GOVERNMENT OF KERALA
DEPARTMENT OF TECHNICAL EDUCATION

CURRICULUM DEVELOPMENT CENTRE
KALAMASSERY

CURRICULUM OF
DIPLOMA COURSE

IN

CHEMICAL ENGINEERING

SEMESTER SYSTEM
(Revision 2006)

Prepared at
CURRICULUM DEVELOPMENT CENTRE, KALAMASSERY

RULES AND REGULATIONSOF THE DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY/COMMERCIAL PRACTICE UNDER THE STATE BOARD OF TECHNICAL EDUCATION, KERALA STATE. (SEMESTER SYSTEM)

01. Duration of the Diploma Course

The duration of the regular Diploma courses will be of three academic years, consisting of Six (6) consecutive semesters. The first 2 Semesters are combined and run on an year pattern, and called "Combined First and Second Semesters".

02. Medium of Instruction

The medium of instruction in all the theory and practical subjects shall be English.

03. Eligibility for Selection to the Diploma Course

Candidates for admission shall be required to have passed Xth class examination (S.S.L.C.) conducted by the Board of Public Examinations, Kerala State or any other equivalent examinations already recognized by the Board of Public Examinations, of Kerala State, with the eligibility for Higher Education.

04. Instructional duration in an academic year

a) The academic year shall consist of 2 Semesters, each consisting of a minimum of 16 weeks of instruction, including intervening holidays, but excluding the period of examinations and study holidays.

b) The course will follow Semester pattern, with an End semester examinations, conducted by the Board of Technical Examinations, Kerala State. The examinations for first year (Semester I & II Combined) will be conducted at the end of second semester.

c) There will be 7 Instructional periods of 55 Minutes duration per Day, and there shall be 5 working days in a week from Monday to Friday, and thereby 35 Periods per Week.

05. Minimum attendance required for obtaining eligibility to appear for the Examination.

a) A candidate must secure a minimum of 80% attendance in the combined First and Second Semester and in each subsequent Semester, in order to secure the eligibility to appear for each End Semester examinations.

b) In the case of those students with 65% or more attendance but could not attain 80% attendance due to Medical reasons, the Principal of the Polytechnic, at his/her discretion, may grant the eligibility to appear for the examination, subject to the remittance of "Condonation fee", fixed by the Government from time to time.

c) Students who have secured less than 65% attendance are not eligible to apply for "condonation", and will not be allowed to appear for the examination under any circumstances.

d) Students who have shortage of attendance, but not condoned, in any of the semesters including first year, are not eligible to appear for the end Semester Examinations, and therefore not eligible to be promoted to the higher semesters. They may seek readmission. Application for readmission may be entertained only for genuine cases on medical grounds and in doubtful cases the Principal may seek report from medical board for verification.

e) Condonation of attendance is permitted only once in the entire course of study both in the case of regular and part time courses.

06. Scheme of Evaluation.

a) The scheme of evaluation shall consist of (1) Internal assessment (Sessional) and (2) End Semester examinations in Theory and Practical Subjects. The maximum marks for End Semester Examinations, and Internal Assessment, both for the Theory and Practical papers will be 75 and 25 respectively except for the Combined I & II Semesters. However, for some exceptional subjects, this may vary. Details of break up of marks are given in the Curricula of each discipline.

b) The Total marks (Internal and End Semester Examinations) will be as follows:

Combined I &II Semesters:	1000 Marks
III to VI Semesters:	700 Marks/ Semester

c) All the end examination including the drawing examination will normally be of 180 Minutes duration. In certain specialized disciplines this requirement may not be adhered to strictly and the End Semester Examination of a longer duration may be permitted.

07. Award of internal assessment marks.

a) In respect of theory subjects the award of sessional mark will be on a Continuous Evaluation method, based on tests, assignments and attendance in the proportion of 40% for tests, 40% for assignments and 20% for attendance. There will be a minimum of three tests and Three Assignments, and all the 3 Test papers and 3 Assignments are taken into account for the calculation of Final Internal Assessment Marks.

b) Split up of Internal Assessment Marks :

A. Attendance:

Sl.No.	Percentage of Attendance*	Marks to be awarded (computed for 5 Marks)
1	Below 65	Zero
2	65 to 79	1
3	80 to 84	2
4	85 to 89	3
5	90 to 94	4
6	95 and above	5

B. Practical:

Sl.No.	Criteria component	Marks to be awarded
1	Observation Note/ Rough Record	20%
2	Fair Record (Timely submission, Accuracy and Neatness)	20%
3	Attendance*	20%
4	Test	40%

C. Drawing

Sl.No.	Criteria component	Marks to be awarded
1	Submission of Completed Drawing Sheets (Timely submission, Accuracy and Neatness)	40%
2	Attendance*	20%
3	Test	40%

*Percentage of attendance for that particular subject only is counted here.

D. Seminar

Sl. No.	Criteria component	Marks to be awarded
1	Relevance of Topic	10%
2	Collection of materials	20%
3	Presentation (Presentation slides, Delivery)	40%
4	Question-Answer,/Discussion	20%
5	Seminar Report	10%

E. Project Work

Sl. No.	Criteria component	Marks to be awarded
1	Relevance of Topic & Selection of	10%
2	Knowledge in the Tool	20%
3	Selection of Tool	20%
4	Fabrication & Final product	20%
4	Role of the individual in the Team	20%
5	Project Report	10%

c) The Faculty concerned will maintain a record of all details regarding Attendance and Internal Assessment marks awarded in the prescribed log book. The students can represent their grievances, if any, in respect of marks awarded, to the concerned Head of Section for clarification.

d) The students are required to keep a record of all their laboratory exercises performed by them in the form of a laboratory record. This record has to be authenticated by the teacher-in-charge of the laboratory and certified as the record of the bonafide work done by the student by the Head of Section before he is allowed to take the practical examinations. No student will be permitted to take any practical examinations without the bonafide Record.

08. End Examination

a) In each theory subject and in the drawing subject there will be an end examination in each Semester conducted by the Board of Technical Examination, Kerala State as per the pre-announced notification of examinations. The Timetable for the examination will also be informed to the students ahead of their conduct.

b) Regular/Supplementary examination for all semesters will be held at the end of each semester as the case may be.

c) The question paper for each Theory paper (excluding the Drawing papers) will consist of Two parts:

Part A – is for a maximum of 15 marks consisting of 10 short answer type questions of 1 ½ (One and a half) marks each (to be answered in one or two sentences) covering the whole subjects area. There will be no choice in Part A.

Part B – consists of 10 structured essay type questions of 12 marks each with two question from each of the five units in a subject. Students will have to attempt one question from each unit to score the prescribed maximum of 60 marks.

The part A and Part B will be given together in one question paper.

d) For drawing subjects, the design of question paper will be according to the needs of that particular drawing. There will not be any short answer type question in drawing.

e) For practical end examinations, the Board of Technical Examination, Kerala State will appoint examiners who will set a question paper consisting of practical exercises. This will be used for that practical subject.

09. Minimum marks for a pass

a) A candidate must secure a minimum of 40% marks in the End Semester examination in Theory and Practical for a Pass in each subject. There will be no separate minimum for a pass in the internal assessment but the total marks of End Semester examination and Internal assessment should not be less than 40% for a pass each subject.

10. Rules for promotion to the Higher Semesters.

a) A candidate will be allowed to go to the next higher Semester, if he/she attended the Combined I & II Semester/ Previous Semester, and has fulfilled the conditions of attendance requirement. However,

b) A candidate will be permitted to register for the Fifth Semester Examination if and only if he/she has passed all the subjects of the Combined I & II Semester, and

c) A candidate will be permitted to register for the Sixth Semester Examination only if he/she has passed all the subjects of Combined I & II, and III Semesters.

11. Classification of successful candidates

a) Candidates shall be declared to have passed the diploma course only if he/she has secured a Pass in all the theory and practical subjects in all the Six Semesters of study.

b) There will be 3 classifications of passed candidates namely.

First class with distinction
First class and
Second class

c) The total marks of the Semesters from 3 to 6 shall be considered to classify the successful candidates. That is all these marks will be added and the percentage of marks out of 2800 worked out.

First Class with Distinction

A candidate will be declared to have passed the Diploma Course in First Class with Distinction if he/she secures not less than 75% of the aggregate marks in all Semesters put together except First Year (Combined I & II Semesters) and passes all the above semesters including the Combined I & II Semesters in the first appearance itself, within the stipulated period of normal study, i.e., Three Years of Six Consecutive Semesters, without any break.

First Class

A candidate will be declared to have passed the Diploma Course in First Class if he/she secures not less than 60% of the aggregate marks in all Semesters put together except First Year (Combined I & II Semesters) and passes all the above semesters including the Combined I & II Semesters, within three consecutive chances including his regular chance offered by the Board of Technical Examination.

Second Class

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

12. Provision for Improvement/Betterment:

a). A candidate, if he desires, may improve his/her marks in any subject, in the immediate chance that follow his regular chance/attempt, in the 3rd, 4th and 5th Semesters. A "regular attempt/chance" is defined as the examination chance of the current semester of his/her study.

b) A candidate, if he/she desires, will be permitted to better his/her marks of the 6th Semester Subjects by reappearing for the entire subjects of that semester together, by taking the next available chance only. (Betterment can be done only for the 6th Semester)

c) Improvement/betterment will not be reckoned as another chance/attempt. Candidates appearing for betterment will not be considered for the purpose of ranking.

13. **Award of Rank**: Rank Holder in each Discipline will be selected from among the successful candidates who have passed the Diploma course in "FIRST CLASS WITH DISTINCTION" only. "Grace mark" awarded for the performance in arts/sports/similar extra or co- curricular activities will not be considered for determining the rank holders subject to rules 11 and 12 above.

14. Maximum duration of the Diploma Course:

Normal duration of the diploma course is 6 consecutive Semesters, spanned in 3 Academic Years, as stated in para 01. However, in the case of those who have not acquired Diploma within the stipulated minimum duration of 3 Years, he/she may acquire the Diploma taking a maximum duration of another 3 Years. However, the maximum number of chances to appear for the End Semester examination is limited to 4, including his/her regular chance.

15. Cancellation of Candidature in the Diploma Examination:

If a candidate desires to cancel his candidature for end semester Examination he/she should forward the duly filled in Application Form, recommended by the Principal of the Polytechnics so as to reach the office of the Controller of Technical Examinations within 10 days after the completion of the last theory Examination of that particular Semester examination. For those who have applied for the examination and absent without canceling their candidature, it will be treated as an attempt/ chance. Cancellation of candidature in any Semester Examination is allowed only once. Candidates reported for malpractice will not be eligible for cancellation of examination.

16. Defaulters of fee:

Defaulters of fee will not be permitted to register for the End Semester examination

17. General Information:

Norms for transfer of students:

a) Application for transfer from one institution to another will be entertained only at the second year (3rd Semester) of the Diploma course. Candidates who desire to get transfer to another institution in the second year (3rd Semester) should submit the application in the prescribed "format for transfer" to the Principal of the Institution to which transfer is requested, through the Principal of the institution where the candidate is studying within 10 days from the date of re-opening of the institution after midsummer vacation.

b) All applications received with in the stipulated time will be processed and the list of candidates selected for transfer on the basis of the index marks secured by the candidates for admission to Polytechnics to the first year (Combined I and II semester)will be published by the concerned principals of the polytechnics to which transfer is requested for, and the selected candidates will be informed accordingly.

c) Principals of Polytechnics should intimate the names of candidates transferred with branch of study to other institution to the Joint Controller of Technical examinations with details such as name of institutions to which transferred, date of transfer, and Diploma Examinations Register Number within ten days from the last date of admission.

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

Branch: Chemical Engineering
First Year (Semesters I & II Combined)

CODE	SUBJECT	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
	THEORY:							
GE101	English	4	-----	4	100	----	25	125
GE102	Technical Mathematics	6	-----	6	100	----	25	125
GE103	Applied Science							
A	Physics	3	----	3	50	----	12.5	62.5
B	Chemistry	3	-----	3	50	----	12.5	62.5
GE104	Engineering Graphics	1	3	4	100	-----	50	150
GE105	Computer Fundamentals & Programming in C	2	1	3	100	----	25	125
CH101	Inorganic Chemistry	4	-----	4	100	----	25	125
	PRACTICAL:							
GE106	Applied Science Lab	----	2	2	-----	50	25	75
A	Physics							
B	Chemistry							
CH102	Inorganic Chemistry Lab	----	3	3	-----	50	25	75
CH103	Workshop Practice	----	3	3	----	50	25	75
TOTAL		**23**	**12**	**35**	**600**	**150**	**250**	**1000**

SUBJECT TITLE : ENGLISH
SUBJECT CODE : GE 101
PERIODS PER WEEK : 4
PERIODS PER YEAR : 128

TOTAL MARKS : 100 (YEARLY EXAMINATION FOR I AND II SEMESTERS)

TIME SCHEDULE

UNIT	TOPICS		PERIODS
I	a)	Lessons – From Ignited minds	
		The dream and the message	10
		Give us a role model	10
II	a)	Lessons – From Ignited minds	
		Visionary teachers and scientists	15
III	a)	Phonetics and Grammar Introducing speech sounds Consonants, Vowels, Syllables, Stress etc. Tense, Nouns, Verbs, Articles, Active voice and Passive voice Prepositions, Adverbs, Auxiliaries, Direct and Indirect Speech Formation of Questions & Question tags	29
IV	a)	Lessons – from Ignited minds	
		Learning from Saints & Seers	15
		Patriotism Beyond Politics and Religion	15
		To My Country Men	5
		Epilogue	5
V	a)	Composition Essay writing Comprehension Precise writing Note making Application for Jobs Preparation of bio – data	24
		Total Periods	**128**

AIM :

The special needs of the technical students in English language require a curriculum that enables them to handle the language as an effective tool for communication. An integration of the four – fold language abilities namely listening, speaking, reading and writing aims at developing the ability to correctly and effectively use the language for specific technical requirements. Thus the teaching of English language to Technical students will definitely help them for their performance in their professional needs.

OBJECTIVES :

1. Comprehension
- 1.1 Discriminate words and derive ideas in a speech/writing
- 1.2 Express the main ideas in a summary
- 1.3 Organise logically the piece of information provided.
- 1.4 Comprehend written English available in the prescribed text.

2. Vocabulary
- 2.1 Identify the key words
- 2.2 Relate the correct meaning to the terms used
- 2.3 Extend the vocabulary
- 2.4 Use a thesaurus
- 2.5 Study the arrangement of words in sentences
- 2.6 Identify the structural functions of words in sentences.

3. Grammar
- 3.1 Use of tense forms
- 3.2 Nouns, Verbs, Articles
- 3.3 Identify sentence types
- 3.4 Analyse the different types of sentences
- 3.5 Study the ways of negation
- 3.6 Convert direct speech into Indirect speech
- 3.7 Realise active and Passive Voice constructions.

4. Composition
- 4.1 Practice writing essays, précis, note making
- 4.2 Preparation of Application for Jobs and Bio – data

5. Spoken Communication
- 5.1 Distinguish between formal and informal speech situations
- 5.2 Simulate model conversations
- 5.3 Converse within the peer group
- 5.4 Conduct seminars on topics learned in the text.
- 5.5 Conduct model Interviews
- 5.6 Arrange group discussions on General topics

6. Pronunciation
- 6.1 Introduce speech sounds
- 6.2 Consonants, Vowels, Syllables, Stress etc.
- 6.3 Find out pronunciation of words from dictionary
- 6.4 Transcribe words and short passages in broad phonemic script

STUDY MATERIALS

1. Ignited Minds by A.P.J. Abdul Kalam Published by Penguin Books
   Chapters : The Dream and the message, Give us a role model, Visionary teachers and scientists. Learning from Saints and seers, Patriotism beyond politics and religion, To my country men, Epilogue.
2. Essential English Grammar by Raymond Murphy Published by Cambridge University Press.
3. Intermediate English Grammar by Raymond Murphy published by Cambridge University Press.

4. Phonetics – A Text Book of English Phonetics for Indian Students by T. Balasubramaniam Published by Macmillan India (P) Ltd.
5. Composition – A Text Book of Two way Communication Techniques by Prof. P.P. John Published by Publication Division, University of Calicut.
6. English Pronouncing dictionary by Daniel Jones Published by Cambridge University Press.

SCHEME FOR SETTING QUESTION PAPERS

TOTAL MARKS : 100

DURATION 3 HOURS

I	Short answer questions	7 Numbers	Answer any 5	(5X2)	10 marks
II	Paragraph questions	7 Numbers	Answer any 4	(4X5)	20 marks
III	Essay questions	3 Numbers	Answer any 1	(1X10)	10 marks
IV	Grammar				30 marks
V	Phonetics				10 marks
VI	Composition				20 marks
				Total	100 marks

SUBJECT TITLE : TECHNICAL MATHEMATICS
SUBJECT CODE : GE 102
PERIODS/WEEK : 6
TOTAL PERIODS : 6 x 32 = 192

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Matrices	8
	1.2 Determinants	6
	1.3 Binomial Series	6
	1.4 Trigonometric Functions	8
	Tutorials	4
	Test on Topics 1.1 to 1.4	3
II	2.1 Properties of Trigonometric functions	7
	2.2 Properties of triangles	6
	2.3 Solutions of a triangle	7
	2.4 Co-ordinate Geometry	8
	Tutorials	4
	Test on Topics 2.1 to 2.4	3
III	3.1 Functions and Limits	8
	3.2 Methods of Differentiation – I	10
	3.3 Methods of Differentiation – II	10
	Tutorials	4
	Test on Topics 3.1 to 3.3	3
IV	4.1 Application of differentiation	10
	4.2 Maxima and minima	8
	4.3 Indefinite Integral	10
	Tutorials	4
	Test on Topics 4.1 to 4.3	3
V	5.1 Integration by parts	6
	5.2 Definite Integral	6
	5.3 Application of integration	8
	5.4 Differential Equations	8
	Tutorials	4
	Test on Topics 5.1 to 5.4	3
	Revision	10
	Model test and feed back	7

		192

OBJECTIVES

On completion of the units, the student will be able to

UNIT – I

1.1 Matrices

1.1.0 Understand operations on matrices such as addition, subtraction, transpose, adjoint, inverse and multiplication

1.1.1 Define a matrix

1.1.2 Identify the type of a given matrix (Square, Unit, Singular etc)

1.1.3 Perform operations of addition and multiplication of a given matrix

1.1.4 Define – transpose, adjoint and inverse of a matrix

1.1.5 Find the inverse of 2 x 2 and 3 x 3 matrices

1.1.6 Solve linear equations by using the inverse of the coefficient matrix

1.2 Determinants

1.2.0 Solve simultaneous linear equations using determinants

1.2.1 Evaluate determinants of second and third order

1.2.3 Find the minors and cofactors of the elements in a determinant

1.2.4 Solve simultaneous linear equations in 3 unknowns using Cramer's rule.

1.2.5 Elimination of three linear equations in to unkowns.

1.3 Binomial series

1.3.0 Understand the binomial theorem for positive integers

1.3.1 State the meaning of nCr

1.3.2 Derive formula for nCr and the proof of nCr = nCn-r

1.3.3 State the Binomial theorem for positive integers

1.3.4 Find a given term in a binomial expansion

1.4 Trigonometric functions

1.4.0 Understand the concept of trigonometric functions of any angle

1.4.1 Define trigonometric functions

1.4.2 Describe signs of trigonometric functions in each quadrant

1.4.3 Find other functions, given a trigonometric function and its quadrant

1.4.4 Find the trigonometric values of the angle between 0˚ and 360˚.

1.4.5 Find the value of trigonometric functions by using tables.

UNIT – II

2.1 Properties of Trigonometric Functions

2.1.0 Apply properties of trigonometric functions of compound angles, multiple and submultiple, sum and product formulae

2.1.1 State the identities for sin (A± B), cos (A± B), tan (A ±B).

2.1.2 Solve the problems of the types

(1) Prove that $\frac{\cos A - \sin A}{\cos A + \sin A} = \tan(45^\circ - A)$

2.1.3 Prove the formulas for Sin 2A, Cos 2A, tan 2A, Sin 3A and Cos 3A

2.1.4 State the identities for SinA, CosA, tanA in terms of A/2.

2.1.5 Solve the problems of the type: if Sin A = 0.6 and A is acute, find sin 2A and cos A/2

2.1.6 Express sum or difference of two sines or two cosines as a product and vice versa.

2.1.7 Apply sum and product formulae to do the problems of the type

(1) $\frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} = \tan 3A$

(2) $\sin 10^\circ \sin 50^\circ \sin 70^\circ = 1/8$

2.2 Properties of Triangles

2.2.0 Understand the properties of triangles

2.2.1 State and prove the following identities

1) $\frac{a}{\text{Sin A}} = \frac{b}{\text{Sin B}} = \frac{c}{\text{Sin C}} = 2R$

2) $a^2 = b^2+c^2-2bc \cos A$

3) $a = b \text{ Cos } C + c \text{ Cos } B$

2.2.2 State and prove

1) Napier's formula

$$\tan\left(\frac{B-C}{2}\right) = \frac{b-c}{b+c} \cot(A/2)$$

2) $(b-c) \cos(A/2) = a \sin\left(\frac{B-C}{2}\right)$

2.3 Solution of triangles

2.3.0 Solve a triangle given necessary data

2.3.1 Solve a triangle, given

1) Three sides
2) Two sides and the included angle by using Napier's formula.

2.4 Co-ordinate Geometry

2.4.0 Understand various forms of the equation of a straight line

2.4.1 Define slope of a straight line

2.4.2 Find the slope of a line joining two points (x_1,y_1) and $(x2,y2)$

2.4.3 Derive the equation of a straight line of the form

1) $y = mx + c$
2) $y-y_1 = m(x-x_1)$
3) $\frac{y-y_1}{y_1-y2} = \frac{x-x_1}{x_1-x2}$
4) $\frac{x}{a} + \frac{y}{b} = 1$

2.4.4 Find the equation of a line given suitable data using any of the above form.

2.4.5 Find the slope and intercepts on the axes, given a linear equation in 'x' and 'y'.

2.4.6 Find the point of intersection of two lines whose equations are given

2.4.7 Find the angle between two lines

2.4.8 Find the condition for two lines are

1) Parallel
2) Perpendicular

2.4.9 Find the equation of the line

1) Parallel and
2) Perpendicular to a given line and passing through a given point.

UNIT – III

3.1 Functions and Limits

3.1.0 Understand the concepts of functions and limits

3.1.1 Give example for functions

3.1.2 Explain the meaning of limit of the following type

1) $\lim_{x \to a} f(x) = l$

2) $\lim_{x \to \alpha} 1/x = 0$

3.1.3 Find the limit of the following type

1) $\lim_{x \to 1} \frac{2x + 1}{3x - 2}$
2) $\lim_{x \to \alpha} \frac{2x^2 + 3x}{5x^2 + 4x + 1}$
3) $\lim_{x \to 3} \frac{x^2 - 3x}{x^2 - 9}$

3.1.4 verify the following results

1) limit $\frac{x^n - a^n}{x - a} = n\,a\,n^{-1}$, when n is rational
   $x \to a$
2) limit $\frac{\sin \theta}{\theta} = 1$, is in radian
   $\theta \to 0$

3.1.5 Solve problems of the type

1) Limit $\frac{\sqrt{x} - \sqrt{a}}{x - a}$
   $x \to a$
2) limit $\frac{\sin m\theta}{\theta}$
   $\theta \to 0$

3.1.6 Describe the general definition of continuous functions

3.2 Methods of Differentiation – I

3.2.0 Apply the methods of differentiation

3.2.1 Define the derivative of a function y = f(x) as limit $\frac{\Delta y}{\Delta x}$
   $\Delta x \to 0$

3.2.2 Show the geometrical concept of derivatives

3.2.3 Find the derivatives of xn, Sinx, and Cosx from first principles

3.2.4 State the rules of differentiation

1) Sum or difference
2) Product
3) Quotient

3.2.5 Find derivatives of ex and log n. State all the fundamental formulae

3.2.6 Apply the rules and differentiate simple functions of the type

1) $x^2 \sec x$
2) $\frac{\tan x}{x^2 + 1}$
3) $\frac{x \operatorname{Cosec} x}{3x - 2}$

3.3 Methods of Differentiation – II

3.3.0 Apply different methods of differentiation

3.3.1 Find the derivatives if the functions of the form
[f(x)]n, Sin f(x), Cos f(x), with respect to x.

3.3.2 Find the derivatives of

$e^{\sin x}$, $\log \sin x$, $(x^2+1)^{10}$ $\sec 5x$, $\frac{\sin 2x}{1+\cos 2x}$, $\cot 5 (x^3)$, $\log (\sec x + \tan x)$

3.3.3 Find the derivative of the implicit functions of the form
$ax^2 + 2hxy + by^2 = 0$

3.3.4 Differentiate parametric functions of the type
$x = f(x)$, $y = g(t)$

3.3.5 Find the second derivative of the functions
$y = \frac{x}{x-2}$, $y = x^2 \sin x$

3.3.6 Solve the problem of the type
If y = x2 cos x, show that
$x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + (x^2+6)\,y = 0$

UNIT – IV

4.1 Applications of Differentiation

4.1.0 Apply the theories of differentiation in different problems

4.1.1 State geometrical meaning of derivatives

4.1.2 Find the slope of the curve
$y = x^2 - 3x + 2$ at (3,2)
$y = \tan x$ at $x = \pi/3$

4.1.3 Find the equation of the tangent and normal to the semi circle $y = \sqrt{25-x^2}$ at (4,3) on it

4.1.4 Solve problems of the type: The radius of a circular plate is increasing in length at 0.1 cm per second. What is the rate at which the area is increasing when the radius is 12 cm.

4.1.5 Solve problems of the type: A spherical balloon is inflated with air such that its volume increases at the rate 5.c.c per second. Find the rate at which its curved surface is increasing when its radius is 7 cm.

4.1.6 Solve problems of the type: The displacement 'S' in time 't' is given by S = 2/3t+ Cost at $t = \pi/4$; find the velocity and acceleration

4.2 Maxima and Minima

4.2.0 Apply the concept of derivative to find maxima and minima

4.2.1 State the conditions for a function $y = f(x)$ to be (1) increasing (2) decreasing

4.2.2 State the conditions for maximum and minimum values of a function

4.2.3 Solve the problem of the type:

1) Find the maximum and minimum values of $y = x^3 - 18x^2 + 96x$
2) Prove that a rectangular of fixed perimeter has its maximum area when it becomes a square.

4.3 Indefinite integral

4.3.0 Apply various methods of integration

4.3.1 Explain that $\int f(x)dx = f(x) + c$ means $\frac{d}{dx}[f(x)+c) = f(x)$, c being an arbitrary constant

4.3.2 State the standard formulas of integral xn, sinx, cos x, ex, etc

4.3.3 Find the integrals using the rules

1) $\int (u \pm v)\, dx = \int u\, du \pm v\, dx$
2) $\int kudx = k \int udx$

4.3.4 Evaluate the integrals of the form

1) $\int f(ax+b)\, dx$
2) $\int \sin^2 x\, dx$

4.3.5 Evaluate the integrals of the form

1) $\int x \sin(x^2)\, dx$
2) $\int \frac{2x4}{1+x10}\, dx$
3) $\int \cos^3 x \sin x\, dx$
4) $\int ex^2\, x\, dx$

UNIT – V

5.1 Integration by parts

5.1.0 Solve the problems of the type

1) $\int x \cos x\, dx$
2) $\int x^2\, e\text{-}x\, dx$
3) $\int x \log x\, dx$
4) $\int \log x\, dx$

5.2 Definite Integrals

5.2.0 Understand the concept of definite integral

5.2.1 Define the definite integral

$$\int_a^b f(x)\, dx = f(b) - f(a) \text{ where } F^1(x) = f(x)$$

5.2.2 Evaluate the definite integral

1) $\int_0^1 x(1-x)^2\,dx$

2) $\int_0^{\pi} \sin^2 x\,dx$

3) $\int_0^1 x\sqrt{1+x^2}\,dx$

4) $\int_0^{\pi} \frac{1-\sin x}{x+\cos x}\,dx$

5) $\int_0^{\pi/2} x\cos x\,dx$

5.3 Application of Integration

5.3.0 Apply the concept of definite integral to solve problems of the following

5.3.1 Find the area bounded by a curve, two ordinates (abscissa) and x – axis (y axis)

5.3.2 Find Volume of a solid of revolution about x or y axis

5.4 Differential equations

5.4.0 Solve simple differential equations of first order

5.4.1 Solve the differential equation of the variable separable type

5.4.2 Solve the differential equation of the form dy/dx + Py = Q where P and Q are simple functions of x

CONTENT DETAILS

UNIT – I

1.1 Matrices

Matrix notation, order of a matrix, and type of matrices: - Square matrix, unit matrix, Zero matrix, and Singular matrix. Transpose of a matrix, symmetric and skew-symmetric matrices, sum and product of matrices, Adjoint of a matrix, inverse of a matrix (definition only) and problems.

1.2 Determinants

Determinants of second and third order matrices, minors and cofactors, Cramer's rule, solution of simultaneous linear equations in three unknowns by Cramer's rule. Elimination of three linear equations in two unknowns.

1.3 **Binomial series**

Idea of nCr, Value of nCr (no derivation). Binomial theorem for positive integers (no proof), finding a given term in a Binomial Expansion.

1.4 Trigonometric functions

Definition of trigonometric functions of an angle in any quadrant, Signs of trigonometric functions of related angles, Given a trigonometric functions of an angle and its quadrant find others. Find the values of the trigonometric functions between 0° and 360°.

UNIT – II

2.1 Properties of trigonometric functions

Addition formulae, Multiple and Sub-multiple formulae, Sum and Product formulae, simple problems.

2.2 Properties of triangles

State and prove Sine rule, Cosine rule and projection formula. State and prove Napier's formula and simple problems relating to this.

2.3 Solution of triangle

Solve the triangle given

1. Three sides
2. Two sides and the included angle (use Napier's formula)

2.4 Co-ordinate geometry

Straight line-Slope, Equations of a straight line in the forms

1) Y = mx + C,

2) $y-y_1 = m(x-x_1)$,

3) $\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$

4) $\frac{x}{a} + \frac{y}{b} = 1$

Points of Intersection of two lines, Angle between two lines, Conditions for two lines, Conditions for two lines to be parallel and predicator.

UNIT – III

3.1 Function and Limits

Definition, some problems for finding limits, Properties

Limit $\frac{xn-an}{x-a} = nan-1$ and limit $\frac{Sin\phi}{\phi} = 1$ (statements only),

$x \to a \qquad \phi \to 0$

General definition of continuous functions.

3.2 Methods of Differentiation I

Definition of derivative of xn, Sin x, Cos x etc by using first principle, find derivatives of ex and log x, Fundamental formulas, product and Quotient rules (statement only). Derivatives of other trigonometric functions, Simple problems.

3.3 Methods of Differentiation II

Function of a function rule, Differentiation of implicit and parametric equations, problems on differentiation of functions involving these forms, second order derivatives, Simple problems.

