HANDLING ROUTE SYSTEMS OR MODULAR COURSE ON ANY ONE OF THE SUGGESTED OR ALIKE RELEVANT TOPIC BE UNDERTAKEN BY A GROUP OF STUDENTS (MIN 10) 9

- Soap making
- Candle and Chalk making
- Plastic molding
- Drinking water testing

7.7 STUDENT ACTIVITIES: 5

Students in a group of 3 to 4 shall perform any two of the following activities. (Other similar activities may be considered) and write a report as a part of team work.



- Collection of data regarding loan facilities or other facilities available through different organizations/ banks to budding entrepreneurs.
- Survey and interviews of successful entrepreneurs in nearby areas.
- Survey of opportunities available in thrust areas identified by government or DIC.
- Survey of data regarding different types of pumps with specifications from manufacturers, local market, end users. (any other engineering products may be considered for survey)
- Survey of fertilizers and pesticides used by farmers.

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