UNIT – IV

4.1 Application of Differentiation

Geometrical meaning of derivatives, Slope, Tangent, Normal and Equation of a straight line, Rate of change.

Problems connecting Area and Volume, Velocity and Accelerations.

4.2 Maxima and Minima

Increasing and Decreasing functions, Turning points, Finding Maximum and Minimum values of a function by using derivatives, Conditions for Maximum and Minimum, Simple problems.

4.3 Indefinite Integral

Definition of integration, Fundamental formulas, Problems, Integration by substitution, function of the form $\int f(g(x)\, g^1(x)\, dx$, $\int f(ax + b)n\, dx$

UNIT – V

5.1 Integrates by parts

Integral of the product of two functions, formula (without proof) and simple problems.

5.2 Definite Integral

Definitions, simple problems, $\int_0^{\pi/2} Sin^2x\, dx$, $\int_0^{\pi/2} \frac{Sinx}{\sqrt{1-cosx}}\, dx$

5.3 Application of integration

Finding areas between the curve $y = f(x)$ and the axes, Volume of the solid, Problems

5.4 Differential equations:

Solutions of equations of the form Variable separable, Linear equations.

REFERENCE BOOKS

1. Washington A.J. : Basic Technical Mathematics, Addison Wesley
2. Green John. R : Calculus with Analytic Geometry, McGraw Hill Book Co.,
3. Karuppannan. T.C. : Mathematics for Technical Students, Macmillan and Co.,
4. T.T.T.I. Madras : Mathematics for Technicians Vol. I and II, Sehgal Educational Consultants (P) Ltd, Faridabad
5. Shanti Narayanan : Algebra

SUBJECT TITLE : APPLIED SCIENCE – A - PHYSICS
SUBJECT CODE : GE 103 A
PERIOD/WEEK : 3
PERIODS/YEAR : 96

TIME SHEDULE

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II	2.1 Statics	10
	2.2 Elasticity	4
	2.3 Fluid Flow	5
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III	3.1 Optics	7
	3.2 Electricity	12
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	3.5 Photoelectric Effect	3
	Test – 3	2
	Total	96

OBJECTIVES

On Completion of the unit, the student will be able to

UNIT – I

1.1 Units And Dimensions

1.1.0 Understand the concept of units and measurements with a basic knowledge about dimensions
1.1.1 Define Unit of a physical quantity.
1.1.2 Explain the principle of measurement.
1.1.3 Identify fundamental and derived units.
1.1.4 Define dimension of a physical quantity.
1.1.5 Derive dimensional formula for physical quantities.

1.2 Dynamics

1.2.0 Apply the dynamics of a particle in practical situations.
1.2.1 Identify vector and scalar quantities.
1.2.2 Derive the expression $Sn = u+a (n – ½)$
1.2.3 Solve Problems related to gravity with equations of motion.
1.2.4 Derive the expressions for time of flight, horizontal range and maximum height for a projectile.
1.2.5 Solve the problems based on the above expression
1.2.6 State the Newton's laws of motion
1.2.7 Define the terms:
1. Force 2. Inertia 3. Momentum
1.2.8 Derive the relation F = ma

1.2.9 State Law of conservation of momentum and prove it in the case of two bodies making a collision.

1.2.10 Explain the principle behind recoil of gun and derive an expression for recoil velocity.

1.2.11 Solve Problems related to Laws of motion.

1.2.12 Define angular displacement, angular velocity and angular acceleration.

1.2.13 Derive relation between linear velocity and angular velocity.

1.2.14 Derive expression for centripetal acceleration.

1.2.15 Apply the principle of centripetal force in the case of banking of roads and rails.

1.2.16 Solve problems related to centripetal force.

1.3 Work, Power and Energy

1.3.0 Understand the concepts of work, power and energy and their applications

1.3.1 Define 1. Work 2. Power 3. Energy

1.3.2 Distinguish between Potential Energy and Kinetic Energy and mention the expressions for them.

1.3.3 Solve problems using the above expressions.

1.4 Rotational Dynamics

1.4.0 Understand the dynamics of a rotating body.

1.4.1 Define Moment of Inertia of a rigid body

1.4.2 Define Radius of gyration

1.4.3 Scale theorems of parallel and perpendicular axes.

1.4.4 Define Torque

1.4.5 Mention relation between torque and angular momentum.

1.4.6 Mention the expression for kinetic energy of rotation.

1.4.7 Derive an expression for moment of inertia of a uniform circular disc about an axis passing through its center and perpendicular to its plane.

1.4.8 Derive expression for kinetic energy of a disc rotting on a horizontal plane.

1.4.9 Solve problems using the above expressions.

UNIT – II

2.1 Statics

2.1.0 Understand the principles of statics and its applications

2.1.1 Add Vectors using triangle method.

2.1.2 Define Resultant and Equilibrant of vectors.

2.1.3 State Parallelogram law of forces.

2.1.4 Derive expression for resultant using Parallelogram law.

2.1.5 State the law of triangle of forces.

2.1.6 State Lami's theorem.

2.1.7 Explain moment of a force.

2.1.8 State the conditions of equilibrium of a rigid body acted upon by a large number of coplanar parallel forces.

2.1.9 Derive expression for work done by a couple.

2.2 Elasticity

2.2.0 Comprehend the concept of elasticity

2.2.1 Define Stress, Strain and Elastic limit.

2.2.2 State Hooke's law.

2.2.3 Derive expression for Young's modulus, rigidity modulus and bulk modulus.

2.2.4 Solve Problems related to modulus of elasticity.

2.3 Fluid Flow

2.3.0 Understand the principle of fluid flow

2.3.1 Distinguish between Streamline and Turbulent flow.

2.3.2 Explain Pressure energy, Kinetic energy and Potential energy of a liquid.

2.3.3 Mention equation of continuity.

2.3.4 State Bernouille's theorem.
2.3.5 Explain the working of airfoil and atomizer.

2.4 Viscosity

2.4.0 Apply the principle of viscosity in solving problems.
2.4.1 Define coefficient of viscosity.
2.4.2 Give the Poiseusilles formula.
2.4.3 Explain terminal velocity.
2.4.4 Mention Stoke's formula.
2.4.5 Explain the effect of temperature on viscosity
2.4.6 Solve problems using Poiseuille's formula.

2.5 Surface Tension

2.5.0 Comprehend the phenomenon of surface tension and its applications.
2.5.1 Define surface tension.
2.5.2 Define surface energy.
2.5.3 Derive the relation between surface tension and surface energy.
2.5.4 Mention the expression for the excess of pressure issued a spherical drop and bubble.
2.5.5 Solve problems related to surface tension.

2.6 Simple Harmonic Motion

2.6.0 Comprehend the concept of wave motion
2.6.1 Define Simple Harmonic motion.
2.6.2 Derive equation for S.H. motion.
2.6.3 Explain period, frequency, amplitude and phase.
2.6.4 Distinguish between transverse and longitudinal waves.
2.6.5 Define wavelength.
2.6.6 Derive the relation $V= n\lambda$
2.6.7 Explain resonance.
2.6.8 Explain ultrasonic frequency.
2.6.9 Mention applications of ultrasonic.

UNIT – III

3.1 Optics

3.1 Understand the concept of optical phenomena
3.1.1 State Snell's law of refraction.
3.1.2 Explain critical angle and total internal reflection.
3.1.3 Explain the propagation of light through optic fiber.
3.1.4 Convex and concave mirror- focus, image formation.
3.1.5 Mention the formula $1/u + 1/v = 1/f$ (No derivation)
3.1.6 Convex and concave lens - focus, image formation.
3.1.7 Mention the formuls $1/f= (n-1)(1/R1 - 1/R2)$, No derivation
3.1.8 Simple microscope, Magnifying power $m=1+D/f$, No derivation.

3.2 Electricity

3.2	Understand the fundamentals of electricity and its magnetic effect
3.2.1	State Kirchoff's law.
3.2.2	Derive expression for balancing condition of wheat Stone's Bridge.
3.2.3	State Biots and Savarts law.
3.2.4	Mention the expression for magnetic field due to current through a circular cuf.
3.2.5	State Fleming's left hand rule.
3.2.6	Describe the principle and construction of a moving coil galvanometer.
3.2.7	Explain the conversion of galvanometer into ammeter and voltmeter
3.2.8	Solves problems based on the above laws.

3.3 Semiconductors

3.3	Comprehend the working of semiconductor devices
3.3.1	Explain P.N. Junction.
3.3.2	Describe a junction transistor PNP and NPN.
3.3.3	Explain transistor configuration.
3.3.4	Describe a common emitter amplifier.
3.3.5	Represent Logic gates symbolically.
3.3.6	Explain with the help of truth table.

3.4 Laser

3.4	Understand laser action and its application
3.4.1	Explain population inversion, spontaneous emission, stimulated emission and optical pumping.
3.4.2	Write down the characteristics of LASER.
3.4.3	Describe various applications of Laser.

3.5 Photoelectric Effect

3.5.0	Comprehend the theories of photoelectric effect
3.5.1	Describe Max planks quantum theory.
3.5.2	Explain Photoelectric effect and its application.
3.5.3	State Laws of Photoelectric emission.
3.5.4	Device Einstein's photoelectric equation.
3.5.5	Solve problems using the above equation.

CONTENT DETAILS

UNIT – I

1.1 Units and dimensions

Units – fundamental and derived units. Systems of units – S.I. Dimensions – Application – Derivation of expression of period of a simple pendulum using dimension.

1.2 Dynamics

Equation of motion (re-capitulation only) - Derivation of Sn = U + a (n – ½) - Acceleration due to gravity – equation of motion under gravity. Numerical problems.

Projectile motion – Derivation of expressions for Time of flight, Horizontal range, Maximum height Problems.

Linear Momentum, Newton's laws of motion – Definition of force and inertia – Derivation of F = ma – Unit of force. Law of conservation of momentum – Derivation – Recoil of gun. Numerical Problems.

Circular motion – definitions for angular displacement angular velocity and angular acceleration – relation between linear velocity and angular velocity (deviation). Centripetal acceleration and centripetal force-derivation-examples Banking of roads and rails (qualitative) centrifugal force – Numerical problems.

1.3 Work, power and energy

Definitions for Work, Power, Energy – Units of work – Power and energy, Potential energy and Kinetic energy – Expression for P.E and K.E. (no derivation). Numerical problems.

1.4 Rotational Dynamics

Moment of inertia of a rigid body – Radius of gyration. Theorems of Parallel and Perpendicular axis (only statement) – Angular momentum Torque – Relation between Torque and angular momentum

(no derivation) expression for K.E. of rotation (no derivation). Moment of Inertia of a uniform circular disc about an axis passing through its center and Perpendicular to its Plane (derivation) – K.E. of disc rolling on a horizontal Plane. Numerical problems.

UNIT – II

2.1 Statics

Vectors and Scalars – Triangle Method of vector addition – Concurrent forces – Resultant and equilibrant – Parallelogram law – Derivation of the resultant in Magnitude and direction – Law of triangle of forces – Lami's theorem – Resolution of forces – Parallel forces – Like and unlike Parallel forces – moment of force- Conditions of equilibrium of body under the action of a number of coplanar parallel forces couples – Moment of a couple – work done by a couple – Numerical problems.

2.2 Elasticity

Elastic and plastic bodies – Stress – Strain – units - Hooke's law – Young's Modulus Rigidity modulus, Bulk modulus – Numerical problems.

2.3 Fluid flow

Stream line and turbulent flow – Pressure enemy, Potential energy and kinetic energy of a liquid – Equation of continuity – Bernoulli's theorem – Applications – Air foil and Atomizer.

2.4 Viscosity

Viscous force – Coefficient of viscosity – Unit dimension - Poiseuille's formula (no derivation). Stokes formula - Variation of viscosity with temperature - Numerical problems.

2.5 Surface tension

Surface tension - Surface energy – Relation between S.T and Surface energy (Proof) – Expression for excess of Pressure inside a spherical drop and bubble (no derivation) – Problems.

2.6 Simple Harmonic Motion

Definition of Simple Harmonic Motion – Examples – SHM as projection of uniform circular motion on any diameter of a circle – Equation of SHM – Period, frequency, amplitude, phase motion – Transverse and longitudinal waves. Definition of wavelength and frequency – Derivation of relation $V + f\lambda$ - free vibration – forced vibration – Resonance – Ultrasonic Applications.

UNIT – III

3.1 Optics

Smells law of refraction – Critical angle – Total internal reflection – Optical fiber Convex and concave mirror – Focus, image formed by mirror (Qualitaive idea only), Mention the formula $1/u + 1/v = 1/f$, (no derivation) – Convex and concave lens, focus image formed by lenses(qualitative idea only), mention the formula $1/f = 9n-1)[1/R1 - 1/R2]$, no derivation. Simple microscope – magnifying power $m=1+d/f$, No derivation.

3.2 Electricity

Kirchoff's Laws – WheatStone's bridge - Condition for balancing – Magnetic effect of Electricity – Biot and Savart Law – Right hand palm rule – Magnetic field due to current through circular coil at a point on the axial line and at the center (no derivation) – Fleming's Left hand rule – Force on a current carrying Conductor placed in a magnetic field – moving coil galvanometer – theory and construction – Conversion of a galvanometer into ammeter and voltmeter – Numerical problems.

3.3 Semiconductors

PN Junction – Junction transistor – Transistor configuration, α and β – Common emitter amplifier.

Logic gates (symbolic representation and truth task only) – AND, OR, NOT gates – universal gates NAND, NOR, XOR gates.

3.4 Laser

Population inversion, Spontaneous emission, stimulated emission, optical pumping – characteristics – applications.

3.5 Photoelectric Effect

Quantum theory – Photoelectric effect – Laws of photoelectric effect – Einstein's photoelectric equation – Numerical problems.

REFERENCE BOOKS

1. Physics - Halliday and Resnick
2. Mechanics - D.S. Mathur
3. Optics - Jenkins and White
4. Digital and Computer Principles - Malvino

SUBJECT TITLE : APPLIED SCIENCE – B. CHEMISTRY
SUBJECT CODE : GE 103 B
PERIODS/WEEK : 3
PERIODS/YEAR : 96

TIME SHEDULE

UNIT	TOPIC	PERIODS
I	**INORGANIC AND THEORECTICAL CHEMISTRY**	
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	1.2 Acid Base & Redox Reactions	9
	1.3 Water	8
	Test – I	1
II	**PHYSICAL CHEMISTRY**	
	2.1 Electrochemistry	10
	2.2 Corrosion	7
	2.3 Energetics	10
	2.4 Colloids	5
	Test – II	1
III	**ORGANIC CHEMISTRY**	
	3.1 Introduction	4
	3.2 Polymers	9
	3.3 Paints, Varnishes & Adhesives	6
	3.4 Fuels	9
	3.5 Environmental Pollution	5
	3.6 Chemistry In Action	2
	Test – III	1
	Total	96

OBJECTIVES

UNIT - I INORGANIC AND THEORETICAL CHEMISTRY

Formulae and Equations

1.1.1 Review the fundamental ideas in chemistry
1.1.2 Explain the terms atom, molecule, valency, radical, molecular formula
1.1.3 Compute molecular weight from molecular formula
1.1.4 Do the calculations based on simple stoichiometric equations – weight(s)/volume(s) of product(s)/reactant(s)

Structure of Atom

1.1.5 Understand the basic ideas related to modern approach to the structure of atom
1.1.6 State the fundamental particles – proton, electron, neutron – their charge & mass
1.1.7 Differentiate atomic number & mass number
1.1.8 Explain the concept of isotopes
1.1.9 Describe the dual nature of matter
1.1.10 Outline de-Broglie equation
1.1.11 State Heisenberg's uncertainty principle
1.1.12 Explain the concept of uncertainty
1.1.13 Distinguish between orbit & Orbital
1.1.14 Illustrate the Hund's rule & Aufbau principle
1.1.15 Illustrate the electronic configuration of first 20 elements

1.1.16 State modern periodic law
1.1.17 Classify elements based on electronic configuration

Chemical Bonding

1.1.18 Understand the different types of chemical bonds – how & why they are formed
1.1.19 Explain the reason for inactivity of zero group elements
1.1.20 Illustrate ionic, covalent & co-ordinate bond
1.1.21 Define electro-negativity
1.1.22 Explain the polar character of covalent bond & significance of Hydrogen Bonding
1.1.23 Illustrate the application of hydrogen bonding – high boiling point of water, density of ice, silky nature of proteins (elementary idea only)

Acid-base & Redox reactions

1.4.0 Appreciate the reactions of acids & bases
1.4.1 Illustrate Arrhenius' & Lewis concept of acids and bases
1.4.2 Distinguish between strong and weak acids and bases
1.4.3 Explain neutralization
1.4.4 Illustrate the calculation of equivalent weights of acids and bases based on equations
1.4.5 Explain the electronic concept of oxidation & reduction
1.4.6 State oxidation number
1.4.7 Define the O.N concept of oxidisation & reduction
1.4.8 Illustrate redox reactions taking the reactions in Daniel Cell as example

PH & Its Applications

1.5.0 Understand the ionic product of water
1.5.1 State pH – understand its expression
1.5.2 Describe what is pH scale
1.5.3 Solve simple problems
1.5.4 Define buffer solutions
1.5.5 Describe what is acid buffer & basic buffer – one example each

Volumetric Analysis

1.6.0 Understand the theory behind volumetric analysis
1.6.1 Describe what is meant by the terms titration, end point & indicator
1.6.2 Identify the indicators phenolphthalein/methyl orange to be used in a given acid-base titration, know the respective pH ranges
1.6.3 Solve problems based on the relation V1N1=V2N2 & V1M1 = V2M2

Water

1.7.0 Understand hard & soft water- definition, types of hardness, its causes & certain methods of removal
1.7.1 Distinguish between hard water & soft water
1.7.2 Mention the types of hardness
1.7.3 Explain methods of removal of hardness – one each (temp. – boiling, permanent – ion exchange)
1.7.4 Define degree of hardness
1.7.5 Explain the method of determination of degree of hardness using EDTA – principle, procedure & calculation
1.7.6 Explain disadvantages of using hard water – wastage of soap in laundry, formation of boiler scales

UNIT - II PHYSICAL CHEMISTRY

Electrochemistry

2.1.0 Review the outline of electrolysis, distinguish between electrolytic cells & galvanic cells, identify corrosion as an electrochemical process
2.1.1 Distinguish between a) conductors & insulators b) metallic & electrolytic conduction c) strong & weak electrolytes
2.1.2 Explain electrolysis taking molten NaCI as example anode reaction & cathode reaction as oxidisation & reduction.

2.1.3 Explain the applications of electrolysis, electroplating & anodizing
2.1.4 Distinguish between electrolytic cell & galvanic cell, the difference in the sign of the electrodes in the above cells
2.1.5 Outline the schematic representation of galvanic cell
2.1.6 Explain the classification of galvanic cells as primary & secondary
2.1.7 Illustrate primary cell with Daniel cell as examples
2.1.8 Illustrate secondary cell with lead storage cell as examples
2.1.9 Explain the electrode reactions while recharging
2.1.10 Explain the term electrode potential
2.1.11 Define electrochemical series
2.1.12 Illustrate the construction of a galvanic cell – minimum 3 examples
2.1.13 Explain the concept of fuel cells (elementary idea only)
2.1.14 Explain hydrogen-oxygen fuel cell & methanol-oxygen fuel cell
2.1.15 Describe the chemical reactions in the cell
2.1.16 Mention the advantages of fuel cells

Corrosion

2.2.0 Understand the concept of corrosion & identify it as an electrochemical process

2.2.1 Define corrosion
2.2.2 Explain the rusting of iron-mention the conditions for rusting
2.2.3 Explain the electrochemical theory of corrosion
2.2.4 Describe the methods of prevention of corrosion, barrier protection and sacrificial protection
2.2.5 Explain the theory behind each method learned

Chemical Energetics

2.3.0 Appreciate the basic concepts of 'Thermodynamics' & 'Chemical Thermodynamics'
2.3.1 Explain the scope and limitations of thermodynamics
2.3.2 Distinguish between a) reversible & irreversible reactions b) exothermic & endothermic reactions
2.3.4 Explain 'system & surroundings'
2.3.5 Distinguish between open, closed & isolated systems
2.3.6 Define macroscopic properties
2.3.7 Distinguish between extensive & intensive properties
2.3.8 Describe the different thermodynamic processes like isothermal, adiabatic, isobaric & isochoric process
2.3.9 State the first law of thermodynamics
2.3.10 Explain internal energy E & ^E
2.3.11 Explain the concept of work & heat
2.3.12 State the mathematical expression for the first law of thermodynamics
2.3.13 State Hess's Law – only statement & examples (solving problems not expected)
2.3.14 Describe the limitations of the 1st law
2.3.15 Explain the terms a) 'enthalpy' H & ^H b) entropy S & ^S
2.3.16 Describe spontaneous & non-spontaneous processes with suitable examples.
2.3.17 State 2nd law of thermodynamics
2.3.18 Explain Gibb's free energy G & ^G
2.3.19 Derive the mathematical expression (only) for Gibb's – Helmholtz equation
2.3.20 State 3rd law of thermodynamics

Colloids

2.4.0 Comprehend the methods of preparation, the properties & some industrial applications of colloid
2.4.1 Define 'colloids'
2.4.2 Illustrate the different types of colloids with examples.
2.4.3 Describe the method for the preparation of Fe(OH)3 sol
2.4.4 Describe Bredic's Arc method

2.4.5 Describe the purification of colloids by Dialysis
2.4.6 Describe the properties 1) Tyndall effect 2) Brownian movement 3) electrophoresis 4) coagulation
2.4.7 State Hardy-Schultze rule & explain with examples.
2.4.8 Define Gold-No
2.4.9 Describe the industrial applications – 1) smoke precipitation 2) sewage treatment 3) purification of drinking water

UNIT – III ORGANIC CHEMISTRY

Introduction to organic chemistry

3.1.0 Understand the fundamental ideas of organic chemistry
3.1.1 List the differences between organic & inorganic compounds
3.1.2 Describe the uniqueness of carbon atom
3.1.3 Define 'catenation'
3.1.4 Distinguish between saturated & unsaturated compounds
3.1.5 Illustrate general classification & that based on functional groups
3.1.6 Define isomerism – explain with simple examples only

Polymers

3.2.0 Understand the nature of some industrially important polymers
3.2.1 Define polymerization
3.2.2 Distinguish between addition & unsaturated compounds
3.2.3 Differentiate between thermoplastics & thermosetting plastics
3.2.4 Outline the merits & demerits of plastics
3.2.5 Distinguish natural rubber from synthetic rubber with suitable examples
3.2.6 Explain vulcanization & its merits
3.2.7 Define "fiber"
3.2.8 Describe different types of fibers with suitable examples

Paints, varnishes, adhesives & lubricants

3.3.0 Appreciate the requisites of good paints
3.3.1 Name the constituents of paints – vehicle, pigment & other additive
3.3.2 Identify the role of various additives – acrylics, polymethanes, fillers, plastizisers, driers, antiskinning agents (one examples each)
3.3.3 List the two types of varnishes & their constituents
3.3.4 State the common uses of varnishes
3.3.5 List the various constituents of varnish
3.3.6 Explain the principle of lubrication
3.3.7 List the types of lubricants – with one example each
3.3.8 Define 'adhesives'
3.3.9 List the two types of adhesives
3.3.10 State the applications of 1) paper adhesive 2) wood adhesive 3) metal bonding adhesive 4) break & clutch bonding adhesive 5) printed circuits

Fuels

3.4.0 Comprehend the classification and use of various types of fuel.
3.4.1 Define "fuel"
3.4.2 Explain their classification into solid, liquid & gaseous
3.4.3 Give brief explanation of solid fuels wood, charcoal, lignite, bituminous coal, anthracite coal – list their applications
3.4.4 Explain briefly the liquid fuels petrol, diesel, kerosene & list their applications
3.4.5 Explain gaseous fuels natural gas (CNG), producer gas, water gas, LPG & Gobar gas
3.4.6 Describe nuclear fuels with examples
3.4.7 Define 1) calorific value 2) octane number 3) Cetane no.
3.4.8 Explain 1) knocking 2) cracking

Environmental pollution

3.5.0 Investigate the impact of pollution on the environment

3.5.1 Describe the categorization and sources
3.5.2 List the different methods of controlling pollution
1) Effluent treatment 2) removal of toxic gases and particulate materials
3.5.3 Distinguish between BOD & COD

Chemistry in action

3.6.0 Understand some commonly used medicines & propellants
3.6.1 Explain what is 1) dyes 2) antipyretics & analgesics 3) antiseptics & disinfectants 4) tranquilizers 5) antibiotics - mention 2 examples each
3.6.2 Define propellants
3.6.3 Classify propellants with one example each.

CONTENT DETAILS

UNIT – I INORGANIC AND THEORECTICAL CHEMISTRY

1.1 Introduction

Atoms and Molecules, Valency, Molecular formula, Atomic weight, Molecular weight, Chemical equation, Problems based on Chemical equation.

Structure of atom, Modern approach De-broghi & Heisenberg's uncertainty Principle (Elementary idea only) – Concept of Orbit, orbital, Aufban, Hundi, Paul's Principle – Electric configuration – Modern Periods Law - classification of elements based on electronic configuration.

Chemical Bonding - theory of valency – Inertness of Zero group elements - Ionic bond, Co-ordinate bond, Co-valent bond, Polar character of covalent bond – Hydrogen bond – Applications High B.P of Water, density of ice, silky nature of protein (Idea only).

1.2 Acids-bases and Redox reactions

Acids-Bases – (Arrherius, & Lewis Concepts) – Concepts of strong and weak acids & bases – Neutralization - Equivalent weight of acid & bases (Calculate based on Equation) -Oxidation, Reduction (electronic concept and oxidation No concept) - Redox reaction (Eg: - Daniel Cell reaction).

Ironic product of water, PH & POH (Definition and expression) PH Scale – Calculation of PH & POH – Buffer solution (examples) – Application of PH a) Boiler feed water b) Potable water c) Effluent treatment.

Volumetric analysis: Quantitative & Qualitative analysis – Units of measurement of Concentration (Normality, Morality & PPM) – Titration, Endpoint Acid – Base Indicators (Phenolphthalein & Methyl orange) – Choice of Indicators.

1.3 Water

Hard & soft water, Types of Hardness – degree of hardness. One method to remove Temporary hardness (Boiling) – Renormal of permanent hardness (Ion-exchange method) – disadvantages of using hard water a) Wastage of Soap in laundry) Boil Scales – Determination of Degree of hardness using EDTA (Principle & Procedure only).

(Problems not expected from the chapter)

UNIT – II PHYSICAL CHEMISTRY

2.1 Electrochemistry & corrosion

Conductors & Insulators, Metallic & electrolyte conductors, strong & weak electrolytes – Mechanism of electrolysis – Molten Nail – Application of electrolysis – Electroplating & Anodizing.

Galvanic cell – Difference in the sign of electrodes – Primary cell (eg: - Daniel cell construction details, Anode reaction, cathode reaction & Net cell reaction)

Secondary cells – Lead storage balling, (Constructional details – charging & discharging) Electrochemical senis – Application in the construction of a cell.

Fuel cells – Introduction, Hydrogen – Oxygen fuel cell, Methanol – Oxygen fuel (elementary idea only) – Advantages.

2.2 Corrosion

Definition – Rusting of Fe condition for Rusting of Fe, Electrochemical theory of corrosion, Preventing of corrosion

i) Barrur protection
ii) Sacrificial protection
iii) Cathodic protection
iv) Antirust solution.

2.3 Chemical Energetics

Understand the term chemical energetic & thermodynamics _ Scope & Limitations of Thermodynamics. Basic concepts – Reversible & Irreversible reaction, Exothermic & endothermic reactions, systems & surroundings – Types of systems Open, closed, Isolated – process – Macroscopic properties – Extensive & Intensive properties.

Thermodynamic process - Isothermal, Adrabalie, Isobaric, Isochoric Process.

First Law of Thermodynamics – (statement)

Internal energy (E) and Internal energy change (E)

Concept of Work & heat

Mathematical expression for the 1st Law of thermodynamics

Application of 1st Law (Hess's Law)

(Statement and eg), Limitation of 1st Law.

Enthalpy (H) and Enthalpy Change (H), Entropy (S) and Entropy Change (S)

Second Law of Thermo dynamics (statement & Mathematical Expression)

Gibbs Free energy (G) and Gibbs free energy change (AG)

Gibbs-Helzmotz equation (expression only)

Third Law of Thermodynamics (statement only)

2.4 Colloids

Definition, Types of colloids, preparation 1) Condensation-e.g. Ferric hydroxide sol 2) Dispersion-e.g. Bredic's arc method, purification – dialysis, Properties. 1. Tyndall effect 2. Brownian movement 3. Electrophoresis 4. Coagulation Hardy – Schulze rule, Gold number Industrial application 1) Smoke precipitation 2) Treatment of sewage 3) Purification of drinking water.

UNIT – III ORGANIC CHEMISTRY

3.1 Introduction

Differences between organic and inorganic compounds – uniqueness of carbon – catenation, saturated and unsaturated – general classification of organic compound – classification based on functional groups isomerism (definition wish an example).

3.2 Polymers

Polymerization – illustrate with examples – Addition and condensation polymerization with one example each.

Plastics - Thermoplastics, Thermosetting plastic, with one example each – advantages.

Rubber – Natural and synthetic rubber (example), vulcanization.

Fiber – Natural fibers, synthetic fibers, semi synthetic fibers, examples.

3.3 Paints and Varnishes and adhesives, lubricants

Requisites of a good paint – Constituents – acrylics, polyurethane, filler, plasticizers, pigments, driers and antiskinning agents.

VARNISHES - Type, Constituents

LUBRICANTS - Principle of lubrication – Types of lubricants

ADHESIVES - Types and Applications.

3.4 Fuels

Types of fuels - solid, liquid, gaseous and nuclear - Calorific value of fuels. Knocking, Cracking - Octane number and octave number.

3.5 Environmental pollution

Categorization, Sources and Controlling.

3.6 Chemistry ice action:

Dyes – antipyretics and analgesics – antiseptic – disinfectant – tranquilizers – antibiotics (Concept and two examples each). Propellants – definition classification (solid – liquid – hybrid) one example each.

REFERENCE BOOKS

1.	Soni P.L.	A Text Book of Inorganic Chemistry	S.Chand & Co., New Delhi
2.	Puri B.L. & Sharma L.R	A Text Book of Inorganic Chemistry	Shoban Lal Nagin Chand&Co
3.	B.S.Bahl	Text book of Organic Chemistry	S.Chand & Co., New Delhi
4.	I.L. Finar Arun Bahl	Organic Chemistry – Vol I	ELBS & Longman, Group Ltd.,
5.	Sono. P.L.	Textbook of physical Chemistry	Sultan Chand & Sons, New
6.	A.J. Mee	Physical Chemistry	William Heinemann Ltd.,
7.	Glasstone & Lewis	Element of Physical Chemistry	Macmillan Press

SUBJECT TITLE : ENGINEERING GRAPHICS
SUBJECT CODE : GE 104
PERIOD/WEEK : 4
PERIOD/YEAR : 128

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Importance of Engineering Graphics	2
	1.2 Drawing Instruments	2
	1.3 Drawing standards	2
	1.4 Free hand Lettering and Numbering	3
	1.5 Dimensioning	3
	1.6 Geometric construction	16
	Test 1	3
II	2.1 Projection of Points, Lines and planes	18
	Test 2	3
III	3.1 Orthographic Projection of Objects	27
	Test 3	3
IV	4.1 Sectional views of objects	11
	4.2 Auxiliary views	3
	Test 4	3
V	5.1 Pictorial Drawing	8
	5.2 Visualization	4
	5.3 Perspective Drawing	3
	5.4 Development of surfaces	11
	Test 5	3
	Total	**128 Periods**

Note : A minimum number of 10 sheets should be done.

OBJECTIVES

UNIT - I

On completion of this study the student should be able to –

1.1 Importance of Engineering Graphics

1.1.0 Understand the importance of engineering graphics
- 1.1.1 Explain the importance of engineering communication medium
- 1.1.2 Describe the development of engineering graphics and computer aided drafting CAD
- 1.1.3 Indicate the link between engineering graphics and other subjects of study in diploma courses

1.2 Drawing Instruments

1.2.0 Use engineering drawing instruments
- 1.2.1 Select the proper instrument to draw horizontal, vertical and inclined lines
- 1.2.2 Select the proper instrument to draw large and small circles and arcs to its specifications
- 1.2.3 Select the proper pencil to draw different types of line according to its specifications
- 1.2.4 Identify the steps to keep the drawing clean and tiny

1.3 Drawing standards

1.3.0 Appreciate the standards of engineering drawing

1.3.1 Select the drawing sheet
1.3.2 Draw different types of lines
1.3.3 Prepare of title block as per BIS
1.3.4 Fold of drawing sheets as per standards

1.4 Free hand Lettering & Numbering

1.4.0 Apply free hand lettering and numbering
1.4.1 Write drawing tile using sloping and vertical lettering including numerals as per BIS
1.4.2 Select suitable size of letters of different layout and applications
1.4.3 Write engineering drawings notes using lettering stencils

1.5 Dimensioning

1.5.0 Apply dimensioning as per standards
1.5.1 State the need of dimensioning as per BIS specification
1.5.2 Identify the notations used in a drawing as per BIS
1.5.3 Identify the system of placement of the dimensions as per BIS
1.5.4 Dimension of a given drawing according to BIS including features
1.5.5 Apply the rules for dimensioning of standard features, given a drawing comprising of standard features
1.5.6 Identify principles of dimensioning, given a dimensioned drawing
1.5.7 Identity the correctness or otherwise of an engineering drawing dimensioned as per SP 46 and dimension the same correctly

1.6 Geometric construction

1.6.0 Apply principles of geometrical construction
1.6.1 Construct polygon, given the length of the side
1.6.2 Insert a regular polygon in a circle.
1.6.3 Define Ellipse, involutes, helix, Parabola, Hyperbola and Cycloid,
1.6.4 Construct Ellipse by different methods (concentric, eccentricity, parallelogram
1.6.5 Construct an involute, helix, parabola from given data
1.6.6 Identify the application of these constructions in engineering practice.

UNIT – II

2.1 Projection of Points, Lines and Planes

2.1.0 Understand the projection of points, lines and planes
2.1.1 Project points in different quadrants
2.1.2 Project lines parallel to both planes
2.1.3 Project lines perpendicular to HP and || to VP
2.1.4 Project lines perpendicular to VP and || to HP
2.1.5 Project lines inclined to HP and || to VP
2.1.6 Project lines inclined to VP and || to HP
2.1.7 Project lines inclined to both planes-simple direct questions and answers
2.1.8 Find true length of lines
2.1.9 Project of planes parallel to VP and perpendicular to HP
2.1.10 Project planes parallel to HP and perpendicular to VP

UNIT - III

3.1 Orthographic Projection of Objects

3.1.0 Apply principles of orthographic projection
3.1.1 Explain the principle of orthographic projection with simple sketches
3.1.2 Prepare an engineering drawing of a given simple engineering path in first angle and third angle projection
3.1.3 Draw the orthographic views of an object, given its pictorial drawing
3.1.4 Sketch (free hand) the orthographic views of 3.2 and 3.3
3.1.5 Select the minimum number of views needed to represent a given object fully
3.1.6 Identify the engineering path correctly from a number of orthographic drawings

UNIT - IV

4.1 Sectional views of objects

4.1.0 Recognize the need of sectional views

- 4.1.1 Explain the need to draw sectional views
- 4.1.2 Select the section place for a given component to reveal maximum information
- 4.1.3 Draw the sectional views for 4.2
- 4.1.4 Sketch simple sections (Full and half) for a range of simple engineering objects
- 4.1.5 Select the component from a given sectional view

4.2 Auxiliary views

4.2.0 Recognize the need of auxiliary views

- 4.2.1 State whether the auxiliary view is needed, given an engineering drawing
- 4.2.2 Draw the auxiliary views of a given engineering drawing

UNIT - V

5.1 Pictorial Drawing

5.1.0 Prepare pictorial drawing

- 5.1.1 Explain the need for and types of commonly used pictorial drawings
- 5.1.2 Prepare isometric drawing of simple objects using appropriate construction procedures given their appropriate drawings
- 5.1.3 Sketch the isometric views of simple engineering objects given either orthographic drawing or actual components
- 5.1.4 Prepare oblique drawing – cavalier and cabinet-of simple engineering objects given either orthographic drawings or actual components
- 5.1.5 Sketch 5.4 by free hand
- 5.1.6 Identify the correct pictorial view from orthographic drawings

5.2 Visualization

5.2.0 Visualize and object in 3D, given its orthographic drawings

- 5.2.1 Compare an engineering part with its drawings
- 5.2.2 Identify surfaces with reference to orthographic drawing
- 5.2.3 Prepare a model of the part, given its orthographic drawing

5.3 Perspective Drawing

5.3.0 Prepare perspectives

- 5.3.1 State the principle of perspective projection
- 5.3.2 Prepare two-point perspective of a rectangular block
- 5.3.3 Sketch perspective of combination of rectangular block

5.4 Development of surfaces

5.4.0 Prepare development of surfaces

- 5.4.1 State the need for preparing the development drawings
- 5.4.2 Prepare development of surfaces of simple engineering component like tray, funnel, ducts (rectangular and square hopper)
- 5.4.3 Prepare development of surfaces of 90-degree elbow pipe

CONTENT DETAILS

UNIT - I

1.1 The Importance of Engineering Graphics

Explanation of the scope and objective of this subject – its importance as a graphic communication, Computer Aided Drafting (CAD) need for preparing drawing as per standards – BIS, SP 46.

1.2 Drawing Instruments.

Basic drawing instruments – T square – Set square – compass dividers – drawing boards – Pencils – Drawing papers – Mini drafter – French curves – Stencils – Selection and mode of using them.

1.3 Drawing Standards

Size of drawing sheets – Layouts of drawing sheet – Title Blocks – Types of lines – Folding of drawing sheets.

1.4 Free hand Lettering and Numbering

Need for legible lettering and numbering on drawings – selection of suitable size of lettering for different drawing writing of Engineering drawing titles and notes using both vertical and sloping styles.

1.5 Dimensioning

Function of dimensioning need for dimensioning engineering drawing according to BIS – rotation used in dimensions – dimension line – extension line – arrow heads and leader – system of dimensions - method I and method II

1.6 Geometric construction

Construction of regular polygon given the length of its side - methods of inserting a regular Polygon in a given circle – construction of ellipse by different methods (eccentrically, concentric circle, parallelogram). Definition of involute, helix, parabola & hyperbola – Construction of cycloid helix, involute and parabola.

UNIT – II

2.1 Projection of points, lines and planes

Projection of points in different quadrants, projection of straight lines parallel to one or both planes, parallel to one plane –perpendicular to other – inclined to one plane and parallel to other line inclined to both planes (In first quadrant only)

Methods of finding true length and its inclination with the reference planes. Projection of planes – parallel to one plane and perpendicular to other plane (in first quadrant only)

UNIT - III

3.1 Orthographic projection of objects

Explanation of the meaning of orthographic projection using a viewing box and a model- number views obtained need of only three views for displaying the object. Concept front view, top view and side view-sketching these views for a number of engineering objects- explanation of the meaning of first angle and third angle projection – symbol of projection

UNIT - IV

4.1 **Sectional views of objects**

Need for sectional drawing of an engineering object- selection of the section plane to reveal the maximum information – sectional views (full and half section) of simple engineering objects.

4.2 **Auxiliary views**

Need of auxiliary views – auxiliary views given engineering drawings

UNIT - V

5.1 **Pictorial drawings**

Isometric projection, construction of isometric scales- isometric projection of simple Engineering objects

Oblique projection cavalier and cabinet of simple Engineering objects

5.2 **Visualization**

Preparation of pictorial views from a group of orthographic drawings

5.3 Perspective drawing

Principle of perspective projection – type of perspective projection – two-point perspective of a rectangular block and combination of two rectangular blocks of different sizes

5.4 **Development of surfaces**

Development of surfaces of simple engineering components trace-funnel, ducts-rectangular and square –hopper-90 degree Elbow

REFERENCE BOOKS

1. Engineering Drawing - N. D Bhutt
2. Engineering Graphics - K. C. John
3. Engineering Graphics - P. I. Varghese

SUBJECT TITLE : COMPUTER FUNDAMENTALS & PROGRAMMING IN C
SUBJECT CODE : GE 105
PERIODS/WEEK : 3
PERIODS/YEAR : 96

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Introduction to Computers	12
	1.2 Windows & Word Processing	6
	Test 1	2
II	2.1 Data Processing	5
	2.2 Problem solving methodology	11
	Test 2	2
III	3.1 Introduction to C Programming	12
	3.2 Programming practice	6
	Test 3	2
IV	4.1 Arrays, strings & functions	12
	4.2 Programming practice	6
	Test 4	2
V	5.1 Graphics in C	7
	5.2 Computer Networks	3
	5.3 Programming practice	6
	Test 5	2
	TOTAL	**96**

OBJECTIVES

UNIT – I

1.1.0 Know the application, classification and working of computers

1.1.1 Define a Computer
1.1.2 Discuss the various applications of computers
1.1.3 List the different classifications of computers based on processing methods
1.1.4 Describe the working of analog, digital and hybrid computers

1.2.0 **Appreciate the functions of hardware and software components**

1.2.1 Define hardware and software
1.2.2 Discuss about Instruction and program
1.2.3 Describe the hardware functional components of a digital computer with the help of a block diagram
1.2.4 List the functions of ALU, Memory, Input, Output Units and Control Unit
1.2.5 Define CPU and Microprocessor
1.2.6 List the classifications of computers based on capability
1.2.7 Describe micro, mini, mainframe and supercomputers in brief
1.2.8 Discuss machine language, Assembly language and high level language
1.2.9 List the different software components
1.2.10 Define system software and application software
1.2.11 Give examples for system software and application software

1.2.12 State the need for translators – assembler, compiler
1.2.13 Define operating system
1.2.14 List the functions of operating system
1.2.15 List the names of various operating system

1.3.0 **Appreciate the working of memory and input – output devices**

1.3.1 Define memory
1.3.2 Discuss the units' bit, byte, kilobyte, megabyte, gigabyte etc.
1.3.3 Discuss the characteristics of primary memory and secondary memory
1.3.4 Distinguish between sequential access memory and Random Access Memory
1.3.5 Differentiate between Read Only Memory and Read/Write memory
1.3.6 Discuss RAM & ROM
1.3.7 List the different types of ROM
1.3.8 List the different secondary memory devices
1.3.9 Discuss the working of floppy disk, magnetic tape, Hard disk, Compact disk (block diagrams and detailed description not necessary)
1.3.10 Discuss working of CDROM, CD-R, CD-RW & DVD (block diagrams and detailed description not necessary)
1.3.11 List the names of various I/O devices
1.3.12 Discuss input devices – Keyboard, mouse, scanner, Optical Character reader, Optical Mark reader, bar code reader, digitizer, light pen, joystick in brief (block diagrams and detailed description not necessary)
1.3.13 Discuss output devices – monitor, Printer, plotter (block diagrams and detailed description not necessary)
1.3.14 Describe the printers – Dot matrix printer, Inkjet printer, Laser printer in brief (block diagrams and detailed description not necessary)

1.4.0 Use the provisions of windows o s and word processing

1.4.0 Define Booting
1.4.1 Define Booting
1.4.2 Demonstrate the features of Windows Operating System
1.4.3 Operate various facilities in windows- 95 or higher version such as Desktop, icon, menu, folder, programs, screen saver, media player, shut down procedure
1.4.4 Discuss word processing
1.4.5 Prepare documents using WORD - create, format, save, print and open documents
1.4.6 Prepare presentations using power point – creation and use of slide show presentations

UNIT – II

2.1.0 Use data processing techniques and DBMS (not for theory exam)

2.1.1 Define Data, Database, and Database management system
2.1.2 Define Data, Database, and Database management system
2.1.3 State the need of spreadsheet
2.1.4 List the name of electronics spreadsheet and DBMS software packages
2.1.5 Use Excel for the creation, formatting, formula, save, print, open close and exit worksheets
2.1.6 Use Access for the creation, editing and querying of tables

2.2.0 Understand problem solving methodology

2.2.1 List the various steps involved in problem solving
2.2.2 Define what is an Algorithm
2.2.3 Write Algorithm for solving general and computer related problems
2.2.4 Define what is a Flow chart
2.2.5 Discuss the different flow-charting symbols
2.2.6 Draw flow chart for solving general and computer related problems
2.2.7 Define syntax and semantic of programming languages
2.2.8 List the name of two programming methods
2.2.9 Discuss the characteristics of procedural and object oriented programming languages

2.2.10 Give examples for procedural and object oriented language

UNIT – III

3.1.0 Use 'C' language in programming

3.1.1 Discuss the characteristic of C language
3.1.2 Describe the structure of a C program
3.1.3 State the need for header files, main ()
3.1.4 Discuss the basic data types in C –int., float, and double char
3.1.5 Discuss about identifiers, keywords and declaration of identifiers
3.1.6 Discuss about statements and compound statements
3.1.7 Describe briefly assignment, arithmetic operators, increment-decrement operators and arithmetic expressions
3.1.8 Discuss operator precedence and rules for evaluation of an expression
3.1.9 State the need of stdio.h
3.1.10 Discuss various input and output statements-printf(), scanf(), getchar(), Putchar (), getchar ()
3.1.11 Discuss the need of various control sequences and escape sequences
3.1.12 Write simple programs using input/output assignment and arithmetic statements
3.1.13 Describe the relational operators and relational expressions with their precedence in brief
3.1.14 Describe logical operators with their precedence in brief
3.1.15 Write programs with relational operators and logical operators

3.2.0 Prepare programs involving branching and looping statements

3.2.1 State the need for branching statements
3.2.2 Describe IF, IF ELSE statement, nested IF and IF Ladder
3.2.3 Describe the Switch Statement
3.2.4 Write Programs using IF Else and Switch statement
3.2.5 State the need for looping statements
3.2.6 Discuss the method of looping using While, Do and for loops
3.2.7 Write programs using While, Do and For loops

UNIT – IV

4.1.0 Create arrays and strings

4.1.1 State the need of arrays
4.1.2 Discuss the method declaring arrays and subscripting in arrays
4.1.3 Discuss the method of inputting, processing, and outputting values of array element
4.1.4 Write program for array processing
4.1.5 Write program for linear search and bubble sort
4.1.6 Discuss about multidimensional arrays
4.1.7 Write programs on multidimensional arrays, matrices manipulation
4.1.8 Discuss the declaration of character string
4.1.9 Discuss various string input and output functions – gets() and puts()

4.2.0 Understand functions in 'C' language

4.2.1 State the need for function
4.2.2 Compare user defined and library functions
4.2.3 Discuss the structure of a user defined function and its calling with or without parameters
4.2.4 Define void function
4.2.5 Describe various library functions – sin (), cos.(),tan(),exp(), abs(), log(),log10(), POW(), sqrt(), - strlen (), strcpy (), strcmp (), strcat ().
4.2.6 Write simple programs on functions and strings

UNIT – V

5.1.0 Use computer graphics in 'C' language to prepare programs

5.1.1 State the use of graphics.h

5.1.2 Define resolution
5.1.3 Discuss the functions initgraph(), setcolor(), setbkcolor(), putpixel(), line(), circle(), rectangle(), outtexty()
5.1.4 Write programs based on graphics

5.2.0 Understand new trends in information technology

5.2.1 Define the work 'multimedia'
5.2.2 Define the word 'multimedia'
5.2.3 Discuss the components required for a multimedia personal computer
5.2.4 Define computer network
5.2.5 Define LAN, WAN
5.2.6 Discuss the concept if Server and nodes
5.2.7 Discuss Internet, World Wide Web, and e-mail
5.2.8 Discuss Computer virus and anti-virus programs
5.2.9 Define artificial Intelligence and discuss its application fields

CONTENT DETAILS

UNIT – I Introduction to Computers & Word Processing

Introduction, application of computers, generations of computers, classification of computers – analog, digital, hybrid Computers, Structure of a computer - Hardware and Software components – Input unit, Output unit, ALU, Memory unit, Control unit, CPU, Microprocessor, micro, mini, supercomputers – machine languages, assembly languages, high level languages – system soft ware, application software – assembler, compiler, operating system – Types of memory – primary memory, secondary memory, sequential access , random access memory, RAM, ROM – magnetic tape, floppy, hard disc, compact disc – input devices, out put devices.
Practical sessions on Windows O/S, Word, Power point

UNIT – II Data Processing and Programming Methodology

Practical session on Electronic spread sheet and DBMS – EXCEL, ACCESS
Steps in problem solving – Algorithm, Flowchart- Flow chart symbols- examples syntax, semantics- types of high level languages – characteristics of high level languages - Types of high level languages – Examples – Procedural and object oriented programming languages

UNIT – III Introduction to C Programming

Characteristics of C-language – structure of a program header files, main (), Statements, compound statements, Data types – Keyword and variables, assignment operators, arithmetic operators, expressions, precedence of operators, order of evaluation – relational and logical operators - Input /out put statements -– control sequences – escape sequences – branching statements, if, if-else, switch – looping statements while, do, for statements.
Writing Sample programs – Practical session on programming

UNIT – IV Arrays and Functions

Arrays – declaration, processing, searching, sorting – linear search, bubble sort – multi dimensional arrays- matrix manipulations, character strings, string declaration, input/out put functions gets (), puts ()

User defined functions – library functions – structure of functions, calling functions, argument passing, void functions – mathematical and string library functions – math.h, stdio.h, string.h

Writing programs – Practical session on programming

UNIT – V Graphics and Networking

C-Graphics – resolution – graphics functions – initgraph (), setcolor (), setbkcolor (), putpixel (), Line (), circle (), rectangle (), out text (), outtextxy ()

Multimedia – Computer networking

LAN, WAN- Internet, modem, www-E-mail, computer virus, artificial intelligence.

REFERENCE BOOKS

1. Brian w. Kernigham and Dennys M. Ripchie The 'C' programming Language PHI
2. Hughes J. K. and Michton J. I. A structured approach to Programming PHI
3. Gottfried.B Theory and problems Programming with C TMH
4. E. Balaguruswamy Programming ANSI C TMH
5. Robert A. Radcliffe Encyclopedia C BPB

SUBJECT TITLE : INORGANIC CHEMISTRY
SUBJECT CODE : CH 101
PERIODS/WEEK : 4
PERIODS/YEAR : 128

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	General Chemistry, Avogadro's Hypothesis, Redox reaction	15
	Test - I	2
II	Periodicity in proportion, Chemical bonding, Nuclear Chemistry	19
	Test - II	2
III	Sand p Block elements (III & IVA Group)	28
	Test - III	2
IV	P Block elements (VA & VIA Group)	28
	Test - IV	2
V	P Block elements (VIIA) & d Block elements	28
	Test - V	2
	Total	**128**

OBJECTIVES

On Completion of the unit the student will be able to

UNIT – I: GENERAL CHEMISTRY

1.1.0 Apply the laws of chemical combination

1.1.1 Illustrate each of the following laws of chemical combination with two examples each:
Law of conservation of mass, Law of definite proportions, Law of multiple proportions, Law of reciprocal proportions, Gay Lussac's law of gaseous volumes.

1.1.2 Solve problems based on the above laws of chemical combination

1.1.3 Perform the following experiments

1.1.4 Solve simple problems based on these experiments
Hydrogen displacement method, Oxide method, Chloride method, Metal displacement method

1.1.5 State Dulong and Petit's Law

1.1.6 Calculate atomic weight of an element, given its specific heat and equivalent weight

1.2.0 Comprehend Avogadro's Hypothesis and its applications

1.2.1 State Avogadro's Hypothesis

1.2.2 State the relationship between vapour density and molecular weight

1.2.3 Describe mole concept

1.2.4 Illustrate the concept of gram molecular volume

1.2.5 Solve problems based on mole concept

1.3.0 Appreciate Redox reactions

1.3.1 Balance the following equations by ion-electron method

(1) $MnO4^- + Fe2 + \longrightarrow Mn2+ + Fe3+$

(2) $MnO4^- + (WOH)2 \rightarrow CO2 + Mn2+$

(3) $CrO2^- + I \rightarrow CO3+ + I2$

UNIT – II:

PERIODICITY IN PROPERTIES, CHEMICAL BONDING, NUCLEAR CHEMISTRY

2.1.0 Narrate the periodicity in properties

2.1.1 Explain the periodicity in the properties of elements in terms of the following: Atomic and ionic radii, Ionization potential, Electron affinity, Electro negativity

2.2.0 Understand the nature of coordinate covalent bond

2.2.1 Explain the concept of hybridization (sp3, sp2, sp)

2.2.2 Describe the shapes of molecules (NH3, H2O)

2.2.3 Describe the valency shell Electron Pair Repulsion Theory

2.3. Nuclear Chemistry

2.3.0 Understand the phenomenon of natural radioactivity

2.3.1 Define natural radioactivity

2.3.2 Distinguish between alpha beeta and gama radiations by stating at least five differences between them

2.3.3 Explain the phenomenon of radioactivity on the basis of Rutherford and Soddy's disintegration theory

2.3.4 Illustrate the Group Displacement law with respect to Alpha particle emission, beta particle emission. With an example for each

2.3.5 Name the three Radioactive series

2.3.6 Illustrate the concept of decay constant with an example

2.3.7 State the relationship between Decay constant and Half life period

2.3.8 Solve problems based on the above relation

2.4.0 Understand the process of Artificial Radioactivity and its application

2.4.1 Illustrate artificial transmutation with an example

2.4.2 Explain how radio isotopes are produced artificially with an example

2.4.3 Show the usefulness of radio isotopes in C14 dating, Chemical analysis, Medicine, Industry

2.4.4 Solve problems based on C14 dating using the relation

2.5.0 Comprehend the principles of nuclear reactions

2.5.1 Distinguish between Nuclear fission and fusion with and example for each

2.5.2 Describe the working principle of atom bomb

2.5.3 Describe the working principles of hydrogen bomb.

UNIT – III: S AND P BLOCK ELEMENTS (IIIA & IVA GROUP)

3.1.0 Understand the chemistry of the compounds of alkali metals

3.1.1 Describe the preparation of Lithium Aluminium Hydride from Anhydrous Atct3 and Lithium Hydride

3.1.2 Illustrate the reducing property of LiAlHy with an example

3.1.3 State one specific use of LiAlHy

3.1.4 Describe the manufacture of NaOH by electrolytic process

3.1.5 Study the reaction of NaOH :- With acids, With Ammonium salts

3.1.6 List two uses of NaOH

3.1.7 Explain how sodium peroxide is prepared from sodium

3.1.8 Illustrate the oxidizing property of sodium peroxide with two examples

3.1.9 List two uses of sodium peroxide

3.1.10 Explain any one method for the manufacture of KI

3.1.11 Describe the reaction of KI with :- Mercuric Chloride, Copper Sulphate, Silver nitrate, Led nitrate

3.1.12 List two uses of potassium iodide

3.2.0 Understand the chemistry of magnesium

3.2.1 Name two ores of magnesium

3.2.2 Describe the extraction of magnesium by electrolysis of fused carnallite

3.2.3 State any two use of magnesium

3.2.4 Give the composition and use of any two alloys of magnesium

3.2.5 List two tests for identifying magnesium

3.3.0 Understand the chemistry of the compounds of alkalini earth metals

3.3.1 Describe the preparation of Epsom salt from Kieserite (MgSo4 H2O)
3.3.2 State what happens when Epsom salt is heated
3.3.3 List two uses of Epsom salt
3.3.4 Explain how plaster of Paris is prepared from gypsum
3.3.5 Explain the chemical reactions that occur when plaster of Paris is used for castes of statues
3.3.6 Give a method for the preparation of bleaching powder
3.3.7 Explain how bleaching occurs while using bleaching powder
3.3.8 Explain why the percentage of available chlorine in bleaching powder decreases on storing it for a long time
3.3.9 List two uses of bleaching powder
3.3.10 Describe the preparation of BaCl2 from Barium Sulphate
3.3.11 List the reactions of Barium Chloride with :- Dilute H2SO4, K2Cro4 and AgNO3
3.3.12 State two uses of BaCl2

3.4 P-Block elements (III, IVA and VA groups)

3.4.0 Understand the Chemistry of Boron

3.4.1 Describe the manufacture of Boron from Colemanite
3.4.2 Describe the reactions of boron with air, Chlorine, carbon, nitrogen and metals
3.4.3 State any two uses of Boron
3.4.4 Describe the preparation of orthoboric acid from colemanite
3.4.5 Explain the action of heat on orthoboric acid
3.4.6 State two uses of orthoboric acid
3.4.7 Describe the preparation of Borax from Colemanite
3.4.8 Explain the action of heat on borax and formation of metaborites with metal oxides
3.4.9 State any four uses of borax

3.5.0 Understand the Chemistry of Carbon

3.5.1 Give the electronic configuration of carbon
3.5.2 Illustrate catenation in carbon compounds
3.5.3 Name the allotropic modifications of carbon
3.5.4 Describe the manufacture of graphite by Acheson process
3.5.5 Explain the manufacture of carbon monoxide from steam and carbon
3.5.6 Explain the reactions of carbon monoxide with hydrogen, chlorine, sulpuhr, sodium hydroxide and metals
3.5.7 Give one example for the reducing property of carbon monoxide
3.5.8 Name two solutions used for absorbing carbon monoxide
3.5.9 Name three fuels containing carbon monoxide as the chief constituent
3.5.10 Illustrate the acidic character of carbon dioxide with two examples
3.5.11 Outline any three uses of carbon dioxide
3.5.12 Describe three tests to distinguish between sodium carbonate and sodium biocarbonate
3.5.13 Describe one method each for the preparation of Aluminium carbide and silicon carbide
3.5.14 State one property of Aluminium carbide and silicon carbide
3.5.15 Name one application for each of the following compounds:
Aluminium carbide and Silicon carbide

3.6.0 Understand the Chemistry of Silicon

3.6.1 Describe how silicon is manufactured from sand
3.6.2 List any two uses of silicon
3.6.3 Name any three important silicate minerals
3.6.4 Explain why zeolities are used as ion exchanges in water softness
3.6.5 Describe the preparation of sodium silicate from sand
3.6.6 List any three uses of sodium silicate

3.7.0 Comprehend the common alloys and compounds of Tin and Lead

3.7.1 State the composition and specific uses of the following alloys of tin :- Bronze, Gun metal, Solder and Britania metal
3.7.2 Describe the process of tinning
3.7.3 Describe tin plating
3.7.4 Describe the method of preparing stannous chloride from tin and hydrochloric acid
3.7.5 Explain the reaction of stannous chloride with hydrogen sulphide
3.7.6 Illustrate the reducing property of stannous chloride with an example
3.7.7 List any two uses of stannous chloride
3.7.8 Describe one test each for identifying stannous and stannic tine
3.7.9 State the composition and the one specific use for type metal and powder
3.7.10 Describe the preparation of lead monoxide from lead
3.7.11 Illustrate with one example the amphoteric nature of lead monoxide
3.7.12 List any three uses of litharge
3.7.13 Describe the preparation of lead dioxide from red lead
3.7.14 Describe the action of heat on read lead
3.7.15 Describe the Dutch process for the preparation of white lead. (Basic lead carbonate)
3.7.16 State any one use of while lead
3.7.17 Describe the preparation of lead tetra ethyl from ethyl chloride
3.7.18 State any one use of lead tetra ethyl

<u>UNIT – IV</u>: p BLOCK ELEMENTS (VA & VIA GROUPS)

4.1.0 Comprehend the chemistry of nitrogen and its compounds

4.1.1 Name any two nitrogenous fertilizers
4.1.2 Describe the manufacture of nitric acid by Ostwald's process and Birkeland Eyde process
4.1.3 Describe the action of nitric acid on the following metals.
Magnesium, Copper, Silver, Lead, Zinc and Iron
4.1.4 Explain how nitric acid oxidizes a flowing chip of wood, sulphur, iodine, potassium iodide, sulphur dioxide, sand ferrous sulphate
4.1.5 State any two uses of nitric acid
4.1.6 Describe the Faber process for the manufacture of ammonia
4.1.7 Illustrate the reducing action and basic nature of ammonia with two examples for each
4.1.8 Explain how ammonium hydroxide acts as an analytical reagent with three examples
4.1.9 Describe two methods of testing ammonia
4.1.10 Describe any two uses of ammonia
4.1.11 Illustrate any one method for the manufacture of calcium cyanamide
4.1.12 State any two properties and two uses of calcium cyanamide

4.2.0 Comprehend the chemistry of phosphorous and its compounds

4.2.1 Name two ores of phosphorous
4.2.2 Describe the manufacture of phosphorous from phosphorite
4.2.3 Name the allotropic modifications of phosphorus
4.2.4 List any three uses of phosphorous
4.2.5 Describe the preparation of phosphorous pentoxide from phosphorous
4.2.6 Explain with equations how phosphorous pentoxide reacts with :- Water, Sulphuric acid, Nitric acid
4.2.7 List any two used of phosphorus pentoxide
4.2.8 Describe the preparation of orthophosphoric acid from phosphorous penntachloride
4.2.9 Describe what happens when orthophosphoric acid is heated
4.2.10 State the products obtained when orthophosphoric acid reacts with NaOH
4.2.11 List any two uses of orthophosphoric acid

4.3 Oxygen

4.3.0 Comprehend the chemistry of oxygen

4.3.1 Describe the manufacture of oxygen by Linde's process
4.3.2 Describe the oxidizing property of oxygen with three examples
4.3.3 State two uses of oxygen
4.3.4 Illustrate the nature of the following types of oxides with an example for each:- Acidic oxide, Basic oxide, Amphoteric oxide, Neutral oxide, Peroxide, Compound oxide

4.4.0 Understand the chemistry of water

4.4.1 Illustrate the meaning of water of hydration with the following examples:- Crystalline Copper Sulphate, Barium Chloride
4.4.2 Explain how hydrogen bonding in water influences its properties
4.4.3 Describe the preparation of heavy water by continued electrolysis of water
4.4.4 State two uses of heavy water
4.4.5 Explain how heavy hydrogen can be prepared by electrolytic process
4.4.6 State two uses of heavy water

4.5.0 Comprehend the chemistry of hydrogen peroxide

4.5.1 Describe the electrolytic method of manufacture of hydrogen peroxide
4.5.2 Illustrating the method of expressing the strength of hydrogen peroxide solution
4.5.3 Problems based on the above concept
4.5.4 Illustrate the following properties of H2O2 with two examples for each:- Oxidizing properties, Reducing properties, Acidic properties
4.5.5 State four uses of hydrogen peroxide

4.6.0 Comprehend the chemistry of ozone

4.6.1 Describe the manufacture of ozone oby Siemen-Maiske ozoniser
4.6.2 Explain how ozone oxidizes: -Lead sulphide, Potassium iodide solution, Bright silver foil, Mercury and Acidified potassium permanganate solution
4.6.3 Describe the addition reaction of ozone with an example
4.6.4 State two uses of ozone
4.6.5 Differentiate between ozone and H2O2 (any three differences)

4.7.0 Comprehend the chemistry of hydrogen sulphide

4.7.1 Describe the laboratory preparation of H2S from ferrous sulphide
4.7.2 Describe the reducing action of H2S with four examples
4.7.3 Explain how H2S reacts with mercury salts, copper salts and lead salts in acid medium and zinc and manganese salts in alkaline medium
4.7.4 Explain how H2S can be used as an analytical reagent for
(1) Classification of metals into groups and
(2) Identification of metals
4.7.5 State any two uses of H2S

4.8.0 Understand the chemistry of sulphuric acid

4.8.1 Describe the contact process for the manufacture of sulphuric acid
4.8.2 Explain the following properties of sulphuric acid with two examples:- acidic property, oxidizing property, dehydrating property
4.8.3 State two uses of sulphuric acid

4.9.0 Comprehend the chemistry of sodium sulphate

4.9.1 Describe the method of preparation of sodium sulphate from washing soda
4.9.2 State two uses of sodium sulphate

4.10.0 Comprehend the chemistry of sodium thiosulphate

4.10.1 Describe the preparation of sodium thiosulphate
4.10.2 Explain the action of heat on sodium thiosulphate
4.10.3 Explain how sodium thiosulphate reacts with the following compounds: Dil. Sulphuric acid, Chlorine water, Bromine water, Silver bromide, Silver nitrate
4.10.4 State any two uses of sodium thiosulphate

<u>UNIT – V: p</u> BLOCK ELEMENTS (VIIA) & d BLOCK ELEMENTS

5.1.0 Comprehend the chemistry of fluorine and its compounds

5.1.1 Describe the manufacture of fluorine by whytlaw Grery's method
5.1.2 State any four special properties of fluorine which are not exhibited by other halogens
5.1.3 Explain how fluorine is highly reactive
5.1.4 Describe the reaction of fluorine with :- Water, Metals, Non metals, Other hydrogen halide
5.1.5 State any two uses of fluorine
5.1.6 Give a method for preparing hydrogen fluoride
5.1.7 Explain why hydrogen fluoride is not stored in glass vessels
5.1.8 State any two uses of hydrogen fluoride
5.1.9 Explain how fluorocarbon are formed with carbon tetra fluoride as an example
5.1.10 State any two uses of fluorocarbon

5.2.0 Comprehend the chemistry of chlorine and its compounds

5.2.1 Describe the method of manufacture of chlorine by electrolytic process
5.2.2 Describe the reaction of chlorine with:- Zn, Co, Ethylene, Sulphur, Methane, Water
5.2.3 State any two uses of chlorine
5.2.4 Describe the manufacture of hydrochloric acid by synthesis
5.2.5 Describe the manufacture of potassium chlorate
5.2.6 State any two uses of potassium chlorate
5.2.7 Describe the manufacture of sodium hypochlorite by electrolytic process
5.2.8 State any two uses of sodium hypochlorite

5.3.0 Comprehend the chemistry of potassium bromide

5.3.1 Describe the manufacture of potassium bromide
5.3.2 Explain how KBr reacts with (1) silver nitrate (2) Cone. H_2SO_4 and lead nitrate
5.3.3 State any two uses of potassium bromide

5.4.0 Comprehend the distinguishing features of fluoride, chloride, bromide and iodide

5.4.1 Compare the reactions of fluorides, chlorides, bromides and iodides with: - Conc. H_2SO_4 and $AgNO_3$

5.5.0 Know the nature of interhalogen compounds

5.5.1 State how interhalogen compounds are formed
5.5.2 State two examples each for interhalogen compounds of the following types
AX, AX_3, AX_5, AX_7

5.6 d-Block elements

5.6.0 Comprehend the chemistry of chromium and its compounds

5.6.1 Name two ores of chromium
5.6.2 Describe the extraction of chromium from chromite by thermite process
5.6.3 List any two uses of chromium
5.6.4 State the composition and specific use of the following alloys of chromium:- Stainless steel, Stellite
5.6.5 Describe two methods of testing chromium
5.6.6 Describe the preparation of potassium dichromate from chrome-iron ore
5.6.7 Illustrate with equation the oxidizing reaction of acidified $K_2Cr_2O_7$ with the following:-
Ferrous sulphate, Sulphur dioxide
5.6.8 List two uses of $K_2Cr_2O_7$
5.6.9 Describe the preparation of chrome alum from potassium dichromate
5.6.10 List two uses of chrome alum

5.7.0 Comprehend the chemistry of Manganese and its compounds

5.7.1 Name two ores of manganese
5.7.2 Describe the extraction of Manganese by alumino thermite process
5.7.3 List any two uses of Manganese
5.7.4 State the composition, characteristic property and uses of the following alloys:- Manganese Bronze, Manganese
5.7.5 Describe any two methods of lesting manganese
5.7.6 Describe the preparation of MnO_2 from Manganous nitrate
5.7.7 List two uses of Manganese dioxide

5.7.8 Describe the preparation of potassium permanganate from purolisite
5.7.9 Describe the oxidizing action of KmnO4 on the following :- Potassium iodide, Oxalic acid sulphate dioxide
5.7.10 List two uses of Potassium permanganate

5.8.0 Comprehend the chemistry of iron and its compounds

5.8.1 Distinguish between cast iron, wrought iron and steel
5.8.2 Give the composition and uses of any four alloy steels
5.8.3 Describe one test for distinguishing Ferrous salts and ferric salts
5.8.4 Describe the preparation of Mohr's salt from Ammonium sulphate and Ferrous sulphate
5.8.5 Illustrate the reducing action of Mohr's salt on: Acid KmnO4, Acid K2Cr2O7
5.8.6 List any two uses of Mohr's salt
5.8.7 Describe the preparation of Ferric Ammonium alum from Ammonium Sulphate and Ferric Sulphate
5.8.8 List two uses of ferric ammonium alum
5.8.9 Describe the chemical principles involved in the preparation of blue prints

CONTENT DETAILS

UNIT – I: GENERAL CHEMISTRY, AVOGADRO'S HYPOTHESIS, REDOX REACTION, AND LAWS OF CHEMICAL COMBINATION

Laws of conservation of mass – Law of definite proportions – Law of multiple proportions - Law of reciprocal proportions – Gay Lussac's law of gaseous volumes - Problems based on the above laws.

Equivalent Weight:

Equivalent weight of elements – methods of determination of equivalent weights by the following methods and problems based on that :- Hydrogen displacement method, Oxide method, Chloride method, Metal displacement method

Dulong and Petit's Law. Its application in the determination of atomic weight of elements. Problems based on the above-mentioned method of determination of atomic weight.

Avogadro's Hypothesis:

Avogadro's Hypothesis and its application. Relationship between molecular weight and vapour density. (Derivation not required).

Atomic and Molecular Mass, Mole concept., Mole and gram Atomic mass, Mole and gram molecular mass, gram molecular volume. Problems based on mole concept.

Redox reactions:

Ionic equations of redox reactions. Balancing ionic equations by ion electron method – Illustration with respect to the following reaction.

1. $MnO_4^- + Fe^{2+}$ ----------$Mn^{2+} + Fe^{3+}$
2. $MnO_4^- + (COOH)_2$ ---------- $Co_2 + Mn^{2+}$
3. $Cr_2O_7^{2-} + I^-$ --------- $Cr^{3+} + I_2$

UNIT – II: PERIODICITY IN PROPERTIES, CHEMICAL BONDING, NUCLEAR CHEMISTRY

Introduction to chemical bonding (Ionic bond or electrovalent bond) covalent bond, co-ordinate covalent bond, concept of hybridization (Carbon compounds), shapes of molecules, VSEPR theory.

NUCLEAR CHEMISTRY.

Natural Radio – activity:

Definition of Natural Radioactivity – Types of radiations – properties of rays – Disintegration Theory – Group displacement Law – Radioactive series – Decay constant. Half-life period. Simple problems based on the relation between Half-life period. Simple problems based on the relation between Half-life period and decay constant;

Artificial Radioactivity:

Artificial transmutation. Production of radioisotopes – uses of radioisotopes. C14 dating. Simple problems based on C14 dating.

NUCLEAR REACTIONS.

Nuclear fission, Nuclear fusion, Principle of atom bomb, Principle of hydrogen bomb.

Periodic table, Periodic properties: Atomic and ionic radii, Ionization potential, Electron affinity, Electro negativity

UNIT – III: S & P BLOCK ELEMENTS. (IIIA & IV A GROUPS)

Compounds of alkali metals:

Preparation of Lithium Aluminium Hydride from ashydrons AICT3 and Lithium hydride – Reducing properties of Lithium Aluminium Hydride – uses of Lithium Aluminium Hydride – Manufacture of NaOH by electrolute process, properties of NaOH – Uses of Hydroxide – Preparation of Sodium Peroxide from Sodium – Oxidizing Properties of Sodium Peroxide – Uses of Sodium Peroxide – Manufacture of Potassium Iodide – Properties of Potassium Iodide – Uses of Potassium Iodide.

Magnesium:

Ores – Extraction of Magnesium by the electrolysis of fused carnallite – uses – Alloys of Magnesium.

Compounds of alkaline earth metals

Preparation, properties and uses of the following compounds

Epsom salt, Calcium Carbide, Plaster of Paris, Bleaching powder, BaCl2

Boron:

Occurrence – Manufacture – Properties uses – preparation, properties and uses of Orthoboric acid and borax

Carbon and its compounds:

Carbon – Electronic configuration and characteristics of carbon atom. Different types of carbon bonds – Allotropes of carbon, manufacture of graphite. Manufacture of carbon monoxide – properties and uses of carbon monoxide and carbon dioxide – general properties of carbonates and bicarbonates – formation and characteristic properties of Aluminium Carbide and Silicon Carbide.

Silicon and its Compounds:

Commercial preparation of silicon – characteristic properties and uses of silicon – silicates – preparation and uses of sodium silicate

Alloys and compounds of Tin & Lead:

Alloys of Tin – Tinning – Tinplating – Preparation, Characteristics, properties and uses of the following compounds:

Stannous Chloride, Lead Monoxide, Lead Dioxide, Basic Lead Carbonate and Lead Tetra Ethyl, tests for Stannous and Stannic Tin. Alloys of lead, Tests for lead. Compounds of Nitrogen.

UNIT – IV: P BLOCK ELEMENTS (V A & VI A GROUPS)

Nitrogenous fertilizers – Manufacture of nitric acid by Birkeland Eyde process – Ostwald's process – Action of nitric acid on metals, wood, sulphur, iodine, potassium iodide, sulphur dioxide and ferrous sulphate – uses of nitric acid – Haber process for manufacture of ammonia – Manufacture of calcium cynamide, properties and uses.

Phosphorus and its compounds:

Occurrence, allotropi modifications of phosphorous, uses of phosphorus – preparation, properties and uses of phosphorous pentoxide and orthoboric acid.

Oxygen and compounds of group VI A elements:

Oxygen – Manufacture of oxygen by Linde's process – properties and uses of oxygen – classification of oxides into (i) Basic oxide (ii) Acidic oxides (iii) amphoteric oxide (iv) neutral oxides (v) peroxides (vi) compound oxides water –

Water of hydration, example crystalline copper sulphate and Barium chloride – Hydrogen bonding in water – Preparation of heavy water. Preparations of heavy hydrogen by electrolyzing heavy water – uses of heavy water.

Hydrogen Peroxide:

Manufacture of hydrogen peroxide by electrolysis of 50% H2SO4 volume strength of hydrogen peroxide solution – problems based on the above concept properties and uses of hydrogen peroxide.

Ozone:

Manufacture of Ozone by Siemen – Maiske ozoniser – Properties and uses of ozone – Differences between ozone and Hydrogen peroxide.

Hydrogen Sulphade:

Preparation of hydrogen sulphade from ferrous sulphade – properties of hydrogen sulphade – hydrogen sulphade as an analytical reagent – uses of H2S.

Sulphuricacid:

Manufacture of sulphuric acid by contact process. Properties and uses of H2SO4.

Sodium Sulphate:

Preparation, properties and uses of sodium sulphate

Sodium thiosulphate:

Preparation, properties and uses of sodium thiosulphate

UNIT – V: p BLOCK ELEMENTS (VIIA) & d BLOCK ELEMENTS

Fluorine and its compounds – Manufacture of fluorine by Whytien Greey's method – Properties and uses of fluorine – Preparation, properties and uses of hydrogen fluoride – fluoro carbons – uses of fluoro carbons. Chlorine and its compounds – Manufacture of Chlorine by electrolytic process, Properties and uses of Chlorine – Manufacture of hydrochloric acid, Potassium Chlorate, Sodium hypochlorite – uses of potassium chloride and sodium hypochlorite.

Potassium Bromide:

Manufacture, properties and uses of potassium bromide.

Comparative study of the general properties of Fluoride, Chloride, Bromide and Iodide – Reaction with conc. H2SO4, Reaction with AgNO3.

Interhalogen compounds:

Formation of interhalogen compounds. Transition elements.

Chromium – Ores of Chromium – Extraction of Chromium from Chromite uses of chromium – Alloys of chromium – Tests for chromium. Compounds of chromium – preparation, properties & uses of potassium dichromite and chrome alum.

Manganese – Ores or Manganese – Extraction of Manganese by Alumino thermite process – uses of Manganese – Alloys of Manganese. Test for Manganese.

Compounds of Manganese – Preparation, Properties and uses of Manganese dioxide and potassium permanganate Iron – Differences between cast iron, wrought iron and steel, alloy steels & its uses, distinguishing tests between ferrous and ferric salts.

Compounds of Iron – Preparation, Properties and uses of Ferrous Ammonium Sulphate (Mohr's salt), Ferric Ammonium Sulphate – Chemical Principles involved in the preparation of blue prints.

REFERENCE BOOKS

1. Soni P.L. : Text Book of Inorganic Chemistry - S.Chand & Co., New Delhi
2. Puri B.L. & Sharma L.R : Text Book of Inorganic Chemistry
3. Khanna J.K : Inorganic Chemistry - Rajhans Prakashan, Mandir, Meerut, UP
4. Linus Paulinj : General Chemistry - Fether & Sumons Pvt. Ltd., Bombay (India Edition)

SUBJECT TITLE : APPLIED SCIENCE LAB - PHYSICS
SUBJECT CODE : GE 106 A
PERIODS/WEEK : 2
PERIODS/YEAR : 64

LIST OF PRACTICAL EXPERIMENTS – PHYSICS

1. Vernier Calipers
2. Screw Gauge
3. Common balance
4. Simple Pendulum
5. Hooke's law
6. Moment bar
7. Inclined Plane
8. Concurrent forces (Mass of the body)
9. Hare's apparatus
10. U-tube
11. Quill tube
12. Resonance column
13. Diode Characteristics
14. Convex lens
15. Ohm's law

SUBJECT TITLE : APPLIED SCIENCE LAB – CHEMISTRY
SUBJECT CODE : GE 106 B
PERIODS/WEEK : 2
PERIODS/YEAR : 64

OBJECTIVES

I. VOLUMETRIC ANALYSIS

1.1 Acidimetry Alkalimetry

1.1.a Determine the strength of the given hydrochloric and solution using a standard solution of sodium hydroxide and calculate the amount of HCI in a given volume

1.1.b Determine the strength of given sulphuric acid solution using a standard solution of sodium carbonate. Calculate the amount of sulphuric acid and in a given volume

1.1.c Determine the strength of given sodium hydroxide solution given a standard solution of sodium carbonate using a link solution sulphuric acid/hydrochloric acid. Calculate the amount of sodium hydroxide in a given volume

1.1.d Determine the strength of given nitric acid solution given a standard solution of oxalic acid using link solution sodium hydroxide/potassium hydroxide. Calculate the amount of nitric acid in a given volume.

1.2 Permanganometry

1.2.a Determine the strength of given potassium permanganate solution using a standard solution of ferrous ammonium sulphate

1.2.b Determine the strength and calculate the amount of crystalline ferrous solution

1.3 Hardness estimation

1.3.a Determine the degree of hardness of a given sample of hard water using a standard solution of EDTA.

II. pH DETERMINATION

2.1.1 Determine the pH of three different solutions using pH meter
2.1.2 Determine the pH value of three different solutions using universal indicator
2.1.3 Determine the pH value of three different solutions using pH test paper

III. PREPARATION OF STANDARD SOLUTIONS

3.1.1 Weigh accurately a crystalline substance using a chemical balance
3.1.2 Prepare a standard solution of sodium carbonate by weighting out accurately solid sodium carbonate and making it into a definite volume
3.1.3 Prepare a standard solution of oxalic acid when oxalic acid crystals are given.

CONTENT DETAILS

I. VOLUMETRIC ANALYSIS

1.1 Acidimetry Alkalimetry
   a) Estimation of Hydrochloric acid
   b) Estimation of Sulphuric acid
   c) Estimation of Sodium hydroxide given standard sodium carbonate solution
   d) Estimation of Nitric acid given standard sulphuric acid solution

1.2 Permanganometry
1.3 Estimation of potassium permanganate
1.4 Estimation of crystalline ferrous sulphate
1.5 Estimation of sodium hydroxide, given standard ferrous salt solution

1.3 Hardness estimation
Estimation of total hardness of water – using standard EDTA solution

II. pH DETERMINATION

2.1 Determination of pH using pH meter
2.2 Determination of pH using universal indicator, pH test paper.
2.3 Determination of pH using pH test paper.

III. PREPARATION OF STANDARD SOLUTION

3.1 Preparation of a standard solution of sodium carbonates
3.2 Preparation of a standard solution of oxalic acid

REFERENCE BOOKS

A.O. Thomas & Mani Practical Chemistry for B.Sc. main

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SUBJECT TITLE : INORGANIC CHEMISTRY LABORTORY
SUBJECT CODE : CH 102
PERIODS/WEEK : 4
PERIODS/YEAR : 128

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Study of Reactions of Acid Radicals	8
	Test - I	4
II	Study of Reactions of Basic Radicals	8
	Test - II	4
III	Analysis of Simple Salts	12
	Test - III	4
IV	Analysis of Binary Mixture containing two Anions & two Calions	84
	Test - IV	4
	Total	128

CONTENT DETAILS

UNIT – I: STUDY OF THE REACTIONS OF THE ACID RADICALS

Carbonate, Sulphide, Sulphite, Sulphate, Thiosulphate, Nitrate, Fluoride, Chloride, Bromide Todide, Acetate, Oxalate, Phosphate, Borate and Chromate.

UNIT – II: STUDY OF REACTIONS OF THE BASIC RADICALS

Silver, Lead, Mercury, Copper, Cadmium, Bismuth, Arsenic, Antimony, Tin, Iron, Aluminium, Chromium, Cobalt, Nickel, Zinc, Manganese, Calcium, Barium, Stroutinous, Magnesium, Sodium, Potassium, Ammonium and Magnesium.

UNIT - III: ANALYSIS OF THE SIMPLE SALTS (minimum of 3 salts)

The salts given for qualitative analysis should: -

1. be soluble in water or dilute acids or conc. HCl
2. contain one acid radical and one basic radical
3. not involve elimination of interfering acid radicals

UNIT – IV: ANALYSIS OF BINARY MIXTURES

The mixture given for qualitative analysis should

1. be soluble the water, dilute acids or conc. HCl
2. contain two acids and two basic radicals
3. not involve elimination of interfering – acid radicals

REFERENCE BOOK

1. Practical Chemistry for B.Sc. Main – Shri. A.O.Thomas

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SUBJECT TITLE : WORKSHOP PRACTICE
SUBJECT CODE : CH 103
PERIODS/WEEK : 3
PERIODS/YEAR : 96

TIME SCHEDULE

UNIT	TOPICS	PERIODS
I	Carpentry	20
II	Fitting shop	20
III	Sheet Metal Work	10
IV	Gas and Electric Welding	10
V	Basic Machine Operations	30
	Test	6
	TOTAL	**96**

OBJECTIVES

Upon completion of the course of study, the student should be able to:

1.0 Perform various exercises as per the given drawing and specifications
1.1 Identify the required tools from a given number of tools
1.2 Select particular tool for a specified operation
1.3 Locate the functional part of equipments and tools
1.4 Explain the use of tools and equipment
1.5 Prepare the edges/work piece as per drawing standard
1.6 Set up the job as per the procedures of operation
1.7 Perform various steps as per the procedure
1.8 Inspect the job for achievement of accuracy and finish
1.9 Clean the tools, instruments and work place
1.10 Return the tools, instrument as per regulations
1.11 Exhibit safety precautions

CONTENT DETAILS

UNIT – I: CARPENTRY

Marking and Measuring Tools:

Straight edge, metre square, tri-square, bevel square, combination square, marking knife, marking gauge, wing compass, trammel divider, outside and inside calipers, spirit level, plumb bob.

Cutting Tools

Rip saw, cross cut saw, panel saw, tenon saw, firmer chisel, beveled edge firmer chisel, mortise chisel, paring chisel, jack plane

Striking Tools

Claw hammer, waring tow hammer, mallet

Miscellaneous Tools

Rasp and file scraper, oil stove, glass paper, ratchet and cabinet type screwdrivers

Timber: Structure of wood, grain of wood, Classification of timber (soft and hard).

Defects in timber – natural, fungi, insects, manufacturing and seasoning of timber.

Air, water, chemical, electrical and kiln methods

Exercise

1. Marking, Sawing, Planing, Chiseling, Grooving types
2. Preparation of carpentry joints

Holding Devices
Bench vice, Bench stop, Bench hold fast, G-clamp

UNIT – II: FITTING

Marking Tools:
Scribers, compass divider, outside and inside calipers, center punch, tri-square bevel square, straight edge, surface plate, v - block.

Cutting Tools:
Chisel, flat, cross-cut, half round, diamond side, files – single cut and double cut, rough, bastard, second cut, smooth and dead smooth files, square pillar, round triangular half – round, knife and needle files.
Scrappers – flat, triangular and half round
Hacksaw – solid and adjustable frames, blades, cutting with power hacksaw

Striking Tools:
Ball pein, straight pein, cross pein and double head hammers

Holding devices:
Vice – Bench, leg-pipe, hand, pin and toolmakers vice

Miscellaneous Tools:
Screw driver, plane spanner, and double end spanner. Adjustable box spanner

Exercise

1. Cutting, Chipping, Filling, Scrapping, Drilling
2. Preparation of joints
3. Marking, measuring and checking instrument to be used during the above working

UNIT – III: SHEET METAL
Metals used for sheet metal work, Gauge tool kit, Sheer snips cutter, notches

Exercise
Hem seam, Rolling and forming operations, Bedding and cramping, Pipe bending, riveting, soldering and spot-welding

UNIT – IV: GAS & ELECTRIC WELDING
Oxy – Acetylene welding, Electric welding, Major advantages and limitations, Safety precautions Welding procedure, Filler and flux, Preparation of job for gas welding, Gas welding practice
Electric Arc welding: Principle, advantages and limitations, safety precautions and work habits.
Electrodes – types on parent metal coding of electrodes, Welding procedure.

Exercise
Work preparation and welding operation

UNIT – V: BASIC MACHINE OPERATIONS

Lathe – types, works and tool holding devices.
Cutting tools, materials and specification, coolants
Speed and feed for :- Cast Iron, Mild steel, Alloy steel, Brass and Aluminium

Exercise
Alignment, Cylindrical and taper operation. Threading operation.

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER III

Branch : Chemical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
CH 301	General Engineering	5		5	75		25	100
CH 302	Organic & Physical Chemistry	5		5	75		25	100
CH 303	Fluid Mechanics	5		5	75		25	100
CH 304	Polymer Technology	5		5	75		25	100
CH 305	Chemical Engg. Drawing-I		4	4		75	25	100
CH 306	Computer Application Lab		4	4		75	25	100
CH 307	Chemistry Laboratory		4	4		75	25	100
	ISAP Skills Development		3	3				
	TOTAL	20	15	35	300	225	175	700

ISAP: - Information Search Analysis and Presentation

SUBJECT TITLE : GENERAL ENGINEERING
SUBJECT CODE : CH 301
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Properties of Steam & Boilers		18
		Test - I	2
II	Steam Turbines & I.C. Engines		18
		Test - II	2
III	Basic Electronic Circuits & Fundamentals		16
		Test - III	2
IV	Motor and Transformers		18
		Test - IV	2
V	Basic Electronics		16
		Test - V	2
		Total	**96**

OBJECTIVES
Mechanical Engineering

UNIT – I

1.1.0 Understand the various properties of steam

1.1.1 Explain the formation of steam under constant pressure
1.1.2 Discuss the effect of pressure on temperature
1.1.3 Distinguish the wet steam, dry steam and super heated steam
1.1.4 Explain the properties of steam such as sensible heat, latent heat, total heat of steam, superheat and dryness fractions

1.2.0 Appreciate the working of steam boilers

1.2.1 Define a boiler
1.2.2 Explain the functions of a boiler
1.2.3 Distinguish between fire tube boiler and water tube boiler
1.2.4 Distinguish between low pressure boiler and high pressure boiler
1.2.5 Describe with line diagram the construction and working of a Cochran boiler, Babcock and Wilcox boiler and La Mont boiler
1.2.6 Compare the smoke tube and water tube boiler
1.2.7 Write the specification of a boiler
1.2.8 State the function of boiler mountings such as stop valve, safety valve, water level indicator, pressure gauge and fusible plug etc. with line sketches.
1.2.9 Explain the functions of boiler accessories such as economizer, feed pump, super heater and air preheater etc. with simple sketch
1.2.10 Explain the developments such as draft, natural draft, induced draft, forced draft and balanced draft

UNIT – II

2.1.0 Appreciate the working of Steam Turbines and I.C. Engines

2.1.1 State the functions of steam turbines
2.1.2 Explain the working principle of impulse and reaction turbines
2.1.3 Identify the important parts of steam turbines such as fixed, moving blades and nozzles

2.1.4 Define an I.C. Engine
2.1.5 Explain the working principle of two stroke and four stroke cycle engines
2.1.6 Explain the working of petrol engine and diesel engine.
2.1.7 Identify the various parts and explain their functions
2.1.8 Compare the two stroke cycle and four stroke cycle engine
2.1.9 Compare the petrol engine and diesel engines

2.2.0 Appreciate the uses of Power Transmission Devices

2.2.1 State the application of belt drive
2.2.2 Classify the various types of belt drives
2.2.3 Explain with sketch, the stepped cone pulley and jockey pulley
2.2.4 Explain the function of belt fasteners
2.2.5 State the application of chain and sprocket drive
2.2.6 Identify the different types of gear wheels such as spur, helical & bevel gears.

Electrical Engineering

UNIT – III

Basic DC circuits & AC fundamentals

3.1.0 Understand the basic electronic circuits

3.1.1 Classify conductors, insulators and semi conductors
3.1.2 Define current, voltage and resistance and mention its units
3.1.3 State the law of resistance
3.1.4 State Faraday's law of electromagnetic induction
3.1.5 Explain the principle of generation of AC voltage and circuits
3.1.6 Define cycle, frequency and time period
3.1.7 Describe the constructional details of DC machines
3.1.8 List the application of DC machines
3.1.9 Describe the constructional details of AC generators

UNIT – IV

4.1.0 Appreciate the construction of motor

4.1.1 Explain the working principle of 3-phase induction motor
4.1.2 List the application of 3-phase induction motors
4.1.3 Outline the advantage of electric heating
4.1.4 Explain the working of electric over
4.1.5 List the types of induction furnaces
4.1.6 Describe the dielectric heating
4.1.7 Mention the advantage of dielectric heating

4.2.0 Understand the working of transformers

4.2.1 Explain the working principles of single phase transformers
4.2.2 Classify according to core construction
4.2.3 Stat the working principle of autotransformer
4.2.4 List the applications of auto transformer

UNIT – V

5.1.0 Understand the characteristics of Electronic Components and Transistor

5.1.1 Mention the types of electron emission
5.1.2 Classify the resistors
5.1.3 Identity resistors using colour code
5.1.4 Explain the working of P-type and N-type semi conductors
5.1.5 Draw the VI characteristics of diode
5.1.6 Draw the circuit diagram of half wave and full wave rectifier
5.1.7 Draw the circuit diagram of common base, common collector and common emitor configuration
5.1.8 Explain the parts of CRO using suitable block diagram
5.1.9 Describe the applications of CRO

5.1.10 Sketch the circuit diagram of speed control of AC and DC motors
5.1.11 Explain the architecture of common microprocessors
5.1.12 List the important applications of microprocessors

CONTENT DETAILS
Mechanical Engineering

UNIT – I: PROPERTIES OF STEAM & BOILERS

Properties of steam – Explanation of properties of steam such as total heat of water, latent heat, total heat of steam, super heat, dryness fraction. Function of boilers – classification – working principle – fire tube and water tube boilers – package type boilers – boiler mountings – accessories.

UNIT – II: STEAM TURBINES & I.C. ENGINES

Impulse and Reaction turbines – Working principle. Identification of important parts of steam turbine – two stroke and four stroke cycle engines – working principle. Diesel and Petrol engines – working principle – various parts. Compare two stroke cycle and four stroke cycle - compare petrol engine and diesel engine. Indicated power – brake power – mechanical efficiency. Belt chain and Gear wheels – open and cross belt – types of pulleys – gear and their types.

UNIT – III: BASIC ELECTRIC CIRCUITS & FUNDAMENTALS

Basic DC circuits – define current, voltage, resistance. Faraday's law – cycle, frequency and time. Constructional details of AC Generators

UNIT – IV: MOTORS & TRANSFORMERS

Working Principle and application of 3-phase induction motors – Electric oven – induction furnace – electric heating. Transformers - principle – classification, auto transformer – principle and application.

UNIT – V: BASIC ELECTRONICS

Transistors – classification – components. Resistors classification – components. Semi conductors – P-type and N-type. Diode – characteristics – circuit diagram of full wave and half wave rectifiers – common collectors – common emitters.– advantages. CRO – parts – application – Microprocessor – architecture - application.

REFFERENCE BOOKS :

1.Electrical Technology Vol. & Vol. II	B.L. THERAJA
2.Basic Electrical and Electronics	B.L. THERAJA
3.Electrical and Electronics	B.L. THERAJA
4.Electrical and Electronics Measurements	SAUHNEY
5.Electrical Power	J.B.GUPTA
6.Industrial Electronics	G.K.MITHAL

SUBJECT TITLE : ORGANIC AND PHYSICAL CHEMISTRY
SUBJECT CODE : CH 302
PERIODS/WEEK : 5
PERIODS/SEMETER : 80

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Introduction to Organic Chemistry	7
	1.2 Hydrocarbons and their derivatives	9
	Test	2
II	2.1 halogen derivatives	8
	2.2 Organic Compounds containing Oxygen and Nitrogen	7
	Test	2
III	Carbohydrates, Proteins, Dyes, Petroleum and soap	9
	Test	2
IV	4.1 Gaseous state, Liquid state, Dilute solution	10
	4.1 Phase equilibrium,	10
	Test	2
V	5.1 Chemical kinetics and Equilibiria, Electro Chemistry	10
	Test	2
	Total	**80**

OBJECTIVES

UNIT – I

1.1.0 Understand the methods of purification of organic compounds
- 1.1.1 Describe the purification of organic solids by crystallization and sublimation with examples
- 1.1.2 Describe the purification of organic liquids by distillation and chromatography with examples
- 1.1.3 Outline the method of purification of organic mixture by column chromatography, gas chromatography, thin layer chromatography
- 1.1.4 Explain how the purity of organic compounds tested

1.2.0 Comprehend the methods of analysis of organic compounds
- 1.2.1 Describe any one test that can be used for detecting the following elements
  a. Hydrogen b. Carbon c. Nitrogen d. Halogens e. Sulphur
- 1.2.2 Describe the following experiments used for the estimation of the specified elements: Hydrogen and carbon by combustion method, Nitrogen by Dumas method, Halogen by caries method, Sulphur by carries method
- 1.2.3 Solve problems based on the above methods of estimation

1.3.0 Elucidate the molecular formula of organic compounds
- 1.3.1 Define empirical formulae
- 1.3.2 Find the empirical formulae from the given percentage composition
- 1.3.3 Define the molecular formulae
- 1.3.4 Find the molecular from the given empirical formulae and molecular net/vapour density

1.3.5 Define structural formulae

1.3.6 Describe the shape of the following molecules in terms of hybridization
a. Methane b. Ethane c. Ethyne d. Benzene

1.3.7 Draw the conformations of the following molecules
a. Ethane b. Ethylene dichloride c. Benzene

1.4.0 Understand the classification of organic compounds

1.4.1 Classify the given organic compound on the basics of functional group

1.4.2 Illustrate 'Homologous series' with examples

1.4.3 Name any five homologous series

1.5.0 Comprehend the different types of Isomerism

1.5.1 Define Isomerism

1.5.2 Illustrate the following classes of structural isomerism with an example for each
a. Chain isomerism b. Functional group isomerism
c. Position isomerism d. Metamerism

1.5.3 Illustrate stereo isomerism by using examples
a. Geometrical isomerism exhibited by Maleic acid and fumaric acid
b. Optical isomerism exhibited by lactic acid and tartaric acid

1.6.0 Understand the methods of preparation of Hydrocarbons

1.6.1 Name the first members of the alkane, alkene and alkyne series using I.U.P.A.C system

1.6.2 Describe one method for the preparation of the following hydrocarbons – methane, ethane, Ethylene, Acetylene, Benzene, Toluene, naphthalene and anthracene

1.6.3 Explain the synthesis of Ethyne from its elements

1.6.4 To know at least three properties of the following hydrocarbons – methane, ethane, ethylene, Acetylene, benzene, Toluene, naphthalene & anthracine

1.6.5 List any three uses of the following hydrocarbons methane, ethane, ethylene, acetylene, benzene, toluene, naphthalene and anthracine

UNIT –II

2.1.0Comprehend the chemistry of halogen derivations of hydrocarbons

2.1.1 Describe the nomenclature

2.1.2 Explain any one method of preparation and at least three properties of the following

2.1.3 halogen derivatives – chloroform, iodoform, carbon tetrachloride, chlorobenzene and benzyl chloride.

2.1.4 Explain the uses of the following halogen derivatives – chloroform – iodoform, carbon tetrachloride, chlorobenzene and benzyl chloride.

2.2.0 Comprehend the methods of preparation, uses and properties of organic compounds containing oxygen and nitrogen. Explain the methods of preparation, properties and uses of the following alcohols – Methyl alcohol,Ethyl alcohol

2.1.1 Explain the methods of preparation, properties and uses of the following aliphatic aldehydes and ketones – formaldehyde, acetaldehyde and acetone

2.1.2 Explain the method of preparation – uses and properties of the acids – formic acid and acetic acid

2.1.3 Explain the esterification of acetic acid with ethyl alcohol and the important properties and uses

2.1.4 Explain the method for preparing Ether and to know the important precautions and uses of ether

2.1.5 Describe the chemistry of nitro ethane, ethyl amine nitrobenzene and aniline

2.1.6 Describe the chemistry of phenol and benzoic acid

2.1.7 Explain the method of preparation, properties and uses of benzaldehyde, benzophenone and ethyl benzoate

2.1.8 Describe the chemistry of the following amides- urea and benzamide

2.1.9 Describe the properties and uses of glucose and fructose

2.1.10 Describe the structure of glucose and fructose

2.1.11 Outline the general nature of sucrose, starch and cellulose

2.2.0 Comprehend the chemistry of Amino Acids and Proteins

2.2.1 Classify amino acids
2.2.2 Explain properties of amino acids
2.2.3 Describe the preparation and properties of peptides
2.2.4 Classify biological functions and test for proteins
2.2.5 Categorize different types of dyes – azo dyes and vat dyes – and methods of application of dyes

UNIT. III

3.1.0 Comprehend the behaviour of gaseous state

3.1.1 State the possibilities of kinetic theory
3.1.2 State the relation between pressure volume and velocity of gases
3.1.3 Describe Boyle's law and Charle's law in terms of Kinetic theory
3.1.4 Derive the ideal gas equation PV=nRT
3.1.5 Calculate the values of universal gas constant in different units
3.1.6 Distinguish between real gases and ideal gases
3.1.7 Describe the causes of deviation of real gases from ideal behaviour
3.1.8 Explain the real gas behaviour by Van der Waals equation of state
3.1.9 State Avogadro's hypothesis
3.1.10 State Graham's law of diffusion

3.2.0 Comprehend the behaviour of Liquid state

3.2.1 Explain the conditions necessary for liquefaction of gases
3.2.2 Define critical constants and describe how critical constants are experimentally determined
3.2.3 Define vapour pressure
3.2.4 Describe the following methods for the determination of vapour pressure
3.2.5 Explain the relation between vapour pressure and boiling point of a liquid

Comprehend the behaviour of dilute solutions

3.2.6 Illustrate the meaning of colligative property
3.2.7 Describe the determination of osmotic pressure by:
1.Berkley and Hartley's method
3.2.8 Define the law of osmotic pressure
3.2.9 Explain the significance of isotonic solutions
3.2.10 Describe the phenomenon of abnormal osmotic pressure
3.2.11 Explain the lowering of vapour pressure
3.2.12 State Raoult's law
3.2.13 Describe how the lowering of vapour pressure determined by gas saturation method
3.2.14 Explain the elevation of boiling point and depression of freezing point and their relation with molality
3.2.15 Describe the methods of determination of molal elevation constant by
a. Beckmann's method and cottrell's method
3.2.16 Describe the method of determination of molal depression constant by Beckmann's method

UNIT. IV

4.1.0 Understand the basic concept of phase equilibria

4.1.1 Define the terms
1. Phase 2. Components 3. Degree of freedom
4.1.2 State phase rule
4.1.3 Record the equilibrium conditions of
1. Water system 2. Sulphur system by applying phase rule
4.1.4 Illustrate the terms
1. Triple point 2. Meta stable state

4.2.0 Understand the conditions of chemical equilibrium

4.2.1 Illustrate with example
1. Reversible 2. Irreversible reactions

4.2.2 State the law of mass action

4.2.3 Derive expression for the equilibrium constant KP and Kc

4.2.4 Derive the relation between KP and Kc

4.2.5 Derive an expression for equilibrium constant for each of the following reactions
$H_2 + I_2 = 2HI$
$CO_2 + H_2 = CO + H_2O$
$N_2 + 3H_2 = 2NH_3$

4.2.6 State Le-Chatlier's principle

4.2.7 Predict the optimum conditions for getting maximum yield of the product by applying the Le-Chatlier's principle in each of the following process
1 – Manufacture of NH_3 by Haber process
2 – Manufacture of SO_3 by contract process

4.3.0 Appreciate the kinetics of chemical reactions

4.3.1 Define rate or velocity of a chemical reaction

4.3.2 Distinguish between molecularity and order of reaction

4.3.3 Illustrate first order reaction with two examples

4.3.4 Derive an equation for 1st order reaction

4.3.5 Explain half life period – derive an expression to determine the half life period

4.3.6 Solve problems based on 1st order reactions

4.3.7 Illustrate second order reactions with two examples

4.3.8 Illustrate third order reaction with an example

4.3.9 State Archenius equation

UNIT – V

5.1.0 Recognize the nature and action of buffer solution

5.1.1 Define buffer solution

5.1.2 Describe the methods of preparation of a buffer by mixing
a. Weak acid and its salt b.Weak base and its salt

5.1.3 Explain the buffer action of acidic and basic buffer

5.1.4 Define the term Hydrolysis of salts

5.1.5 Predict the nature ie (acidic, basic and neutral) of the aqueous solutions of a given salt.

5.2.0 Comprehend the concept of electromotive forces and its application

5.2.1 Explain the term E.M.F. of a cell

5.2.2 Define oxidation potential and reduction potential

5.2.3 Explain the nature of standard single electrodes
1. Hydrogen electrode 2.Calomel electrode 3. Glass electrode

5.2.4 Illustrate how the pH can be calculated using hydrogen electrode.

CONTENT DETAILS

UNIT –1: ORGANIC CHEMISTRY – I

Introduction to organic chemistry – Elementary organic chemistry – Methods of purification detection of Elements – Empirical formulae and molecular formulae – classification of organic compounds, IUPAC nomenclature – Isomerism, Hydrocarbons – Preparation, properties and uses of Methane, Ethane, Ethylene, Acetylene, Benzene, Toluene, naphthalene, Anthracene

UNIT – II: ORGANIC CHEMISTRY – II

Halogen derivatives – Preparation, properties and uses of chloroform, Iodoform, carbon tetrachloride, cholorobenzene and benzyl chloride.

Organic compounds containing oxygen and nitrogen, Preparation, properties and uses of methyl alcohol, ethyl alcohol, glycerin formaldehyde, acetaldehyde, acetone, formic acid, acetic nitro ethane, ethyl amine acid, benzaldehyde, benzophenone, ethyl benzoate, nitrobenzene, aniline, urea and benzamide.
Carbohydrates – mono and disaccharides – glucose, fructose and sucrose – starch and cellulose.
Elementary study of amino acids, proteins – dyes, petroleum and soap

UNIT – III

Gaseous State: -

Ideal gas equation – evaluation of the gas constant in :- Liter atmospheres, Erg, Calories
Kinetic theory of gases – derivation of gas pressure from Kinetic theory – derivation of Boyle's law, Charle's law, Avagadro's Hypothesis and graham's law of diffusion from Kinetic theory

1. Real gases: - Derivation from ideals behaviour causes – Vander wals eqn.

Liquid state: - Determination of critical constants
Vapour pressure and boiling point – determination of vapour pressure:- Barometric method, Gas saturation method – problems
Methods of expressing the concentration of a solution

1. Mass percentage – parts per million-molarity, molality and mole fraction – colligative properties. Osmosis and Osmotic pressure – definition – determination
   a. Berkely and Hartley's method

   Laws of osmotic pressure – Isotonic solutions
2. Lowering of vapour pressure. Raoult's law. Determination of lowering of vapour pressure – gas saturation method only. Calculation of molecular weight problem.
3. Elevation of boiling points – its relation with molarity molal elevation constant determination.
4. Depression of freezing point – its relation with molality – molal depression constant determination. Backmann's method and calculation of molecular weight

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UNIT IV

PHASE EQUILIBRIA.

Definition of phase component and degree of freedom phase rule – one component system

a. Water, steam and ice b. Sulphur system

Two component systems

Chemical Equilibria:

Reversible reactions

Chemical Equilibria:

Reversible reactions –law of mass action – forms of equilibrium constant Kp and Kc. Le chateteirs principle. Homogeneous gases Equilibria

a. Reactions with out change in no. of molecules

Eg: - $H_2 + I_2 \rightarrow 2HI$

$Co_2 + H_2 \rightarrow Co + H_2O$ Problems.

b. Reactions with change in no. of molecules

Eg: - $N_2O_4 \rightarrow 2 NO_2$

$N_2 + 3H_2 \rightarrow 2NH_3$

Derivation of equilibrium constants and problems. Homogeneous equilibrium in liquid systems.

Eg: - Esterification reactions

Heterogeneous chemical equilibrium in solid and gases

Eg: - $C+CO_2 \rightarrow 2CO$

$CaCO_3 \rightarrow CaO = CO_2$

Chemical Kinetics:

Velocity of reaction order of reaction – molecularity of reaction – reactions of first order – examples – half-life period

UNIT-V

Reactions of second order, examples – reactions of third order – examples. Arrhenius equation, Buffer solutions – buffer action of acidic and basic buffer hydrolysis of slats. Electromotive force of a cell, oxidation and reduction potentials – hydrogen electrode, calomel electrode – glass electrode – determination of pH by electromotive force method

Reference Books

1. Organic Chemistry. Vol. – I - I.L. Funar (1975), 5th edition
2. Engineering Chemistry – P.C.Jain & Monika Jain
3. Text book of physical chemistry - P.L.Soni, O.P.Dharmarha (1980)
4. Text book of physical chemistry - Samuel Glasstone (1948)
5. Elements of Physical Chemistry - Glasstone & Lewis

SUBJECT TITLE : FLUID MECHANICS
SUBJECT CODE : CH 303
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Properties of Fluid Fluid Statics Fluid Dynamics		14
		Test	2
II	Fluid Friction Fluid Measurement		14
		Test	2
III	Piping Systems and Valves		14
		Test	2
IV	Pumps		14
		Test	2
V	Blowers, Compressors, Vacuum Systems		14
		Test	2
		Total	**80**

OBJECTIVES

UNIT – I

1.1.0 Use the properties of Fluids

1.1.1 Define density
1.1.2 Compute specific gravity
1.1.3 Define viscosity
1.1.4 Describe Newton's law of viscosity
1.1.5 Compute viscosity using Newton's law of viscosity
1.1.6 Classify fluids
1.1.7 Compare Newtonian and Non-Newtonian Fluid
1.1.8 Define viscosity index
1.1.9 Determine viscosity using capillary tube method and Redwood viscometer
1.1.10 Define pressure

1.2.0 Understand the laws of fluid statics and the working of pressure measuring instruments

1.2.1 Explain the laws of Fluid statics and its applications
1.2.2 List the pressure measuring instruments
1.2.3 Explain liquid column manometers
1.2.4 Draw the sketch of differential manometer
1.2.5 Describe 'U' tube manometer
1.2.6 Draw the sketch of differential manometer
1.2.7 Draw the sketch of an inclined tube manometer
1.2.8 Compute pressure difference using 'U' tube manometer
1.2.9 Calculate pressure difference using manometers
1.2.10 Define total pressure
1.2.11 Define gauge pressure
1.2.12 Compute total pressure from gauge pressure and atmospheric pressure

1.3.0 Apply the theories of fluid dynamics for computing energy of moving fluids

1.3.1 List the types of flow
1.3.2 Compare viscous and Turbulent flow
1.3.3 Describe Reynold's experiment

1.3.4 Define critical velocity
1.3.5 Define Reynold's number
1.3.6 State Transition range
1.3.7 Calculate Reynold's number and predict types of flow
1.3.8 Calculate critical velocity
1.3.9 Discuss velocity distribution in pipes
1.3.10 Discuss the energies of fluid in motion
1.3.11 Define fluid head
1.3.12 State static head
1.3.13 Describe impact head
1.3.14 Define velocity head
1.3.15 Define potential head
1.3.16 Compute the total mechanical energy of a moving fluid

1.4.0 Apply Bernoulli's theorem

1.4.1 State Bernoulli's theorem
1.4.2 Explain Bernoulli's theorem
1.4.3 State equation of continuity of liquid flow
1.4.4 Explain rate of discharge
1.4.5 Define mass rate
1.4.6 Define volume rate
1.4.7 Calculate mass rate from velocity
1.4.8 Explain the head developed by a pump in Bernoulli's equation
1.4.9 Calculate the efficiency of a pump
1.4.10 Calculate friction losses in a pumping system using Bernoulli's equation
1.4.11 Apply Bernoulli's equation for finding the velocity at the discharge end

UNIT - II

2.1.0 Compute loss of head due to friction in fluids

2.1.1 Explain skin friction
2.1.2 Explain form friction
2.1.3 Designate friction of straight pipe
2.1.4 Calculate friction losses in straight pipe in viscous flow using Hagen Poiseuille equation
2.1.5 Calculate friction losses in straight pipes using Fanning's equation
2.1.6 Define Fanning's friction factor
2.1.7 Calculate friction factor in rough pipe
2.1.8 Calculate friction factor in smooth pipe
2.1.9 Discuss the effects of Reynold`s number and relative roughness on friction factor
2.1.10 Compute friction losses in Bernoulli's equation
2.1.11 Discuss the losses in pipe fittings
2.1.12 State expansion losses
2.1.13 Calculate losses due to expansion in pipes
2.1.14 Calculate losses due to contraction in pipes
2.1.15 Discuss economic pipe diameter

2.2.0 Understand the working of flow measuring equipments

2.2.1 List the classification of flow measuring equipments
2.2.2 Name the equipments in hydrodynamic method
2.2.3 Name the important mechanical flow measuring devices
2.2.4 Define flow meter
2.2.5 State the principle of flow meters
2.2.6 Draw the sketch of an orifice meter
2.2.7 Describe the working principle of an orifice meter
2.2.8 Derive an equation for finding the velocity through orifice
2.2.9 Draw the sketch of a venturi meter
2.2.10 Describe the working principle of venture – meter

2.2.11 Derive an equation for finding the velocity through the pipe
2.2.12 Compare the advantages and disadvantages of orifice and venturimeter
2.2.13 Calculate volume rate through the pipe line using the equation for velocity through the orifice plate
2.2.14 Calculate volume rate through the pipe line using the equation for velocity through the venturi throat

2.3.0 Use Pitot Tube & Weir

2.3.1 Draw the sketch of a pitot tube
2.3.2 Write the working principle of pitot tube
2.3.3 Plot the velocity profile using pitot tube
2.3.4 Derive an equation for finding the velocity
2.3.5 Calculate volume rate using equation for velocity through the pitot tube
2.3.6 Discuss the use of weir
2.3.7 Describe the rectangular Notch
2.3.8 Describe V-Notch

2.4.0 Use Rotameter an Displacement meters

2.4.1 Write the working principle of Rotameter
2.4.2 Draw the sketch of Rotameter
2.4.3 Describe the working of Rotameter
2.4.4 Mention the types of floats in Rotameter
2.4.5 Draw the sketch of a current meter
2.4.6 Explain the working of a current meter
2.4.7 Draw the sketch of a displacement meter
2.4.8 Explain the working of a displacement meter
2.4.9 Draw the figure of a wet gas meter
2.4.10 Explain the working of a wet gas meter
2.4.11 Describe an electro magnetic flow meter

UNIT – III

3.1.0 Understand the Piping systems & Valves

3.1.1 Differentiate between pipes and tubes
3.1.2 List the advantages of transporting by pipes
3.1.3 List the merits of circular pipes for fluid transport
3.1.4 Describe about the various pipe standards
3.1.5 Distinguish between seamless and welded pipes
3.1.6 Discuss the methods of joining pipes with figures
3.1.7 List the advantages and disadvantages of screwed, flanged and welded joints
3.1.8 Describe joining method of tubes - compression and flanged joints
3.1.9 Draw sketches of pipe fittings for screwed, flanged and welded pipes
3.1.10 Explain with sketches the following expansion joints:- Expansion joints, Bellow type expansion joints, Packed expansion joints
3.1.11 List the various ferrous, non ferrous and non metallic pipe materials with their standards
3.1.12 Explain the functions of gaskets and packing in pipe fittings
3.1.13 List the gasket materials commonly used with their properties and uses
3.1.14 Discuss the properties and applications of metallic gaskets
3.1.15 Describe with sketches of two types of stuffing boxes and mechanical seals
3.1.16 Distinguish between stuffing boxes and mechanical seals
3.1.17 Describe the basis of classification of valves with their operating mechanism
3.1.18 Describe with sketches the following valves:- Gate valve, Plug valve – lubricated and non lubricated types, Ball valve, Gate valve – angle valve, Y-valve, needle valve, Butterfly valve, Diaphragm valve – weir type and straight through type
3.1.19 List the types of check valves
3.1.20 Describe with sketches of any two types of check valve
3.1.21 Write a short account on safety valves and bursting discs

UNIT – IV

4.1.0 Recognize the functions of various types of Pumps in a Chemical Industry

4.1.1 Explain the basis of classification of pumps
4.1.2 List the characteristic features of positive displacement and dynamic pumps
4.1.3 Differentiate between piston pumps and plunger pumps
4.1.4 With sketches explain the working principles of :- Piston pump – Simplex, Duplex and Single acting and double acting, Plunger pump – simplex pumps
4.1.5 List the field of application of piston and plunger pumps
4.1.6 Differentiate between rotary and reciprocating positive displacement pumps
4.1.7 Describe with sketches of internal and external gear pump
4.1.8 Explain, why safety relief valves are provided in piston pumps
4.1.9 Write short account on the following:- Air lift, Acid egg, Electromagnetic pumps, Screw Pump, Diaphragm pump, Solenoid pump, Lobe Pump, Vane pump
4.1.9 Discuss the advantages and disadvantages of centrifugal pumps
4.1.10 Explain the basic working principle of centrifugal pumps.
4.1.11 List the classification of centrifugal pumps
4.1.12 Explain with special reference
(1) Types of Centrifugal pump casings
(2) Types of centrifugal pump impellers
4.1.13 Explain with reference to centrifugal pump:- Priming, Cavitations, NPSH

UNIT – V

5.1.0 Understand the Basics of Fans, Blowers and Compressors

5.1.1 Explain the basics of classification of fans blowers and compressors
5.1.2 Explain with sketches of radial flow and axial flow fans
5.1.3 Describe with a sketch of a reciprocating compressor.
5.1.4 Explain the axial turbo compressor
5.1.5 Explain the advantages of multi stage compressors
5.1.6 Explain the effects of inter cooling in the efficiency of compressor
5.1.7 Explain with a sketch of a centrifugal blower
5.2.0 Understand the Vacuum Producing Equipments used in Industry
5.2.1 Explain with a sketch of a Nash Hytor
5.2.2 List the applications and advantages of Nash Hytor
5.2.3 List the advantages of using steam jet ejectors for producing vacuum
5.2.4 Explain with sketches of the following :- Single stage ejector, Two stage ejector without condenser, Multistage ejector with inter condensers
5.2.5 Explain the use of condensers along with ejectors

CONTENT DETAILS

UNIT – I: PROPERTIES OF FLUID, FLUID STATISTICS AND FLUID DYNAMICS

Properties of fluids – compressible and incompressible fluids – viscosity – definition, units and determination of viscosity. Viscosity of gases and liquids and their variation with temperature and pressure. Viscosity index – Newtonian and Non-Newtonian fluids.

Laws of fluid statics and its application – fluid pressure – units and its measurements – concept of fluid heads and its calculations, gauge pressure – manometers – piezometer tubes, single column manometers, inclined manometers, simple U-tube manometer, two liquid manometer – construction, working and calculation of pressure difference based on reading of the above manometers, industrial type manometers.

Fluid dynamics: - Types of fluid flow in pipes, viscous and turbulent flow, Reynold's experiment, critical velocity, problems, types of fluid heads – static head, kinetic head, impact head, potential head, definitions and expressions.

Bernoulli's Theorem: - Application to simple problems, head developed by a pump – H.P of a pump and efficiency. Velocity distribution in pipes – relation between maximum and average velocity. Expressing flow rates as velocity, volume rate and mass rate. Equation for continuity. Simple problems.

UNIT – II: FLUID FRICTION

Causes of fluid friction in pipe systems – skin friction and form frictions – boundary layer separation and wake formation. (Description only)

Friction in straight pipe – Hagen Poiseuille equation for viscous flow (no derivation) and problems.

Friction in turbulent flow – Fanning's equation (derivation not required) friction factor chart. Effect of Reynold's number and relative roughness on friction factor. Empirical equation for friction factor. Calculation of friction losses in straight pipes and accounting for the loss in Bernoulli's equation.

Friction losses in pipe fittings – equivalent length, expansion and contraction losses. Problems in fluid flow involving friction loss in pipefitting. Economic pipe diameter.

Flow measurement: - Flow metering- classification of flow measuring equipments. Hydrodynamics method, mechanical method and special methods.

Orifice meter, venturi meter, pitot tube and weirs. Basic working principle, derivation of mathematical expressions – simple problems.

Rotameter – working principles, materials of construction and applications. Mechanical flow measurements – Displacement meters, wet gas meter, rotating disc meter and piston meters, Current meters – cup current meters, propeller meters.

Special Methods: - Dilution methods, simple problems – Electro magnetic flow meter.

UNIT – III: PIPING SYSTEMS & VALVES

Pipes and pipe fittings: Pipes and tubes – pipe and tube standards, ASME, BSS, ISI Standards, Schedule number, seamless and welded pipes.

Pipe fittings – fittings for screwed, welded and flanged joints. Joints for tubes – compression and flare fittings.

Expansion joints: - Expansion loops and bends, Pack less expansion joints, Bellow type joints for low and high pressures.

Packed expansion joints – slip type expansion joints – pipe supports – pipe materials, Ferrous and Non-ferrous metals and alloys, plastics – pipe with linings.

Gaskets and packing: - Rubber, plastic, cork, rubber cork, asbestos, compressed asbestos fibre, metallic gaskets. Sealing of rotating shafts – stuffing boxes and mechanical seals. Properties of fluid to be conveyed and operation conditions.

Fundamentals of flow control mechanism and valve classifications :- 1. Gate valve and its variations like sluice valve and slide valve 2. Plug valve (cocks) – 2 way and 3 way and non-lubricating plug valves 3. Ball valves 4. stop valves – Globe valve, 'Y' valve, angle valve, and needle valve 5. Butterfly valve 6. Diaphragm valve – weir type and straight through type 7. Pinch valve 8. Check valves – swing check – lift check – ball check and piston check 9. Valves for special duties and pipe line strainer 10. Safety valves and bursting discs

Constructional details and applications of the above valves

UNIT – IV: PUMPS

Pump classifications – Positive displacement and Centrifugal.

Positive displacement pumps – reciprocating and rotary – reciprocating type – piston plunger pumps – simplex and duplex – single acting and double acting.

Diaphragm pumps – Rotary – gear pump, screw pumps, lobe pumps.

Fluid displacement pumps – Airlift, Acid egg, Jet pumps, Electro magnetic pumps

Centrifugal pumps: - Basic working principles, types of impellers for different fluids, single suction and double suction type. Split case and multistage pumps. Priming of centrifugal pumps and self-priming pumps. Turbine pumps, NPSH, cavitations, selection of pumps based on liquid characteristic, head, capacity etc: -

UNIT – V: - BLOWERS, COMPRESSORS, AND VACUUM SYSTEMS

Fans, Blowers, compressors – Positive displacement blowers, turbo blowers, turbo compressors, positive displacement compressors, vacuum pumps and ejectors. Nash Hytor.
Installation, start up and shut down procedures of above machineries.

REFERENCE BOOKS

1. Introduction to chemical Engg., - Walter.L.Badger & Julius.T.Banchero
2. Unit Operations – Warren.L.McCabe & Julian.C.Smith
3. Unit Operations – I (Chemical Engg.,) – TTTI, Chennai
4. A Text Book of Hydraulics & Fluid Mechanics – R.S.Khurmi

SUBJECT TITLE : POLYMER TECHNOLOGY
SUBJECT CODE : CH 304
PERIOD/WEEK : 5
PERIOD/SEMESTER : 80

TIME SHEDULE

UNIT	TOPIC		PERIODS
1	Introduction, properties, analysis of polymers and important sources of monomers		14
		Test	2
2	Type of polymerisation reaction Type of co-polymer and method polymerisation		
		Test	2
3	Manufacture of thermoplastics, thermosetting plastics, Additives		14
		Test	2
4	Man made fibres moulding techniques for plastics		14
		Test	2
5	Elastomers		14
		Test	2
		Total:	**80**

OBJECTIVES

UNIT I

1.1.0 Introduction to polymers
1.1.1 Classification of polymers according to
1.1.2 Commodity – engineering and speciality
1.1.3 Thermoplastic/ Thermosetting plastics
1.1.4 Plastics – Rubber – Fibre – adhesive – coatings
1.2.0 General properties of polymers
1.2.1 In comparison to engineering materials like metals, ceramic, wood etc.
1.2.2 Mechanical properties
1.2.3 Thermal properties
1.2.4 Electrical properties
1.3.0 Analysis of polymer materials
1.3.1 Melting point test.
1.3.2 Solubility test.
1.3.3 Copper wire test
1.3.4 Specific gravity test.
1.3.5 Determination of molecular weight by viscosity method
1.4.0 Important sources of monomers and manufacturing of the following
1. Ethylene 2. Propylene 3. Vinyl Chloride 4. Styrene 5. Caprolactum

UNIT II

2.1.0 Types of polymerisation reaction
2.1.1 Addition polymerisation

2.1.2 Step polymerisation
2.1.3 Chain polymerisation
2.1.4 Anionic and cationic polymerisation
2.1.5 Polymerisation by condensation
2.1.6 Different types of co-polymers
2.1.7 Random , block, graft co-polymer
2.1.8 Characters features and applications of co-polymerisation
2.1.9 Methods of polymerisation, bulk solution , suspension, Emulsion interfacial polycondensation.

UNIT III

3.1.0 Manufacture of thermoplastics.
3.1.1 Commodity plastics (1) Polyethylene (2) Poly propylene
3.1.2 Engineering Plastics
1. Polyvinyl chloride 2. Polystyrene 3. Nylon 4. Polyesters
3.2.0 **Manufacture of thermosetting plastics**
3.2.1 Formaldehyde based plastics.
1. Phenol formaldehyde 2. Urea formaldehyde 3. Melamin formaldehyde
3.2.2 Polyesters and epoxies 1. Polyurethanes
3.2.3 Uses of the above plastics
3.3.0 Reinforced Plastics
3.3.1 Materials used for reinforcement
3.3.2 Effect of reinforcement on properties.
3.3.3 Method of manufacture.
3.4.0 List of additives used in plastics
1. Antioxidants 2. Sterilizes 3. Plasticizers 4. Fillers 5. Lubricant 6. Colorants

UNIT IV

4.1.0 Man made fibres
4.1.1 Comparison to natural fibres
4.1.2 Spinning methods 1.Melt 2. Solution and dry
4.1.3 Describe the manufacture of
1. Viscose rayon 2. Polyester 3.Nylon
4.1.4 Uses of above fibres
4.2.0 Moulding techniques for plastics
a. Calendaring b. Die casting c. Film casting
d. Injection moulding e. Blow moulding f. Extrusion moulding

UNIT V

5.1.0 Properties , uses and manufacture of elastomers
5.1.1 Define elasticity
5.1.2 Distinguish between elasticity and plasticity
5.1.3 State the composition and properties of natural rubber latex
5.1.4 Describe the manufacture of smoked rubber sheet from latex
5.1.5 Describe the coagulation and coagulants used.
5.1.6 Describe briefly the polymerisation, process of Butadiene, Styrene and
5.1.7 Neoprene.
5.1.8 Describe vulcanization process
5.1.9 Describe manufacture of vulcanized rubber articles.

CONTENT DETAILS

Unit-I

Introduction to polymers, Classification, General properties, Analysis of polymer materials, sources of monomers, manufacture of Ethylene, propylene, venyl chloride, styrene, caprolactum.

Unit-II

Types polymerisation reaction , Types of co-polymers, Characteristics features and applications of co-polymerisation, method of polymerisation

Unit-III

Manufacture of thermo plastics- Polyethylene, poly propylene, polyvinylchloride, polystyrene, Nylon, polyesters, Manufacture of thermosetting plastics-Formaldehyde based plastics, polyesters and epoxies and uses of above plastics, Reinforces plastics, additives used in plastics

Unit-IV

Man made fibres, Spinning methods manufacture of viscose rayon, nylon, Polyester, uses of above fibres, Moulding techniques for plastics.

Unit-V

Properties, uses and manufacture of elastomers, Define elasticity, plasticity, composition Properties of natural rubber, manufacture of smoked rubber sheet polymerisation process

REFERENCES

1. Polymer Science - Gowariker .V. R
2. Textbook of Polymer Science - John Wiely
3. Rubber Technology - C.M .Blow

SUBJECT TITLE : CHEMICAL ENGINEERING DRAWING -1
SUBJECT CODE : CH 305
PERIODS/WEEK : 4
PERIODS/SEMESTER : 64

TIME SCHEDULE

UNIT	TOPIC	PERIODS
1	Fastening devices for Chemical engg. Equipments And permanent Riveted Joints for chemical Process Equipments	18
	Test	3
II	Pipe Layout, Pipe Joints & Welded Fabrication drawing	18
	Test	3
III	Line Sketches of fluid flow, pressure Measuring apparatus & Pumps	18
	Test	4
	Total	**64**

Content Details

UNIT I: FASTENING DEVICES

Temporary and permanent Fastening Areas of applications – bolts and nuts, different types of bolted joints for different applications – purpose of locking nuts – types of lock nut.
Permanent Riveted joints for chemical Process Equipment – Types proportions and specifications of rivets – different types of riveted joint – exercise in drawing riveted joints, using standard proportions, Exercise in the selection of appropriate fastening devices to meet given working conditions.

UNIT 2 PIPING LAY – OUT

Classification of pipes and tubes – components – piping layout like pipe joints, valves elbows etc. Exercise in drawing (Schematic) single line diagram of pipe layouts using standard conventions – one exercise in preparing a simple piping lay out in isometric view. Pipe Joints – flanged – Socket – Spigot – Screwed union ,Integral flanged,srewed flanged.

UNIT- 3 CHEMICAL ENGG. EQUIPMENT DIAGRAMS

Line diagrams of the following –
Manometers – U – Tube Differential – inclined, etc – Orifice meter – venturi meter Rotameter,Wet gas meter – Magnetic Flow meter.
Pumps – Reciprocating Pump – Centrifugal Pump – Diaphragm Pump – Gear Pump'

Reference Book

1. Machine Drawing - John & Varghese
2. Introduction to Chemical Engineering - Walter.L.Badger&Julias.T.

SUBJECT TITLE : COMPUTER APLICATION LAB
SUBJECT CODE : CH 306
PERIODS/WEEK : 4
PERIODS/SEMESTER : 64

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	DOS & WINDOWS / LINUX	10
II	MS – OFFICE AND OPEN OFFICE	20
III	Introduction to Computer Aided Drafting	10
IV	Working with CAD	10
V	Editing, Adding Dimensions and Text	14
	Total	**64**

Content Details

UNIT-I

Understanding MS – OFFICE & OPEN OFFICE

Familiarizing all menu bars and practice all the applications

1. Understand the Desktop
2. Create a new folder, name it, copy a few files from one folder to another
3. Rename the folder and delete one file in the folder
4. Copy all from CD drive to hard disk
5. Type a paragraph in notepad, save it and retrieve / Recall it.
6. Set the time in Clock
7. Use the calculator for calculate

UNIT-II

Word Processing, Presentation & Spread Sheet packages

Familiarizing all menu bars and practice all the application

Practice MS DOS Commands to create directory – List Directory, Remove Directory, Change Directory

1. Practice MS DOS Commands to create files using
2. Edit, Copy , Rename, Type
3. Practice external commands in Dos
4. Set up familaraisation
5. Format, FDisk, Booting, Disk Preparation

UNIT – III

Introduction to Computer Aided Drafting

History – application – Advantages over manual drafting – Hard ware requirements – Soft ware requirements – Different software - Auto CAD – Pro E – IDEAS etc:-

AutoCAD basics – main menu, starting a new drawing, drawing editor, entering commands using mouse, pull down menu, getting help, data entry, entity selection, error correction

UNIT – IV

Working with CAD Software

Setting limits of Drawing, grid, snap, co-ordinates, orthomode, zooming, drawing lines, arcs, circles, erase, undo, oops – commands, save and end commands

UNIT – V

Editing, Adding dimensions and text

Editing drawings using various modified commands. Add dimensions and text on drawings, copy, mirror, array, fillet, chamfer, hatching the sectional views. Developing simple orthographic views and dimension it with text. Developing detailed orthographic views with all features

NOTE : Use of Open source software to be promoted

SUBJECT TITLE : CHEMISTRY LABORATORY
SUBJECT CODE : CH 307
PERIODS/WEEK : 4
PERIODS/SEMESTER : 64

TIME SCHEDULE

UNIT	TOPIC		PERIODS
i	Volumetric Analysis		14
		Test	2
II	Gravimetric Analysis		14
		Test	2
III	Physical Chemistry		14
		Test	2
IV	Organic Preparation		14
		Test	2
		Total	**64**

CONTENT DETAILS

UNIT –I: VOLUMETRIC ANALYSIS

Acidimetry and Alkalimetyry

Standardization of NaOH using standard HCl acid
Standardization of Na2CO3 crystals
Estimation of KOH using Na2CO3 crystals
Estimation of H2SO4 using oxalic acid crystals
Estimation of K2CO3 using Na2CO3 crystals

Permanganometry

Standardization of KmnO4 using std. Mohar's solution
Estimation of Ferrous Iron using std. Oxalic acid
Estimation of Oxalic acid using Mohr's salt crystals
Estimation of Ca using Oxalic acid crystals

Dichometry and Iodometry

Prepare the primary standard solution of Potassium dichromate
Standardize the sodium thiosulphate
Estimation of amount of Ferrous Iron in the whole of the given solution
Estimate the amount of Copper in the whole of the given solution
Estimate the Chlorine in bleaching powder

Argentometry

Prepare the primary standard solution of silver nitrate
Standardize the NaOH solution
Estimate the chloride and salinity of water

UNIT –II : GRAVIMETRIC ANALYSIS

Estimate the Ba++ as BaSO4
Estimate the SO4- -as BaSO4
Estimate the Fe3++ as Fe(OH)3

UNIT –III : PHYSICAL CHEMISTRY EXERCISES

Determine the melting point and boiling point
Determine the critical temperature of phenol
Determine the elevation of boiling point
Determine the depression of freezing point

UNIT – IV: ORGANIC PREPARATIONS

Dinitrobenzene starting from nitrobenzene – (Nitration)
Acetanilide starting from aniline (Acetylation)
Benozoylation from aniline (Benzoylation)
Benzoic acid from methyl benzoate (Hydrolysis)
Benzoic acid from benzyl chloride (side chain oxidation)

REFERENCE BOOKS

1. Practical Chemistry for B. Sc Main – A. O. Thomas and Mani.

Information Search Analysis and Presentation Skills Development

Periods/Week : 3
Periods/Semester : 48

Introduction

The average Engineer walking out of education institution is surprised by the amount of non-technical work he or she faces in the real world (by the amount of personal contact, the number of phone calls, meetings, reports and presentation etc). Further many cannot find appropriate jobs, because of the lack of these skills. The problem aggravates in the case of diploma pass outs who are supposed to have interactions with different cadres in an industrial environment.

The time allotted for ISAP skills development are to be utilized to provide a slice of practical training in a form that may be used in a class room setting. This is not to be taught in a conventional manner. Here the emphasis will shift from teacher oriented methods to students oriented methods. While the information – skills acquired by all students will be same, the actual methods & techniques used by each student will vary according to his or her initiative, enthusiasm, effort taken etc.

These hours are to be taken as a supplement to the theory classes. Students will acquire ISAP skills based on the fundamental knowledge he/she has acquired from the theory sessions.

Objectives

Educational researchers have found that 17 year olds, in a single academic year, learn about 200 to 300 new words, in a university environment. However, during the same period they acquire around 4000 words in their informal home and play environment. That is learning is higher in an informal environment than in an academic one designed specifically for that purpose. The primary objective here is to simulate the informal learning environment.

Student is provided an ideal opportunity to acquire skills in learning to learn which is essential for the professional growth. This will inculcate information skills in the students. These skills will be a life long asset to him or her in fact they grow with age.

Oral and written communication skills are of at most importance to any engineer for a positive professional growth. Emphasis is given for this aspect also.

Activities

A. PART ONE.

Write articles on various technical areas and basic research papers. Students can identify simple projects individually or groups of not more than 4 any technical area. Emphasis here is on the acquisition of ISAP skills.

Source of Information

a. People
b. Print media – Magazines, News papers, Journals, Vendors catalogues etc.
c. Electronic information – CD ROM, Usage of internet – User news groups, WWW.

B. PART TWO

Transparency based Presentation

1. Preparation
   1.1 Audience Analysis.
   1.2 Information Gathering.
   1.3 Transparency design using Power Point/Presentation software.
   1.4 Production of transparency for OHP.
2. Delivery

Sample Projects

1. Prepare and deliver transparency based presentations on the topics,
    a. Technicians are not properly appreciated in the society.
    b. Engineers do not know about non technical topics.
    c. Lay people do not know enough about technical topics.
    d. India's products are not competitive in international markets as its quality is not good.
    e. India's software professionals are paid too much.
2. Prepare transparency based presentation for the opposite side of the issue you choose in project 1.
3. Prepare and deliver a brief autobiographical presentation.
4. Prepare and deliver a sales promotional presentation (Example – Washing machine, Computer , Air conditioner, Microwave oven or other items related to your branch of study)
5. Prepare and deliver a brief sales promotional presentation on a service (Example- Insurance Policy, Credit cards etc)
6. Prepare and deliver a technical presentation before lay audience (Example – Use of computers to common man, energy saving measures in a domestic environment or other topics related to specific branches of study)

C. PART THREE – COMMUNICATION SKILLS

Written Communication

Preparation of

a. Reports
    - Formal reports
    - Progress reports
    - Feasibility Reports
    - Laboratory reports.
b. Technical Proposals.
c. Email.
d. User manuals
e. Job Hunting material
    - Resumes
    - Letters for job hunting
f. Business letters
g. Memo, Notices, Agenda and minutes

Oral Communication

Oral communication activities like,

a. Dyadic communication (Interaction between two persons, example Telephone conversation)
b. Meetings.
c. Job interview.
d. Group Discussions.
e. Debates.
f. Case studies.

EVALUATION

There is no separate evaluation for ISAP skills. But the teachers will consider this for the award of internal assessment marks related to the theory subjects in that semester. The performance of the student will be taken equivalent to an Assignment and an Examination while awarding the internal assessment marks.

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER IV

Branch : Chemical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
CH 401	Petroleum & Energy Engineering	5		5	75		25	100
CH 402	Heat Transfer & Evaporation	5		5	75		25	100
CH 403	Chemical Process Principle	5		5	75		25	100
CH 404	Inorganic Chemical Technology - I	5		5	75		25	100
CH 405	Polymer Technology Lab		3	3		75	25	100
CH 406	Chemical Engineering drawing - II		3	3		75	25	100
CH 407	Fluid Mechanics Laboratory		6	6		75	25	100
	ISAP Skills Development		3	3				
	TOTAL	20	15	35	300	225	175	700

SUBJECT TITLE : PETROLEUM & ENERGY ENGINEERING
SUBJECT CODE : CH 401
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Liquids Fuels	14
	Test	2
II	Solid Fuels	14
	Test	2
III	Gaseous Fuels &Nuclear Fuels	14
	Test	2
IV	Analysis of Fuel, Fuel Burning Systems and Furnaces	14
	Test	2
V	Non Conventional Energy	14
	Test	2
	Total	**80**

OBJECTIVES

UNIT – I

1.1.0 Understand the Important primary and Secondary Liquids Fuels.

1.1.1 Define Petroleum, Origin, Formation of Petroleum, Exploration, and Drilling.
1.1.2 Name the Different Crude Oil and their sources.
1.1.3 Classification of Petroleum
1.1.4 Explain fractional distillation of crude oil refining process with flow diagram
1.1.5 List the petroleum products from crude oil refining and their boiling ranges
1.1.6 Draw the fractionating column and name the parts
1.1.7 Explain the production of Gasoline by secondary process
1.1.8 Define cracking, list the types of cracking and types of catalytic cracking
1.1.9 Explain with flow diagram of fluidised catalytic cracking process
1.1.10 Explain the flow diagram of fixed bed catalytic cracking process
1.1.11 Explain with flow diagram of thermal cracking process and their mechanism
1.1.12 Define hydro cracking, polymerisation, reforming, alkylation, isomerisation
1.1.13 Explain with flow diagram of catalytic reforming
1.1.14 Explain with the flow diagram of catalytic polymerisation
1.1.15 Define octaine number, knocking and cetaine number
1.1.16 Name the anti-knocking agent
1.1.17 Evaluvate the composition of gasoline
1.1.18 Treatment of gasoline (1) Sweetening process (2) Doctor's treatment
1.1.19 Explain the various types of non petroleum liquid fuels
1.1.20 Explain the various process for removal of sulfur compounds from gasoline
1.1.21 Explain with flow diagram for removal of sulfur compounds from LPG
1.1.22 Explain with flow diagram for removal of sulfur compounds from kerosene
1.1.23 Outline the storage of liquid fuels

UNIT II

2.1.0 Appreciate the construction of various types of calorimeter

- 2.1.1 Define "fuel " & calorific value of fuel
- 2.1.2 Define higher & lower calorific value
- 2.1.3 List the apparatus used for determining calorific value
- 2.1.4 Draw the figure of Bomb calorimeter
- 2.1.5 Draw the figure of Junker's gas calorimeter
- 2.1.6 Explain construction ,working & calculation of Bomb calorimeter
- 2.1.7 Define flame temperature , flash point & fire point

2.2.0 Analyze the solid fuels

- 2.2.1 Describe combustible & non combustible components
- 2.2.2 Classify the fuels
- 2.2.3 Define solid fuels
- 2.2.4 Explain primary & secondary solid fuels with examples
- 2.2.5 Evaluate the composition of wood
- 2.2.6 Evaluate the composition of charcoal
- 2.2.7 Evaluate the original coal
- 2.2.8 List the theories behind origin of coal
- 2.2.9 Evaluate the ranks of coal
- 2.2.10 Describe the characteristics of peat
- 2.2.11 Describe the characteristics of Lignite
- 2.2.12 Describe the characteristics of semi bituminous
- 2.2.13 Describe the characteristics of sub bituminous
- 2.2.14 Describe the characteristics of Anthracite
- 2.2.15 Define fusion point of ash
- 2.2.16 Define calorific intensity
- 2.2.17 Discuss the classification of Indian coals
- 2.2.18 Evaluate the proportion of coal for industrial purpose
- 2.2.19 Evaluate the properties of coal used for metallurgical process
- 2.2.20 Evaluate the properties of coal used for gas producers
- 2.2.21 Evaluate the properties of coal used for locomotive engines & steam generation
- 2.2.22 Describe cleaning methods of coal
- 2.2.23 Explain gravity separation by wet & dry process
- 2.2.24 Explain froth floatation by wet process
- 2.2.25 Explain Jigbaum washing by wet process
- 2.2.26 Explain Wilfly table method by dry process
- 2.2.27 Explain Cyclone washing
- 2.2.28 Discuss Storage of solid fuels
- 2.2.29 Define spontaneous combustion
- 2.2.30 Outline precautions taken for storage of coal
- 2.2.31 Define carbonization
- 2.2.32 Name the two types of carbonization
- 2.2.33 Differentiate between low temperature & high temperature carbonization
- 2.2.34 Manufacture coke using beehive oven
- 2.2.35 Manufacture coke using Ottp Hoffman by product oven.
- 2.2.36 Evaluate the properties of metallurgical coke.
- 2.2.37 Describe recovery of byproducts from coke manufacture
- 2.2.38 Describe the composition of coke oven gas
- 2.2.39 List the uses and calorific value of coke oven gas.

UNIT-III GASEOUS FUELS AND NUCLEAR FUELS

3.1.0 Appreciate the energy content of gaseous fuels

- 3.1.1 Define natural gas
- 3.1.2 Estimate calorific value, composition uses of natural gas.
- 3.1.3 Describe the manufacture of producter gas with the aid of gas generators
- 3.1.4 List the uses of producer gas and their reactions
- 3.1.5 Evaluate the composition and calorific of producer gas.
- 3.1.6 Explain the manufacture of water gas with the aid of gas generator.
- 3.1.7 Evaluate the reactions of the water gas.
- 3.1.8 List the uses of water gas.
- 3.1.9 Evaluate the composition and calorific value of water gas.
- 3.1.10 Explain the manufacture of carbureted water gas with the aid of gas generator
- 3.1.11 List the uses of carbureted water gas.
- 3.1.12 Evaluate the composition calorific value of carbureted water gas
- 3.1.13 Explain the manufacture of oil gas
- 3.1.14 Evaluate the composition and uses of oil gas
- 3.1.15 Evaluate the calorific value of oil gas
- 3.1.16 Describe the manufacture of coal gas with the help of diagram.
- 3.1.17 List the uses of coal gas
- 3.1.18 Evaluate the composition and calorific value of coal gas.
- 3.1.19 List the uses of LPG
- 3.1.20 Evaluate the composition & calorific value of LPG
- 3.1.21 Explain manufacture of Biogas/gobar gas
- 3.1.22 Draw the figure of biogas generator, name the parts
- 3.1.23 Evaluate the composition & calorific value of Gobar gas
- 3.1.24 List the uses of biogas or gobar gas
- 3.1.25 List the composition of Blast furnace gas
- 3.1.26 Evaluate the calorific value of Blast furnace gas

3.2.0 Understand the nuclear fuels& their uses

- 3.2.1 Define Nuclear fusion reactors
- 3.2.2 Classify the reactors
- 3.2.3 Evaluate the types of moderators
- 3.2.4 Evaluate types of coolant
- 3.2.5 Draw the nuclear reactor & name the given parts
- 3.2.6 List the nuclear fuel materials
- 3.2.7 Evaluate the occurrence of uranium
- 3.2.8 Evaluate the occurrence of thorium
- 3.2.9 Evaluate the occurrence of plutonium
- 3.2.10 Explain magneto hydrodynamics power generation with the help of diagram
- 3.2.11 Evaluate the types of MHD system
- 3.2.12 List the advantage of using hydrogen as an energy carrier
- 3.2.13 Describe the storage of hydrogen

UNIT IV Analysis of Fuel, Fuel Burning Systems and Furnaces

4.1.0 Analysis of Fuels

- 4.1.1 Discuss flue gas analysis
- 4.1.2 Name the apparatus used for flue gas analysis
- 4.1.3 Draw the figure & name the parts of Orsat apparatus
- 4.1.4 Explain construction,& working of Orsat apparatus
- 4.1.5 List the specific application of Orsat apparatus in industries

4.1.6 Name the analysis of coal
4.1.7 Define proximate & ultimate analysis
4.1.8 Describe the proximate analysis
4.1.9 Describe the ultimate analysis

4.2.0 Understand the construction & working of furnace

4.2.1 Define the term furnace
4.2.2 Explain the construction & working of blast furnace with the help of sketch
4.2.3 Explain the constructional details & working of open-hearth furnace with the help of a sketch.
4.2.4 Explain the construction and working of electric furnace.
4.2.5 Explain the different heat saving methods.
4.2.6 Explain regeneration waste heat recovery.
4.2.7 List the application of each of the following furnaces,electric furnace,open hearth ,blast furnace,rotary tunnel kiln.

4.3.0 Know the coal burning system.

4.3.1 Understand different coal burning system.
4.3.2 Explain primary air amd secondary air supplied to the burning system.
4.3.3 Draw the figure and explain the working of over feed stocker.
4.3.4 Draw the figure and explain the working of traveling grate stocker.
4.3.5 Draw the figure and explain the working of chain grate stocker
4.3.6 Explain the coal burning system.
4.3.7 Explain the coal burning system.
4.3.8 Explain the fluidized bed combustion system
4.3.9 Explain burning system for liquid fuel.
4.3.10 Draw the figure of the following oil atomizing burner,venturiburner,blast buner(low pressure and high pressure),rotary cap burner,swerling burner.
4.3.11 Explain burning system for gaseous fuel.
4.3.12 Draw the figure and explain inside mixing type burners.
4.3.13 Draw the figure and explain outside mixing type burners

UNIT V: NON CONVENTIONAL ENERGY

5.1.0 Now the non-conventional energy

5.1.1 Explain solar energy
5.1.2 List the different types of collectors
5.1.3 Evaluate the flat collectors with the help of diagram.
5.1.4 Evaluate the liquid flat collectors with the help of sketch
5.1.5 Draw the cylindrical parabolic concentrating collectors.
5.1.6 Explain the working of cylindrical parabolic concentrating collectors
5.1.7 Draw the figure and explain the working solar heater
5.1.8 Describe the thermal applications of solar energy.
5.1.9 Draw the figure and explain water heating.
5.1.10 Draw the diagram of forced circulation water heating system.
5.1.11 Draw the diagram and name the parts of space heating.
5.1.12 Draw the schematic diagram and explain the space heating system using solar air heater
5.1.13 Describe the space cooling and refrigeration
5.1.14 Draw the figure and name the parts of solar absorption refrigeration system
5.1.15 Explain the working solar still for using solar distillation with the help of figure
5.1.16 Evaluate the solar drying & solar cooking
5.1.17 Draw the diagram & name the parts of box type solar cooker
5.1.18 Describe the working of silicon cell
5.1.19 Evaluate the application of silicon cell

5.1.20 Draw the schematic diagram of photo voltaic water pumping system
5.1.21 Draw the diagram of satellite solar power station
5.1.22 Explain the working of wind hills
5.1.23 List the types of wind mill rotors
5.1.24 Draw the figure of different wind mill rotors
5.1.25 Evaluate the energy from Biomass
5.1.26 Describe principle working ocean thermal energy conversion
5.1.27 Draw the schematic diagram of OTEC plant
5.1.28 Explain the different sites of tidal energy in India
5.1.29 List the geothermal power stations in India
5.1.30 Explain tidal electric power generations

CONTENT DETAILS

UNIT-I: LIQUID FUELS

Primary- secondary fuels-colloidal fuel-coal tar distillation-crude oil sources-classification of petroleum-fractional distillation-petroleum products-cracking-catalytic,thermal,hydrocracking-reforming-polymerisation-knocking agent-octane number-cetane number-removal of sulphur form gasoline,kerosene,LPG storage of liquid fuels

UNIT-II-SOLID FUELS

Calorific value-Determination of calorific value using Bomb calorimeter,Junker's gas calorimeter-Solid fuels-classification-composition of wood-origin of coal-theories of origin of coal-ranking of coal-Charactristicks-peat-lignite-bituminous-semi bituminous coal-cleaning of coal-high temperature and low temperature carbonization-Storage of coal-Behive oven-Otto Hoffman by product oven

UNIT-III-GASEOUS FUEL

Natural gas-Producer gas-carburratted water gas-oil gas-coal gas-LPG-gober gas or bio gas –composition, calorific value and uses of above gas fuels-blast furnace gas.
Nuclear fuels-nuclear fusion, nuclear fission-classificationof reactors-nuclear material-occurrence-preparation of nuclear materials-preparation of nuclear material. Uranium, Thorium,plutonium, fuel cell-open and closed cycle system

UNIT-IV- ANALYSIS OF FUEL, FUEL BURNING SYSTEMS AND FURNACES

Analysis of coal-proximate and ultimate analysis-classification of coal according to their analysis,properties and uses of coal for industrial purpose-Classification of furnaces-contruction and working of blast furnaces, open hearth, rotary kiln, electric arc furnaces –waste heat recovery-application of various furnaces-fuel burning system-stockers-grates-puverized coal burning system-fluidised bed combustion system-burning system for liquid fuels- steam atomizing burners-burning system for gaseous fuel- inside and out side mixing burners

UNIT-V NON CNVENTIONAL ENERGY

Solar energy-types of collectors – thermal application for solar energy-water heating –space heating-cooling and refrigeration- distillation-solar drying and cooking-working of silicon cell-
Wind energy-working of wind mills energy from bio mass-working principle of ocean thermal energy conversion –Schematic diagram of OTEC-Geo thermal power- geo thermal power station in India-tidal energy sites in India-tidel energy power generation

Reference Books

1) Text book of engineering Chemistry - S.S.DARA
2) Fuel, furnaces and refractories - O.P.GUPTA
3) Solar energy - S.P.SUKHATME

SUBJECT TITLE : HEAT TRANSFER AND EVAPORATION
SUBJECT CODE : CH 402
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Heat Transfer Theory	14
	Test - I	2
II	Forced Convection and Radiation	14
	Test - II	2
III	Heat Transfer Equipments	14
	Test - III	2
IV	Constructional Details & Working of Evaporators	14
	Test - IV	2
V	Theory of Evaporation and Working of Multiple Effect Evaporators	14
	Test - V	2
	Total	**80**

OBJECTIVES

UNIT – I

1.1.0 Understand the mechanism of transfer of heat by conduction

1.1.1 Define conduction
1.1.2 Apply rate equation for heat flow
1.1.3 Derive the conduction equation for plane well
1.1.4 Define and explain Fourier's law of thermal conduction
1.1.5 Solve the simple problem apply the basic equation of thermal conduction
1.1.6 Define thermal conductivity
1.1.7 Explain the variation of thermal conductivity with the help of solids, liquids, gases
1.1.8 Distinguish between steady slate and unsteady state conduction
1.1.9 Derive the equation to calculate heat transfer through composite plane wall
1.1.10 Derive the equation to calculate heat transfer through cylindrical wall
1.1.11 Derive the equation to calculate heat transfer through spherical wall
1.1.12 Solve the problems using equation derived
1.1.13 Explain the log mean area
1.1.14 Explain the economic thickness of insulation
1.1.15 Explain the different type of insulating materials
1.1.16 Explain the characteristic of good insulating materials

1.2.0 Appreciate the transfer of heat by Convection

1.2.1 Define and explain the convection
1.2.2 Explain the film concept in heat convection
1.2.3 Draw and explain the temperature gradient in forced convection
1.2.4 Define and explain individual heat transfer coefficient
1.2.5 Explain the factors affecting the heat transfer coefficient
1.2.6 Calculate the values of heat transfer coefficients using empirical equation

1.2.7 Explain the factors influencing heat transfer coefficient in boiling liquid and condensing vapours
1.2.8 Explain the concept of overall heat transfer coefficients based on inside and outside area
1.2.9 Derive an equation for overall heat transfer coefficient from film coefficients
1.2.10 Solve the problems using the equation derived

UNIT – II

2.1.0 Understand the mechanism of Natural and Forced convection

2.1.1 Explain the term forced convection
2.1.2 Distinguish between natural convection and forced convection
2.1.3 Give the examples to forced convection and natural convection

2.2.0 Understand transfer of heat by free convection

2.2.1 Explain the mechanism of natural convection
2.2.2 Explain the dimensional equations
2.2.3 Define Nusselt number
2.2.4 Define Reynold number
2.2.5 Prandtl number
2.2.6 Define Grashof number
2.2.7 Explain the relation between Nusselt number and Reynold number and Prandtl number
2.2.8 Define Dittus Boilters equation
2.2.9 Calculate the heat transfer coefficient from this equation
2.2.10 Solve the problems relating this equation

2.3.0 Appreciate the heat transfer in boiling liquid and condensing vapour

2.3.1 Explain heat transfer to boiling liquid
2.3.2 Define pool boiling of saturated liquid
2.3.3 Define sub cooled boiling
2.3.4 Explain pool boiling of saturated liquid with fig heat flux Vs temperature drop
2.3.5 Define Leiden frost point
2.3.6 Define nucleate boiling
2.3.7 Define transition boiling
2.3.8 Explain sub cooled boiling

2.4.0 Appreciate the heat transfer in fluid with phase change

2.4.1 Explain heat transfer from condensing vapour
2.4.2 Explain film type condensation
2.4.3 Explain Drop wise condensation
2.4.4 Explain coefficient for film type condensation on vertical tube (equation only)
2.4.5 Explain condensation of super heated vapours

2.5.0 Appreciate radiation as a mode of heat transfer

2.5.1 Explain Radiation
2.5.2 Explain the concept of black body, white body, gray body
2.5.3 Explain the laws of Radiation, Krichoff's, Plank's law, Stefan Boltzman,wien's law
2.5.4 Solve the problem relating above laws .
2.5.5 Explain radiation heat transfer between two solids
2.5.6 Explain radiation errors in pyrometry
2.5.7 Explain the concept of combined heat losses by convection, conduction and radiation

UNIT – III

3.1.0 Understand the construction and working of heat transfer Equipments

3.1.1 Distinguish between parallel flow, counter current flow and cross flow in heat exchangers
3.1.2 Explain the term fouling factors in heat exchangers
3.1.3 Fouling effect calculations in heat exchangers
3.1.4 Explain the concept of varying temperature drop and log mean temperature drop

3.1.5 Solve the problem using log mean temperature drop equation in counter flow, parallel flow and cross flow
3.1.6 Explain LMTD correction factors in heat exchanges
3.1.7 Calculate the heat transfer area of heat exchanger
3.1.8 Calculate the tube length of a heat exchanger
3.1.9 Explain the constructional details and working of a single pass shell and tube heat exchanger with the help of sketch
3.1.10 Explain the concept of multipasses in heat exchangers and economic passes
3.1.11 Discuss the allowances for expansion in heaters and heat exchangers
3.1.12 Explain the constructional details of floating head type heat exchangers
3.1.13 Explain the uses of baffles on shell side of a heat exchanger
3.1.14 Explain the constructional details and working of double pipe heat exchanger
3.1.15 Explain the constructional details and working of plate type heaters, air fin cooler and finned tubes
3.1.16 Explain the simple principles of installation and maintance of heat exchangers

UNIT – IV

4.1.0 Understand the construction and working of evaporators

4.1.1 List the application of evaporation operation in chemical industries
4.1.2 Explain the classification of evaporators
4.1.3 Explain the construction and working of horizontal tube evaporator
4.1.4 Explain the construction and working of short tube evaporator with help of sketch
4.1.5 Explain the construction of and working of Basket type evaporator with the help of sketch
4.1.6 Explain the construction and working of falling film type evaporator with the help of sketch
4.1.7 List the advantage and disadvantage of above evaporators
4.1.8 List the application of each of those evaporator
4.1.9 List the materials of construction of tubes and evaporator body
4.1.10 Explain the principle underlying the selection of evaporator for specific requirement
4.1.11 Explain the control of evaporator operation
4.1.12 Explain the special type of evaporators
4.1.13 Explain the operational difficulties in evaporators
4.1.14 Explain construction and working of different condensers
4.1.15 Explain the working of vacuum pump
4.1.16 Explain the condensate removing equipments different type of traps
4.1.17 Explain operating temperature range
4.1.18 Explain the use of vacuum in evaporators
4.1.19 Explain the concept of foam and entrainment
4.1.20 Explain the method of air removal and salt removal
4.1.21 Explain the scale formation in evaporators and its removal methods

UNIT – V

5.1.0 Compute the material balance and energy balance in single effect evaporator

5.1.1 Write the material balance and heat balance equation in single effect evaporator
5.1.2 Drive the equation to calculate the heat transfer area, steam requirement, capacity and steam economy
5.1.3 Define the term capacity of an evaporator
5.1.4 Define the term economy of an evaporator
5.1.5 Explain boiling point elevation
5.1.6 Define Duhuring's rule

5.1.7 Draw the Duhuring's line for Nacl-water
5.1.8 Solve the problem relating to area, capacity and economy using duhuringline
5.1.9 Explain the thermal effect of boiling point elevation
5.1.10 Explain the effect of Hydro static head

5.2.0 Understand the general principles underlying multiple effect evaporation

5.2.1 Explain the principles of multiple effect evaporation
5.2.2 Draw the layout of a multiple effect evaporation system
5.2.3 Explain the four methods of feeding in multiple effect system
5.2.4 Explain the advantage and disadvantage of each system
5.2.5 Explain the temperature distribution in multiple effect system with special reference to boiling point elevation
5.2.6 Solve the problems to calculate the concentration of liquior in each effect and temperature in each effect

5.3.0 Understand the principle of vapour compression evaporation

5.3.1 Explain the principle of mechanical and thermo compression
5.3.2 Explain the industrial use of vapour compression
5.3.3 Explain the advantage of vapour compression
5.3.4 Explain optimum temperature difference
5.3.5 Explain the use of heat pump cycle in evaporator with special reference to evaporation of fruit juices.

CONTENT DETAILS

UNIT – I: HEAT TRANSFER BY CONDUCTION

Heat transfer by conduction in solids – steady state and unsteady state flow – definition – units of heat flow.

Fourier's law of conduction – Rate equation for heat flow – steady state heat flow conduction through single wall – derivation of equation and simple problems – Thermal conductivity – units.

Steady state conduction through composite wall in series derivation of equation and problems

Steady state conduction through cylindrical wall and spherical wall derivation – problems

Theory of convection – film concept of heat transfer temperature gradient in forced convection – derivation of overall heat transfer coefficient from individual heat transfer coefficient – simple problems

UNIT – II: FORCED CONVECTION AND RADIATION

Forced convection: Heat transfer by forced convection inside tubes for laminar and turbulent flow – heat transfer to fluid with out phase change – thermal boundary layer – hydro dynamic boundary layers.

Dimensional equation – simple problems – mechanism of natural convection – heat transfer in boiling liquids – flash building sub cooled boiling – saturated boiling – regimes of boiling – maximum and minimum radiation – elementary idea of black body – gray body - emissivity – emissive power – radiation laws. Stefan Boltzman equation – simple problems – radiation between surfaces – simple problems – radiation error in pyrometry – combined beat losses by convection and radiation.

UNIT – III: HEAT TRANSFER EQUIPMENTS

Parallel flow – counter current flow – cross flow heat exchangers – Fouling effect calculation – LMTD – calculation in heat exchangers – Heat transfer equipment – Heaters and heat exchangers – single pass shell and tube heaters

Multipuss heaters – economic number of passes, allowances for expansion in heaters and heat exchange – floating head heaters – use of baffles on shell side of heat exchangers, double pipe heat exchangers – plate type heat exchangers – air fin cooler – calculation of heat transfer area and length of tubes – solve problems related to this –

UNIT – IV: CONSTRUCTIONAL DETAILS AND WORKING OF EVAPORATOR

Evaporation – Examples of industries where evaporation is used as a unit operation. Types of evaporators – basis of classification – horizontal tube – vertical tube – climbing film – falling film – forced circulation evaporators – examples of application of each in industries - continuous operation and control of evaporators – evaporator accessories – entrainment separator – condensers, vacuum pump – steam trap – salt catchers – continuous salt removal, evaporation under vacuum – operational difficulties.

UNIT – V: THEORY OF EVAPORATION AND WORKING OF MULTIPLE EFFECT EVAPORATORS

Material and heat balance equation for single effect evaporators – simple problems – calculation of heating area – capacity – steam economy – factors that control heat transfer coefficient and effect of hydro static head – boiling point elevation.

Multiple effect evaporation – principle of multiple effect evaporation – operation of multiple system – method of feeding – advantages of multiple effect evaporation – steam economy and capacity.

Temperature distribution in multiple effect and effect of boiling point elevation – optimum number of effect – simple problems in determining concentration and temperature in each effect

Vapour compression evaporation – mechanical and thermo compression basic principles with specific industrial uses – optimum temperature differences – incorporating heat pump cycle in evaporation of fruit juice

REFERENCE BOOKS

1. Unit Operation – I - T.T.T.I. Kalamassery
2. Introduction to Chemical Engineering - Water.L.Badger
3. Unit operation of Chemical Engineering - Warren.L.McCabe and Julian.C.Smith
4. Heat transfer - D.D.Tiwari
5. Fundamentals of Engg., Heat and Mass transfer - R.C.Sachdeva
6. Heat and Mass Transfer - R.K.Rajputh

SUBJECT TITTLE : CHEMICAL PROCESS PRINCIPALES
SUBJECT CODE : CH 403
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Unit, dimension, Conversions of units, Basic Chemical Operations, Chemical process in the field of Chemical Engg.		14
		Test – I	2
II	Gas laws and their applications		14
		Test – II	2
III	Material Balances – Involving without Chemical		14
		Test - III	2
IV	Material balances involving with Chemical reactions		14
		Test – IV	2
V	fundamentals of Thermodynamics Energy balance equations		14
		Test - V	2
		Total	**80**

OBJECTIVES

UNIT – 1

1.1.0 Apply the dimensions used in chemical Engineering and convert the units

1.1.1 Dimension – state the concepts is dimension
1.1.2 Explain the various system of units
1.1.3 Explain the difference between fundamental and derived units
1.1.4 List the fundaments and derived units and SI systems
1.1.5 List the commonly used prefixes and suffixes used in SI systems
1.1.6 Solve problems in conversions of units
1.1.7 Explain the concepts of dimensionless groups
1.1.8 Calculate , using chemical formule, the mass, volume, mole relation, molality, molarity, normality
1.1.9 Define gm atom, kg atom, gm mole, jg mole
1.1.10 Solve problems using atomic weight molecular weight and equivalent weight
1.1.11 Solve problems using mass, volume relationship for gaseous substances
1.1.12 Solve problems to find out the compositions of mixtures of solid, liquid and gases in volume, mass andmole.
1.1.13 Explain density and specific gravity and specific gravity scales
1.1.14 Solve problems in density and specific gravity
1.1.15 Explain various chemical process in the field of chemical engineering

UNIT – II

2.1.0 Use gas laws in chemical Processes

2.1.1 Explain ideal gas law and the deviation from ideal behavior
2.1.2 State Dalton's law and Amagat's law
2.1.3 Solve problems in gas mixtures applying Dalton's law and Amagat's law
2.1.4 Derive the relation volume % = mole % = Partial pressure %
2.1.5 Solve problems using above relations
2.1.6 Calculate the average molecular weight of gas mixture
2.1.7 Calculate densities of ideal gas mixture
2.1.8 Solve problems with volume change and composition changes
2.1.9 Solve problems using wet, dry basis composition

UNIT - III

3.1.0 Understand Material Balances involving without chemical reactions

3.1.1 State law of Conservation of mass
3.1.2 Define the various unit operations like evaporation, distillation, crystallization absorption leaching, extraction
3.1.3 Solve material balance problems involving unit operations like, Evaporation, Distillation, Crystallization, Absorption, Leaching, Extraction
3.1.4 State key component
3.1.5 Solve material balance equations using key component
3.1.6 Solve material balance problems involving bypass and recycle

UNIT - IV

4.1.0 Understand material balance involving chemical reactions

4.1.1 Define the terms complete reaction and incomplete reaction
4.1.2 Define the terms limiting reactant and excess reactant
4.1.3 Calculate stoichiometric proportions of reactants and products
4.1.4 Calculate percentage conversion and yield
4.1.5 Solve material balance problems involving incomplete, complete reactions. Calculate the percentage conversion and yield
4.1.6 Solve material balance problems in combustion of fuels
4.1.7 Calculate percentage of excess air
4.1.8 Calculate the ratio of air to fuel, flue gases to fuel
4.1.9 Define recycle, Bypass and purge

UNIT - V

5.1.0 Appreciate the fundamental principles of Thermodynamics

5.1.1 Outline development of thermodynamics as a science
5.1.2 Define a system.
5.1.3 Classify the system
5.1.4 Explain the terms system and surroundings
5.1.5 Explain the terms such as pressure, temperature, work, energy etc
5.1.6 Explain the laws of thermodynamics
5.1.7 Explain the terms enthalpy, internal energy, entropy etc.

5.2.0 Understand energy balances equations

5.2.1 Define law of conversation of energy
5.2.2 Define heat capacity and mean heat capacity
5.2.3 Solve problems in enthalpy and heat capacity
5.2.4 State Hess's law of heat of summation
5.2.5 Define heat of reaction, heat of formation heat of combustion, heat of solution
5.2.6 Solve problems by heat balnce equation for simple process.

CONTENT DETAILS

UNIT – I

Units and dimensions, conversion of units, dimesnsionless group, chemical formulae, mass relation, chemical reactions, gm atom, gm mole, kg atom, kg mole, Relation between mass and volume of gaseous substances . Method of expressing compositions of mixture of solids, liquids and gases, Density , specific gravity and specific gravity scales.

UNIT- II : GAS LAWS AND THEIR APPLICATIONS

Ideal gases – gas laws (derivation is not required), simple problems involving single gas. Derivation from ideal behavior. Gas mixtures – Dalton's Law, Amagat's law, Volume % = mole % = partial pressure % . Average molecular mass, density, specific gravity of ideal gases and mixtures. Compositions of gases on wet and dry basis. Problems with volume changes and compositions changes.

UNIT III : - Material Balances – Not involving Chemical Reactions.

Types of processes – Material balances equations – key component - material balances problem involving mixing , leaching, crystallization, evaporation, distillation, absorption – simple problem involving bypass and recycle.

UNIT – IV : Material Balances involving chemical reactions

Chemical reactions, complete and incomplete reactions, stochiometric proportions of reactants and product limiting reactant and excess reactants, percentage conversion and yield. Material balance calculation involving chemical reactions including combustion problems.

UNIT – V : Fundamentals of Thermodynamics and Energy Balance

Introduction – explain the tems systems & surrounding, pressure, volume temperature, work, energy , internal energy, total heat, concept of perfect gas, thermodynamic explanation of the first and second law of thermodynamics. Define the term entropy, Law of conservation of energy and applications, enthalpy, simple problems, heat capacities, heat of reactions, heat of combustion, heat of formation, Hess's law – solve problems by heat balance equations.

Reference Books

1. Stoihiometry - B. I. Bhatt & S. M Vora
2. Process Calculations for chemical engineers - Chem. Engg., Edn Development Centre, IIT Madrass
3. Chemical process Principles – I - Houghen., O. A Waston K. M, Regatz. R. A

SUBJECT TITLE : INORGANIC CHEMICAL TECHNOLOGY – I
SUBJECT CODE : CH 404
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEMDULE

UNIT	TOPIC	PERIODS
1	Introduction to Chemical Engineering	14
	Test 1	2
2	Water	14
	Test 2	2
3	Industrial Acids – 1	14
	Test 3	2
4	Industrial Acids – 2	14
	Test 4	2
5	Chlor - Alkali Industries	14
	Test 5	2
	Total	**80**

OBJECTIVES

UNIT I

1.1.0 Recognize the field of chemical engineering
- 1.1.1 Explain the concept of unit operation and unit process
- 1.1.2 List the examples of unit operation and unit process
- 1.1.3 Explain the uses of flow diagram in chemical industries
- 1.1.4 Prepare flow diagrams for simple process

1.2.0 Locate the major chemical industries in Kerala
- 1.2.1 List the major chemical industries in India
- 1.2.2 List the major petrochemical industries in Kerala
- 1.2.3 List the product and raw materials of ten major industries
- 1.2.4 Explain the importance of chemical industry

1.3.0 Explain the duties of a Chemical Engineer
- 1.3.1 Compare the duties and responsibilities of a chemist and a chemical engineer
- 1.3.2 List the duties & tasks of a Chemical engineering technician in Industry
- 1.3.3 Explain the principle of development of a chemical plant
- 1.3.4 Explain the principles of economy, chemical feasibility in chemical industries and the purification process

UNIT – II

2.1.0 Importance of water in chemical industries and the purification process
- 2.1.1 List the source of water
- 2.1.2 List the characteristics of water
- 2.1.3 Define hardness
- 2.1.4 Define temporary and permanent hardness
- 2.1.5 State the disadvantages of hard water
- 2.1.6 State the scale and sludge formation in boilers
- 2.1.7 List the disadvantages of scale formation
- 2.1.8 Define caustic embitterment

2.1.9 Explain the following softening methods i)lime soda process 2)zeolite process 3) Ion exchange process
2.1.10 Advantages disadvantages cold and hot lime soda process
2.1.11 Explain the qualities of water for various industries
2.1.12 Explain the method of water purification with respect to specific industries
2.1.13 Explain the method of municipal water treatment.

UNIT – III

3.1.0 Apply the manufacturing procedures of Sulphuric acid

3.1.1 Explain the importance of Sulphuric acid economy of the country
3.1.2 List the properties – Physical and Chemical
3.1.3 List the uses of Sulphuric acid
3.1.4 List the raw material for the manufacture of Sulphuric acid
3.1.5 Explain the reactions involved and heat evolved with the help of chemical equation
3.1.6 Explain cooling and cleaning of SO2
3.1.7 Explain the working of waste heat boilers
3.1.8 Explin the general principles and theory behind contact process
3.1.9 Apply the principles of Equilibria as route of conversion to the SO2 SO3
3.1.10 Distinguish the advantages and disadvantages of platinum and Vanadium pentoxide catalyst
3.1.11 Explain the phenomenon of catalyst poisoning
3.1.12 Explain the catalyst carriers
3.1.13 Explain the constructional details and working of converters
3.1.14 Explain the principles of absorption of SO3
3.1.15 Explain the constructional details and working of SO3 absorbers
3.1.16 Explain the production method of oleum
3.1.17 Explain the principles of DCDA process with flow sheet

3.2.0 Appreciate the production of Nitric acid

3.2.1 List the properties and uses of Nitric acid
3.2.2 Explain the reaction involved in the process
3.2.3 Draw the flow sheet for the manufacturing process
3.2.4 List the raw materials used in the process
3.2.5 List the reaction involved in the process
3.2.6 Explain the catalyst used
3.2.7 Explain the construction and working of converter
3.2.8 Name the materials of construction of converter
3.2.9 Explain the heat recovery and utilization involved in the process
3.2.10 Explain the various grade of acid and concentration of acids

UNIT IV

4.1.0 Appreciate the production of HCl acid

4.1.1 List the properties and uses of hydrochloric acid
4.1.2 List the raw materials and source of raw material
4.1.3 Draw the flow diagram of manufacturing process
4.1.4 Explain the constructional details and working of chlorine burners
4.1.5 Explain the principle of absorption
4.1.6 Explain the constructional details and working of absorption tower explain the various grade of acids and its concentrations

4.2.0 Appreciate the production of Phosphoric Acid

4.2.1 List the properties and uses
4.2.2 List the raw materials for the manufacturing process

4.2.3 Draw and explain the flow sheet for the manufacturing by wt process
4.2.4 Explain the dry process, with flow sheet
4.2.5 Explain the over all reactions involved

UNIT – V

5.1.0 Understand the Manufacturing of Soda Ash

5.1.1 Explain the steps involved with preparation and purification of Brine
5.1.2 Explain the process of ammoniation of Brine
5.1.3 Explain the process of carbonation of ammoniated brine
5.1.4 Explain the construction and working of carbonating tower
5.1.5 Explain the reaction involved in the carbonating tower
5.1.6 Draw the sketch of carbonating towers
5.1.7 Explain the working of filters for filter bicarbonate
5.1.8 Explain the conversion of bicarbonate to carbonate
5.1.9 Explain the process for recovery of ammonia
5.1.10 Draw the flow diagram for the entire process of Solvay and modified Solvay process

5.2.0 Understand the manufacturing of Chlorine and Caustic Soda

5.2.1 Explain the constructional details and working of diaphragm cell
5.2.2 Explain the chemical reaction involved
5.2.3 Define decomposition voltage and voltage efficiency
5.2.4 Explain the mercury cell for the manufacture of caustic soda explain the cathodic and anodic reaction in mercury cell
5.2.5 Explain the latest developments in the mercury cell
5.2.6 Explain the latest developments in the mercury cell
5.2.7 Merit and demerit of mercury cell over diaphragm

5.3.0 Understand the working of membrane cell

5.3.1 Explain the cathodic and anodic reaction
5.3.2 Explain the characteristic of membrane
5.3.3 Proportion of Flemion membrane
5.3.4 Explain the cell components
5.3.5 Explain the materials of construction of anode element cathode element
5.3.6 Explain caustic soda flake production
5.4.0 Appreciate the process of cleaning and drying of Cl2
5.4.1 Explain the chlorine compression and liquefaction
5.4.2 Draw the flow diagram for the entire process

CONTENT DETAILS

UNIT – 1

INTRODUCTION TO CHEMICAL ENGINEERING, CHEMICAL INDUCTRIALS, PROCESS

Major industries in Kerala and India – Raw materials and products – Economic importance of chemical industry – comparison of the field of chemist and chemical engineer – duties of chemical engineer – duties and functions of a diploma chemical Engineer – Pilot plant d\study – concept of unit operation and unit process – flow diagrams.

UNIT – II

WATER – Water sources – impurities – Characteristics – Softening methods, Lime soda process- lon exchange – conditioning of water for specific industries- Desalinations Process – municipal water treatment –

UNIT III

Sulphuric acid – Introduction – Importance of Sulphuric acid – properties and uses
Raw materials – Sulpur – pyrities – production of sulphur dioxide, sulphur burners – cleaning and cooling of gases – waste heat boilers. Contact process – theory of contact process – Equibilibrium and rate equation – catalyst – vanadium pent oxide – platinum – flow diagram of entire process – working and constructional detailsof converter – absorber DCDA process with flow – sheet.
Nitric acid – Properties and uses – reaction – catalyst – manufacturing process – concentration of nitric acid grades.

UNIT IV

Hydrochloric Acid:- Properties and uses and commercial grades – manufacture of Hydrochloric acid by synthesis process with flow sheet.
Phosphoric Acid:- Properties, uses and grades, raw materials manufacturing process. Wet and dry process

UNIT V

Preparation and purification of brine, reaction and flow diagram, light and heavy soda Ash, industrial applications, grades. Solvay and Modified solvay process. Caustic Soda – raw materials – purification – diaphragm cell – mercury cell – membrane cells – manufacture of solid caustic soda. Chlorine – purification – liquefaction uses. – storage.

REFERENCE BOOKS

1. Out lines of Chemical Technology - Dryden
2. Chemical Process industries - R. Norris Shreve
3. Chemical Technology Volume - II - TTTI, Chennai

SUBJECT TITLE : POLYMER TECHNOLOGY LABORATORY
SUBJECT CODE : CH 405
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

CONTENT DETAILS

Determination of viscosity using ostwald viscometer – Measurment of Shore – Dhardness – Measurment of specific gravity – Fabrication of FRP laminaters – Measurment of softening point of plastic material – preparations of phenol formaldehyde – preparation of phenol formaldehyde – preparation of urea formaldehyde – preparation of cuper ammonium rayon.

List of Experiments

1. Intrinsic Viscosity
2. Shore – D – Hardness
3. Specific Gravity
4. Softening Point
5. Fabrication of FRP
6. Softening point
7. Preparation of phenol formaldehyde
8. Preparation of urea formaldehyde
9. Preparation of cuper ammonium rayon

Demonstration Experiments

1. Study the fatigue behaviour of materials using rotary fatigue testing machine
2. Injection moulding
3. Blow moulding

SUBJECT TITLE : CHEMICAL ENGINEERING DRAWING – II
SUBJECT CODE : CH 406
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

TIME SCHEDULE

UNIT	TOPIC	PERIODS
1	PIPE JOINTS	14
	Test	2
2	ASSEMBLY AND DETAIL DRAWINGS	14
	Test	2
3	CHEMICAL ENGG. EQUIPMENT DIAGRAMS	14
	Test	2
	TOTAL	48

CONTENT DETAILS

UNIT.I . Couplings – Muff Coupling (Solid & Split) - Flanged – Protected Un-protected – Flexible Coupling

UNIT.II : ASSEMBLY AND DETAIL DRAWINGS

Need and functions of assembly and detailed drawings – selection of sheet size – preparation of title block - bill of materials and parts list. Steps in preparing assembly and detailed drawings. Exercises in preparing assembly and detailed drawing of commonly available component – , cotter joint knuckle joint, foot step bearings, Plummer block and stuffing box.

UNIT.III : CHEMICAL ENGG. EQUIPMENT DIAGRAMS

Fixed tube sheet heat exchanger, floating head heat exchanger, U-tube exchanger, 2-4-floating heat exchanger.

Long tube vertical evaporator, Horizontal tube evaporator, forced circulation evaporator,– multiple effect evaporators – forward feed, back ward feed, mixed feed, parallel feed.

Steam Traps – Condensers – Entrainment Separators – Reboiler – Steam Ejector.

REFERENCE BOOK

1. Machine drawing - John & Varghese
2. Introduction to Chemical Engineering - Walter.L.Badger & Julias.T.Banchero

SUBJECT TITLE : FLUID MECHANICS LABORATORY
SUBJECT CODE : CH 407
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Pipe Friction Apparatus		18
		Test - I	3
II	Flow Measurements		18
		Test - II	3
III	Efficiency Determination		18
		Test - III	3
IV	Velocity Distribution		15
		Test - IV	3
V	Pressure Drop Measurement		12
		Test - V	3
		Total	96

CONTENT DETAILS

UNIT 1. PIPE FRICTION APPARATUS

1. Determine pipe friction in straight pipe
2. Determine pipe friction in straight circular pipe with fluid air using Fanning's equation
3. Verification of Fanning's equation with pipe fittings

UNIT 2. FLOW MEASUREMENT

4. Determine Venturi coefficient
5. Determine Orifice coefficient
6. Calibrate the given Rota meter
7. Determine flow through Weirs and Notches (Rectangular & V-Notch)

UNIT 3. EFFICIENCY DETERMINATION

8. Determine efficiency of centrifugal pump
9. Determine efficiency of gear pump
10. Determine efficiency of blower
11. Determine Volumetric efficiency of compressor

UNIT 4. VELOCITY DISTRIBUTION

12. Determine the velocity profile of airflow in straight pipe
13. Determine point velocity using pitot tube
14. Conduct Reynolds experiment
15. Determine orifice coefficient using open orifice

UNIT 5. PRESSURE DROP MEASUREMENT

16. Determine the drop in pressure through a Packed column
17. Determine the drop in pressure through a Fluidization column
18. Verify Stroke's law

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER V

Branch: Chemical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
CH 501	Inorganic Chemical Technology -II	5		5	75		25	100
CH 502	Mass Transfer Operations - 1	5		5	75		25	100
CH 503	Particle Technology	5		5	75		25	100
CH 504	Instrumentation & Process Control	5		5	75		25	100
CH 505	Chemical Engineering Equipment Drawing		4	4		75	25	100
CH 506	Chemical Technology Laboratory		4	4		75	25	100
CH 507	Heat Transfer Laboratory		4	4		75	25	100
	Project & Seminar		3	3				
	TOTAL	20	15	35	300	225	175	700

SUBJECT TITLE : INORGANICCHEMICAL TECHNOLOGY - II
SUBJECT CODE : CH 501
PERIODS/WEEK : 5
PERIODS/SEMESTER :80

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Fertilizers	14
	Test	2
II	Electro Thermal Products	14
	Test	2
III	Pigments and Paints	14
	Test	2
IV	Cement and Glass	14
	Test	2
V	Refractories and Ceramics	21
	Test	2
	Total	80

OBJECTIVES

UNIT- I

1.1.0 Understand the Manufacturing of Ammonia

1.1.1 List the properties and uses of Ammonia
1.1.2 Explain the chemical Equilibria and rate conversion in the production of Ammonia
1.1.3 Explain the preparation of N2 and H2 from air and Napht with flow sheet
1.1.4 Explain and working of various equipments with above process
1.1.5 Explain the composition in the synthesis
1.1.6 Explain the working and construction of compressor
1.1.7 Explain the catalytic conversion of Ammonia
1.1.8 Explain the working and constructional details of Ammonia converter
1.1.9 Draw and explain the process with flow sheet

1.2.0 Understand the manufacturing of Ammonium Sulphate

1.2.1 Explain the process of ammonium sulphate manufacture by direct neutralization with gypsum
1.2.2 Draw the process of ammonium sulphate manufacture by direct neutralization with gypsum
1.2.3 List the reaction involved in process
1.2.4 List the equipments used in the process

1.3.0 Understand the manufacturing of Urea

1.3.1 Explain the chemical reaction involved in the process
1.3.2 Explain the kinetics and equillibria of the reaction involved
1.3.3 Draw and explain the flow diagram for the manufacturing process
1.3.4 Explain the process details
1.3.5 Explain the various grade of urea
1.3.6 Explain the manufacture of plastic grade urea

UNIT – II

2.1.0 Electro Thermal Product

2.1.1 Graphite
2.1.2 List the Raw materials
2.1.3 List the Properties and Uses
2.1.4 Explain the Production Artificial Graphite with Flow diagram
2.1.5 List the natural abrasive materials
2.1.6 Explain the artificial Abrasive with Flow diagram
2.1.7 List the Raw materials properties and uses of fused Alumina
2.1.8 Explain the Furnace details of fused alumina
2.1.9 list the raw materials of tungsten carbide
2.1.10 Explain the manufacture of tungsten carbide
2.1.11 Explain the manufacture of titanium carbide and its uses
2.1.12 Explain the manufacture of silicon carbide ,its properties and uses
2.1.13 Explain the manufacture of calcium carbide with flow diagram ,its properties and uses

UNIT – III

3.1.0 Understand the manufacturing of pigments

3.1.1 List and explain various constituents of paints
3.1.2 Explain the manufacturing process of paints
3.1.3 Explain the manufacturing process of Titanium dioxide with flow sheet (Chloride process & Sulphate process)
3.1.4 Explain the manufacture of carbon black with flow sheet
3.1.5 Explain the manufacture of red pigment

3.2.0 Understand the Manufacturing of Sodium Silicate

3.2.1 List the raw materials for the manufacture of sodium silicate
3.2.2 Explain the manufacture of sodium silicate with the help of flow sheet
3.2.3 List the applications of sodium silicate

UNIT - IV

4.1.0 Understand the Manufacturing of Cement

4.1.1 List the raw materials of cement
4.1.1 Explain the dry process and wet process for the manufacture of cement with the help of flow sheet
4.1.2 Explain the construction and working of rotary drier
4.1.3 Explain the phenomenon of setting of cement

4.2.0 Understand the Manufacturing of Glass

4.2.1 List the raw material for the manufacture
4.2.2 Explain the manufacture of class from raw materials
4.2.3 Explain the various grade of glass
4.2.4 List the properties and uses of various grade

UNIT V

5.1.0 Understand the Manufacturing of Refractory

- 5.1.1 List and explain various type of refractory
- 5.1.2 Classify various type of refractory
- 5.1.3 List the raw material for the manufacture
- 5.1.4 Explain the manufacture of various types

5.2.0 Understand the Manufacturing of Ceramics

- 5.2.1 List and explain various types of ceramics
- 5.2.2 List the properties and uses of various types

CONTENTS DETAILS

UNIT I

Ammonia Synthesis – theoretical principles – equilibrium reaction, catalyst, space velocity. Different source of synthesis gas low and high pressure process for the manufacture of Ammonia – properties and uses of Ammonia. Manufacture of ammonium sulphate – direct neutralization and gypsum process. Urea – Manufacture of urea – equilibrium and kinetics consideration – different process – plastic grade urea

UNIT II

Natural graphite – manufacture of artifial graphite –properties and uses – manufacture of fused alumina – furnace details – properties and uses –manufacture of tungsten carbide, titanium ,calcium carbide, properties and uses

UNIT III

Pigments – TiO2 manufacture with help of flow sheet – chloride process and sulphate process. Carbon black – red lead – paints – constituents Manufacture of sodium silicate – uses

UNIT IV

cement – raw materials – main unit operation and process involved – wet and dry process – merits and demerits. Glass – manufacturing method; different grades – uses.

UNIT IV

Refractories - types – classification, properties – manufacture of fire clay brick, silicate brick, high alumina brick, carbon ceramics – raw material – main unit operation and process

REFERENCE BOOKS

1. Chemical Technology Volume – II – TTTI, Chennai
2. Chemical Process Industries – R.Norris Shreve
3. Out lines of Chemical Technology – Dryden

SUBJECT TITLE : MASS TRANSFER OPERATIONS - I
SUBJECT CODE : CH 502
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Diffusion		12
		Test	2
II	Absorption		14
		Test	2
III	Humidification		14
		Test	2
IV	Drying		14
		Test	2
V	Distillation		16
		Test	2
		Total	80

OBJECTIVES

UNIT I

1.1.0 Diffusion

- **1.1.1** Define diffusion
- **1.1.2** Classification of diffusion
- **1.1.3** Define eddy diffusion
- **1.1.4** Define molecular diffusion
- **1.1.5** Define thermal diffusion
- **1.1.6** Explain the molar flux
- **1.1.7** Explain fick ‘s rate equation
- **1.1.8** Explain steady state diffusion of gas A through non-diffusing gas B. (Rate equation)
- **1.1.9** Simple problems
- **1.1.10** Explain steady state diffusion of liquid component A through non-diffusing liquid component B. (No derivation)
- **1.1.11** Simple problems based on the above equation
- **1.1.12** Explain the two film theory and mass transfer coefficient
- **1.1.13** Explain the gas phase separation process
- **1.1.14** Explain the working of single stage thermal diffusion cell
- **1.1.15** Explain the working of thermal diffusion column
- **1.1.16** Define pressure diffusion
- **1.1.17** Explain the working of gas centrifuge
- **1.1.18** Define mass diffusion
- **1.1.19** Explain the mass diffusion column

UNIT II

2.1.0 Absorption

- 2.1.1 Define absorption
- 2.1.2 Define desorption
- 2.1.3 Comparison of gas absorption and distillation

2.1.3 Explain the mechanism absorption operation\
2.1.4 Explain the condition of equilibrium between gas and liquid
2.1.5 Selection criteria for solvent in gas absorption
2.1.6 Material balance
2.1.7 Simple problems relating to material balance

2.2.0 Appreciate the construction and working of Absorption operation equipments

2.2.1 Construction details and working of packed tower
2.2.2 Name the different types of packing materials
2.2.3 List the important characteristics of packing materials
2.2.4 Distinguish between regular and random packing
2.2.5 Explain the flow patterns of fluid through packings
2.2.6 Describe the various types of liquid distributors
2.2.7 Define the term channelling
2.2.8 Constructional details and working of mechanically agitated vessels
2.2.9 Constructional details and working of plate column
2.2.1 Compare the merits and demerits of packed column

UNIT III

3.1.0 Understand the Principles of Humidification

3.1.1 Define the terms – humidity, relative humidity percentage humidity, molar humidity, humid volume & humid heat
3.1.2 Express the above terms in the form of a mathematical equation
3.1.3 Solve problems based on the above equations
3.1.4 Explain the humidity chart for air-water vapour system
3.1.5 Calculate humidity, dew point, percentage humidity etc., from humidity chart
3.1.6 Solve simple problems using humidity chart
3.1.7 Explain the terms adiabatic saturation temp and wet bulb temp
3.1.8 Derive the equation for adiabatic saturation temperature and wet bulb temperature
3.1.9 Explain the factors influencing the adiabatic saturation and wet bulb temp
3.1.10 Explain the construction and working of water cooling towers
3.1.11 Explain the methods of humidification and dehumidification
3.1.12 Explain the equipments used for air conditioning
3.1.13 Compare the humidification and dehumidification operations

UNIT IV

4.1.0 Understand the mechanism of drying operations

4.1.1 List the applications of drying
4.1.2 Explain the classification of drying equipments
4.1.3 Explain the constructional details and working of dryers
4.1.4 Explain the control measure adopted for the control of drying operation int eh case of dryers
4.1.5 List the field of application of various dryers
4.1.6 Compare the performance of various dryers
4.1.7 Explain the theory of drying
4.1.8 Distinguish between wet basis and dry basis of expression of moisture content of solids
4.1.9 Define the terms, equilibrium moisture content, free moisture content and critical moisture content
4.1.10 Distinguish between bound water and unbound water

4.1.1 Explain the mechanism of batch drying

4.1.2 Explain constant rate period and falling rate period

4.1.3 Derive an equation for calculating the time for drying (constant rate period and falling rate period)
4.1.4 Simple problems using the above derived equation
4.1.5 Explain the factors influencing the rate of drying
4.1.6 Explain case hardening

UNIT V: DISTILLATION

5.1.0 Understand the Basic Principles of Distillation

5.1.1 List the applications of distillation operation
5.1.2 Define binary and multi component mixture
5.1.3 Define the terms less volatile, more volatile, low boiling and high boiling
5.1.4 Express the composition of mixtures of liquid and vapour
5.1.5 Define Raoult's law
5.1.6 Define and distinguish ideal and non ideal solutions
5.1.7 Calculate compositions in terms of mole fractions
5.1.8 Construct the vapour – liquid equilibrium diagram for a binary mixture
5.1.9 Calculate vapour liquid equilibrium data applying Raoult's law
5.1.10 Derive an equation for relative volatility
5.1.11 Problems using the above derived equation
5.1.12 Define 'azeotrope'
5.1.13 Explain maximum and minimum boiling azeotrope with suitable examples
5.1.14 List the various methods of distillation
5.1.15 Explain equilibrium distillation with neat sketch
5.1.16 Explain simple distillation
5.1.17 Derive and verify Rayleigh's egn for simple distillation
5.1.18 Problems based on Rayleigh's equation
5.1.19 Explain steam distillation
5.1.20 List the advantages and applications of steam distillation

CONTENT DETAILS

UNIT - I DIFFUSION

Molecular diffusion – molar flux – Fick's rate equation – steady state diffusion of gas A through non diffusing B – Simple problems – steady state diffusion of liquid component A through non diffusing B – simple problems

UNIT – II ABSORPTION

Mechanism of Absorption – conditions of equilibrium between gas and liquid – Henry's law – factors controlling rate of absorption – concept of NTU & HTU (No derivation) – simple problems – equipments for absorption operations – packed tower – packing materials – characteristics of packing – liquid distributors – channelling.

UNIT – III: HUMIDIFICATION

General mechanism of diffusional processes – Definitions and mathematical expressions for molal humidity – Absolute humidity – Relative humidity – percentage humidity – Humid volume – Humid heat – Enthalpy and dew point – simple problems. Humidity chart – its importance and application in solving problems – simple problems

Adiabatic saturation temperature – wet bulb temp cooling towers – atmospheric – natural and forced draft, cross flow type – humidification and dehumidification – air conditioning

UNIT – IV DRYING

Purpose and industrial applications – drying equipment – classifications – tray dryer – tunnel dryer – rotary dryer – turbo dryer – spray dryer – drum dryer – cylinder dryer – fluid bed dryer – dry basis and wet basis of expression of moisture content – equilibrium moisture content – free moisture content – bound and unbound water – mechanism of batch drying of solids – constant rate and falling rate period. Derivations of equations for time of drying in constant rate and falling rate period – simple problems – case hardening.

UNIT –V DISTILLATION

Distillation as an interphase mass transfer – industrial application – definition of terms – less volatile, more volatile, low boiling, high boiling – vapour – liquid equilibrium diagrams and their importance. Ideal and non-ideal solutions – Raoult's law – calculation of X-Y data using Raoult's law. Azeotropes – maximum and minimum boiling – volatility and relative volatility – calculation of relative volatility of a binary mixture.Types of distillation – equilibrium – simple distillation, steam distillation,

REFERENCE BOOKS

1. Unit Operations – McCabe and Smith
2. Mass Transfer Operations – Treybal.R.E
3. Unit Operations of Chemical Engg., Vol. – I – P.Chathopadhya
4. Mass Transfer Operations – Surya Narayana
5. Unit Operations. II – GHAVANY

SUBJECT TITLE : PARTICLE TECHNOLOGY
SUBJECT CODE : CH 503
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPICS		PERIODS
1.	Filtration and Centrifugation		14
		Test	2
2.	Size Reduction		14
		Test	2
3.	Size Separation and Fluidization		14
		Test	2
4.	Sedimentation Agitation		14
		Test	2
5.	Storage and Transportation of solids Storage of Gases and Liquids		14
		Test	2
		Total	80

OBJECTIVES

Unit – I: Filtration and Centrifugation

1.1.0 Understand filtration as a solid liquid separation

1.1.1 Define filtration
1.1.2 List the type of filters
1.1.3 Discuss the working of sand filter
1.1.4 Draw the sketch of plates and frames of filter press
1.1.5 Draw the sketch of plate and frames in the filtering operation
1.1.6 Discuss the working of plate and frame filter press
1.1.7 Explain the washing of plate and frame filter press
1.1.8 Explain the working of leaf filter
1.1.9 Explain the working of sweet land filter
1.1.10 Explain the working of Moore filter
1.1.11 Draw the sketch of Horizontal filter
1.1.12 Draw the sketch of Rotary Drum Filter
1.1.13 Explain the working of Rotary Drum Filter

1.2.0 Recognize the selection criteria of filters

1.2.1 List the factor on which rate filter section depends
1.2.2 List the factors on which rate of filtration depends
1.2.3 List the types of filter aid
1.2.4 State the function of filter aid in filtration
1.2.5 State the application of filter aid
1.2.6 List the types of filter cakes
1.2.7 Explain compressible and non-compressible filter cakes
1.2.8 Explain constant pressure filtration
1.2.9 Explain constant volume filtration

1.2.10 State the rate equation for constant pressure filtration
1.2.11 State term resistance of filter cake
1.2.12 Compute the time of filtration using the rate equation

1.3.0 Understand the process Centrifugation

1.3.1 Discuss the centrifugal fire developed in centrifuge
1.3.2 List the classification of centrifuges
1.3.3 Draw the sketch of top driven taken centrifuge
1.3.4 Describe the working top driven batch centrifuge
1.3.5 Describe the working of bottom driven centrifuge
1.3.6 Draw the sketch of semi continuous centrifuge
1.3.7 Describe the working of semi continuous centrifuge
1.3.8 Draw the sketch of super centrifuge
1.3.9 Describe the working of super centrifuge
1.3.10 Draw the sketch of Disc centrifuge
1.3.11 Describe the working of disc centrifuge

Unit – II: Size Reduction

2.1.0 Appreciate the size reduction techniques

2.1.1 Generalize the important of size reduction
2.1.2 List the nature of materials to be crushed
2.1.3 Discuss closed circuit grinding
2.1.4 Discuss open circuit grinding
2.1.5 List the classification of crushing and grinding equipments

2.2.0 Understand the working crushing equipments

2.2.1 Draw the sketch of Blake Jaw crusher
2.2.2 Explain the working of Blake Jaw crusher
2.2.3 Compare Blake and Dodge Jaw crusher
2.2.4 Draw the sketch of gyratory crusher
2.2.5 Explain the working of gyratory crusher
2.2.6 Explain crushing rolls
2.2.7 Draw the sketch of a smooth roll crusher
2.2.8 Define the angle of Nip of crushing rolls
2.2.9 Explain the theory behind the action of crushing rolls
2.2.10 Compute the angle of Nip
2.2.11 Draw the sketch of a single Roll crusher
2.2.12 Describe the working of a single roll crusher
2.2.13 Draw the sketch of a ball mill
2.2.14 Explain the working of ball mill
2.2.15 Compare ball and tube mill
2.2.16 List the factors influencing the size of the product of a ball mill
2.2.17 Derive an equation of critical speed of a ball mill
2.2.18 Compute critical speed

2.3.0 Interpret the laws of crushing

2.3.1 Explain Rittingers law
2.3.2 State Kicks law
2.3.3 State Bond's law
2.3.4 Calculate power consumption using Rittingers law
2.3.5 Define particle shape
2.3.6 Define particle size
2.3.7 State mixed particle size
2.3.8 Define specific surface of mixture

2.3.9 Define average particle size
2.3.10 Define shape factor

Unit – III: Size Separation and Fluidization

3.1.0 Understand size separation

3.1.1 Compare the Tyler and U.S standard screens
3.1.2 List the types of screening equipment
3.1.3 Explain the working of grizzlies
3.1.4 Draw the sketch of a trommel
3.1.5 Explain the working of trommel
3.1.6 Differentiate between shaking and vibrating screen
3.1.7 Draw the sketch of vibrating screen
3.1.8 State the principle of Dust collection
3.1.9 Draw the sketch of cyclone separator
3.1.10 Explain the working of cyclone separator
3.1.11 Explain the application of fluidization in phthalic anhydrude production
3.1.12 With a sketch explain bag filter
3.1.13 State the principle of electrostatic precipitation

3.2.0 Understand settling methods

3.2.1 List the types of settling
3.2.2 Explain free settling
3.2.3 Derive stokes law
3.2.4 Calculate terminal settling velocity using Stoke's law
3.2.5 Explain Hindered settling
3.3.0 Understand the mechanism of fluidization
3.3.1 Define fluidization
3.3.2 Discuss the mechanism of fluidization
3.3.3 Describe the characteristics of fluidization
3.3.4 Define minimum fluidization velocity
3.3.5 Define minimum bed height in fluidization
3.3.6 Define the term bed porosity
3.3.7 Discuss the effects of gas velocity on expansion of bed and pressure gradient
3.3.8 List the application of fluidization
3.3.9 Explain with a sketch fluidized bed coal conversion
3.3.10 Describe the fluidized bed oil conversion
3.3.11 Explain phthalic anhydride production
3.3.12 Explain the application of fluidized bed in catalytic cracking with a sketch
3.3.13 Describe application fluidized bed drying

Unit – IV: Sedimentation, Agitation and Mixing

4.1.0 Understand sedimentation methods

4.1.1 Define sedimentation
4.1.2 Draw the sketches of various stages in Batch sedimentation
4.1.3 Explain Batch sedimentation
4.1.4 Explain continuous sedimentation
4.1.5 Discuss Kynch theory
4.1.6 Explain the determination of thickener area
4.1.7 Draw the sketch of Double cone classifier
4.1.8 State the principle of Jigging
4.1.9 Explain Tabling

4.2.0 Understand Floatation methods

4.2.1 Define flotation
4.2.2 Draw the flow sheet of floatation plant using rougher, scavenger and cleaner
4.2.3 Describe flotation equipment
4.2.4 Explain Magnetic separator

4.3.0 Understand the working of agitation and mixing equipments

4.3.1 Define Agitation
4.3.2 Distinguish between Agitation and Mixing
4.3.3 List the purpose of agitation
4.3.4 Draw the sketch of an agitation equipment
4.3.5 Explain the working of agitation equipment
4.3.6 Explain the types of Impellors
4.3.7 Draw the sketch of propellers
4.3.8 Explain paddles
4.3.9 Explain the flow pattern in agitated vessels
4.3.10 Explain the function of draft tube and Baffle
4.3.11 Explain the power consumption in agitated vessels
4.3.12 Define power Number.
4.3.13 Define Froude Number.
4.3.14 Calculation of power no, Froude no. and Reynold's no. with respect to agitation and mixing
4.3.15 Explain dry mixer
4.3.16 Draw the sketch of Banbury mixer
4.3.17 Explain the working of Banbury mixer
4.3.18 Describe 'V' type mixer
4.3.19 Describe with a sketch kneading machine

<u>Unit – V:</u> Storage and Transportation of Solids Storage of Gases and Liquids

5.1.0 Appreciate the storage of solids

5.1.1 Describe hoppers
5.1.2 Explain bins
5.1.3 Explain silos
5.1.4 Define angle of Repose
5.1.5 Discuss the points to be noted in the open storage of solids

5.2.0 Understand conveying methods and working of conveyors

5.2.1 Classification of conveyors
5.2.2 Draw the sketches of belt conveyor drives
5.2.3 Explain the belt conveyor construction
5.2.4 Draw the sketch of belt conveyor support belt conveyor idler
5.2.5 Explain belt conveyor take ups
5.2.6 Discuss belt conveyor feeders
5.2.7 Explain belt conveyor discharge methods
5.2.8 Explain chain conveyors
5.2.9 Discuss Apron conveyor
5.2.10 Describe the working of a screw conveyor
5.2.11 Draw the sketch of screw conveyor flight
5.2.12 Compare elevators and chain conveyors
5.2.13 Draw the sketch of a pneumatic
5.2.14 Explain the working of pneumatic conveyor

5.3.0 Appreciate the storage of Liquid and gases

5.3.1 Define an atmospheric tank
5.3.2 Sketch some types of roofs of atmospheric storage tank

5.3.3 Define a gasholder
5.3.4 Define pressure vessel in storage of gases
5.3.5 Differentiate between bottles and pipelines in storage of gases

CONTENT DETAILS

Unit – I: Filtration and Centrifugation

Filtration as a solid, liquid separation and its application in industry. Classification of filters atmospheric, pressure and vacuum filters – field of application and constructional details, working and application of the following

1. Sand filter – open – closed
2. Filter presses – plate and frame filter press, non-washing, open delivery, washing, closed delivery
3. Leaf filters – pressure and vacuum types – Moore filter.
4. Continuous filter – rotary drum – working cycle – methods of cake discharge – installation – horizontal pan filters – tilting pan filters – selection of filters – filter aids, their function and applications – pre-coating, filter media – types of filter mediums and its specific applications – properties of filter medium and selection.

Filter operation – effect of pressure – constant pressure and constant volume filtration. Rate equation for constant pressure filtration. Determination of constants in filtration equation – time of filtration – time of washing, simple problems. Specific resistance - compressible and non compressible cake.

CENTRIFUGATION:

Centrifugal force developed in centrifuges – classification of centrifuges – batch – semi continuous, continuous – top driven – bottom driven – perforated solid bowl – super centrifuges – operation – field of application.

Unit – II: Size Reduction

Nature of the materials to be crushed – hardness, structure, moisture content, crushing strength, stickyness, soapyness – explosiveness

Types of crusting equipments, coarse crushers – Intermediate crushers – fine grinders – open circuit grinding – closed circuit grinding.

Laws of crushing – Kick's law – Rittingers law – Bonds law – Jaw crusher – gyratory – crusher – crushing rolls – angle of nip – simple problems – capacity, hammer mill – ball mill. – critical speed – simple problems – Raymond mill – tube mill

Average particle size – specific surface of mixture, volume surface mean diameter – arithmetic mean diameter – mass mean diameter – shape factor.

UNIT III: Size Separation and Fluidization

Screens: Tyler and U.S. standard screens

Screen analysis: efficiency and capacity of screens

Types of screening equipment – grizzlies – trammels, shaking screens, vibrating screens

Air separation methods: cyclone separator – air separator – bag filter. Electrostatic precipitator – settling chambers – cyclone separator – venturi scrubbers – separation of solids in liquids. Theory of settling, free and hindered setting – Stoke's law and its application, terminal velocities – simple problem

Fluidization:

Mechanism of fluidization – conditions for fluidization – batch fluidization – boiling effect – minimum porosity – bed height – minimum fluidization velocity – effect of gas velocity on expansion of bed and pressure gradient. Characteristics of gas solid fluidized systems – uses of fluidized bed systems – chemical reactors (catalytic and non catalytic) physical contacting drying – classification and conveying.

UNIT IV Sedimentation, Agitation and Mixing

Sedimentation separation in liquid medium – batch sedimentation – application of batch settling tests to design of continuous thickness – Kynch theory, determination of thickener area – equipments – double cone classifier – Dorr classifier –gravity continuous thickeners – elutriator jigging – tabling – light and dense medium separation based on difference in densities and its application.

Principle of froth flotation cells, froth floatation cells – simple flow sheet for floatation plant, magnetic separator

AGITATION AND MIXING:

Purpose of agitation – agitation equipment – propellers, paddles and turbines.

Flow pattern in agitated vessels – prevention of swirling – draft tubes and baffles - their functions and effects.

Power consumption in agitated vessels – simple problems in determination of power consumption and design of mixers. Mixing of solids to solids. Ribbon blender – double cone, 'V' type mixes – pug mill.

UNIT V: Storage and Transportation of Solids Storage of Gases and Liquids

Storage of solids – Hoppers – bins – angle of repose. Devices of for discharge of solids – open storage of solids

Conveyor types – belt conveyor – chain conveyor – scraper conveyor – apron conveyor – Bucket conveyors – Bucket elevators – Screw conveyors – pneumatic conveyors – pneumatic conveying system auxiliary equipments – field of application of the above conveyors – construction and working.

Storage of liquid – storage tanks, Storage of volatile liquids – floating roof, Storage of gases: Horton sphere – pressure cylinders – gas holders – wet and dry specifications and codes for gas storage – safety precautions.

BOOKS RECOMMENDED

1. Introduction to chemical engineering – Waklter.L.Badger & Julius.T.Banchero
2. Unit Operations – Warren.L.McCabe & Julian.C.Smith
3. Unit Operations of Chemical engineering. Vol 1 – P.Chathopadhyay
4. Perry's Chemical Engineers Hand Book 4th edition
5. Chemical Engineering vol.II – J.M.Coulson & Richardson

SUBJECT TITLE : **INSTRUMENTATION AND PROCESS CONTROL**
SUBJECT CODE : **CH 504**
PERIODS/WEEK : **5**
PERIODS/SEMESTER : **80**

TIME SCHEDULE

UNIT	TOPIC	PERIODS
1.	Measuring Instrument, Temperature and Pressure measurement	14
	Test	2
2.	Flow, Level, Specific gravity, Viscosity, Humidity and Moisture content measurement	14
	Test	2
3.	Instrumental methods of analysis	14
	Test	2
4.	Process control	14
	Test	2
5.	Computerized process control	14
	Test	2
	Total	**80**

OBJECTIVES

UNIT – I

1.1.0 Appreciate the working of measuring instruments, temperature and pressure measurements

1.1.1 Discuss the importance of instrumentation in chemical process industries
1.1.2 List 10 important process variables in chemical industry
1.1.3 List the basic elements of measuring instrument
1.1.4 Draw a sketch of measuring instrument and indicate the basic elements and explain the functions of these elements
1.1.5 Tabulate the classification of temperature measuring instruments giving their range of measurements and principle of operation
1.1.6 List the basis of classification of filled system thermometers
1.1.7 Explain with sketches of mercury filled, gas filled and vapour filled thermometers
1.1.8 Write a short account on temperature compensation in filled system thermometers
1.1.9 Distinguish between the four types of filled system thermometers
1.1.10 Explain why temperature compensation is not required for vapour filled systems
1.1.11 Draw a sketch of a bimetallic thermometer and indicate the parts. List the fields of application and advantages of a bimetallic thermometer
1.1.12 List the elements for converting temperature variation in to electrical variables
1.1.13 Discuss the variation of resistance with temperature in materials like copper, nickel, platinum
1.1.14 Describe the methods of ambient temperature compensation in resistance thermo meters
1.1.15 Write short account on the use, rang and accuracy of resistance thermometer with a diagram
1.1.16 Draw sketches of two types of resistance thermometer bulbs

1.1.17 List the functions of protection wells for thermometer bulbs
1.1.18 Explain the SEE BACK, THOMSON AND PETLIER effect with reference to thermocouple.
1.1.19 List the commonly used thermocouple wires with their temperature range of measurement
1.1.20 Explain with figure the method of making thermocouple junction, insulation and protection of thermocouple
1.1.21 List the basic principles involved in installation and maintenance of thermocouple
1.1.22 Describe the temperature indicating instruments used with thermocouples with sketches vis. Deflection type thermocouple pyrometer, elementary potentiometer circuit, automatic self balancing potentiometer
1.1.23 Explain the basic principles of radiation and optical pyrometers and list their advantages over other types
1.1.24 Describe a total radiation pyrometer with a sketch
1.1.25 Explain about the thermopile and vacuum thermo couple used in radiation pyrometer
1.1.26 Draw a sketch of an optical pyrometer and explain the working principles
1.1.27 Illustrate the use of optical wedge in optical pyrometer
1.1.28 Define the terms pressure vacuum, absolute pressure, gauge pressure and gauge vacuum and give units
1.1.29 List the method of measuring pressure
1.1.30 Explain with sketches of U-tube manometers well type, 2-liquid type, and inclined manometer
1.1.31 List the liquids commonly used as manometer liquid
1.1.32 Explain with a sketch an industrial type manometer with mechanical or electrical output
1.1.33 Draw sketches of types of random element, below element and diaphragm element used in pressure
1.1.34 Explain the working principle of a 'c' type Bourden tube
1.1.35 Describe the following gauges with sketch. (1) Absolute pressure gauge (2) Me leod gauge (3) Pirani gauge (4) Thermal conductivity gauge

UNIT – II

2.1.0 Appreciate the working of flow and level measuring instruments

2.1.1 List the classifications of flow measuring devices giving examples
2.1.2 Explain briefly orifice meter, venturimeter, rotameter and pitot tube with sketches
2.1.3 List the merits and demerits of the above meters
2.1.4 Classify the various types of mechanical flow meters
2.1.5 Explain with sketch of any one type of positive displacement flow meters
2.1.6 Describe current or propeller type flow meter with a sketch
2.1.7 Describe about the open channel meters such as weirs, notches etc
2.1.8 Describe hot wire anemometer with the help of a sketch
2.1.9 Describe with sketches of the following level measuring instruments
(1) Sight glasses (2) float type (3) Torque tube (4) Diaphragm box (5) Bubbler system (6) Electrical type (7) Magnetic type
2.1.10 Select suitable level measuring instrument for specific purpose

2.2.0 Understand the measuring instrument for viscosity, specific gravity, humidity and moisture content

2.2.1 Describe the sketches displacement and hydrometer type density measuring instrument for on line measurement
2.2.2 Describe with sketches of the following viscosity measuring instrument
(1) Short tube viscometers (2) Continuous viscosity meter
2.2.3 Explain the terms absolute humidity, percentage humidity and relative humidity

2.2.4 Explain with sketches of the following instruments:- Wet and dry bulb thermometer, Hair hygrometer, Electric hygrometer, Dew point recorder (Fox pro type), Dew point recorder (Mirror type)

2.2.5 Describe with sketches of the instruments for measuring moisture in soap, wood, grains and paper

UNIT – III

3.1.0 Understand the working principles and applications of instruments used for chemical analysis

3.1.1 Describe briefly the general principles of chromatographic analysis

3.1.2 List the classifications of chromatographic analysis gas

3.1.3 Describe a gas chromatograph with a neat sketch and list the field of its application

3.1.4 Explain with neat sketches of any two type of detectors used in gas chromatograph

3.1.5 Describe with a sketch of liquid column chromatograph and explain any one type of detectors used in LCC. List applications of LCC

3.1.6 Describe with a sketch of a flame photometer and list its applications

3.1.7 Describe briefly the basic principles and applications of spectrophotometers

3.1.8 Describe visible spectrophotometer with a sketch and list its applications

3.1.9 Describe with a sketch an ultraviolet spectrophotometer

3.1.10 Explain the basic principles of atomic absorption spectrophotometery and give the field of application

3.1.11 Explain briefly infrared and NMR spectroscopy

3.1.12 List the components in a mass spectrometer and explain with a sketch of any one type of mass spectrometers and describe its field of application

3.1.13 Define the terms specific conductance and equivalent conductance

3.1.14 Explain the basic principles and applications of conductivity meters

3.1.15 Explain the basic principles of conductometric titration

3.1.16 Explain what is pH and its significance in process industries

3.1.17 List the pH scale, with pH of some known liquids

3.1.18 Explain the basic working principles of a pH meter

3.1.19 Describe with sketches of glass electrode and reference electrode and combination of electrodes

UNIT – IV: PROCESS CONTROL

4.1.0 Interpret the basic principles and applications of process control

4.1.1 List and explain the static and dynamic characteristics of measuring instruments

4.1.2 Explain the terms process – capacitance lag and response

4.1.3 Draw block diagrams and explain open and closed loop control

4.1.4 Explain with example and sketches of two self operated controllers

4.1.5 List the types of control modes

4.1.6 Explain the characteristics of this modes of control – two – position control, proportional, derivative, integral and their combinations

4.1.7 Draw and explain pneumatic type of the above modes of control

4.1.8 Explain what is meant by a transducer

4.1.9 Explain with sketches any two types of transducers used in industry

4.1.10 Write short account of telemetering

4.1.11 Distinguish between mechanical, electrical pneumatic and electronic controllers

4.1.12 Draw sketches of an automatic control valves operated by compressed air

4.1.13 Explain the meaning of the term valve actuators giving examples

4.1.14 Explain the working of (1) Solenoid valve (2) Motor valve

UNIT – V: COMPUTERIZED CONTROL

5.1.0 Appreciate the use of computers for the control of process and instrumentation diagrams

5.1.1 Give the meaning of analog and digital signal transmission with necessary diagrams
5.1.2 State the features and their uses of A/D and D/A converters in process control system
5.1.3 Draw the microprocessor distributed control system diagram and give its functions
5.1.4 List the advantages and the limitations of DCS
5.1.5 State the methods of controlling the process plants by the computer
5.1.6 Draw the standard symbols of instruments and controllers
5.1.7 Draw P-I diagrams of (1) Heat exchanger (2) Distillation column (3) Dryers (4) Filters of small plants
5.1.8 Draw the diagram of control panels and give their functions
5.1.9 List the functions of control room instruments

CONTENT DETAILS

UNIT – I:

MEASURING INSTRUMENTS – TEMPERATURE AND PRESSURE MEASUREMENTS

Principles of measurement – Instruments for indication, recording and remote control. Process variables to be measured in chemical industries – elementary principles and description of the instruments used for the measurement of the following:

1. Temperature – filled system thermometers – bimetallic – thermocouples – resistance thermometers – total radiation and optical pyrometers.
2. Pressure and vacuum – manometers – diaphragm gauges, bellow gauges, strain gauges, boarden gauges, absolute pressure gauges, Mc load gauges pirani gauge, thermal conductivity gauges – piezo resistance and piezo electric transducers.

UNIT – II: FLOW MEASUREMENT

Variable head meters – orifice, venturi and pitot tube, annular tube – variable area meters – rotameter – positive displacement meters, current or propeller type flow meters, weirs, notches, hot wire anemometers

Level measurement: Sight glasses, float type, displacement type (torque tube), diaphragm box, bubbler system, electrical methods, radiation methods

Specific gravity, Off line and on line measurement, Humidity, Dew point method, wet bulb method, hygrometry, electrical type.

Moisture content in different products

UNIT – III: INSTRUMENTAL METHODS OF ANALYSIS

Chromatographic analysis – flame photometry, spectro photometry, mass spectrograph, conductivity meters, pH meters

UNIT – IV: PROCESS CONTROL

Recorders, timers – transducers and telemetering devices

Characteristics of measuring elements and process control system – open and closed loop systems – block diagrams of back ward feed, forward feed controls – types of control modes – on-off, proportional, integral, derivative, and their combinations. Characteristic of these controls. Pneumatic systems for the above modes of control. Self operated controllers, elementary principles of controls – its advantages over the other. Final control elements – control valves, actuators, pneumatic, hydraulic, electric and mechanical, motor valves, and solenoid valves

UNIT – V: COMPUTERIZED CONTROL AND INSTRUMENTATION DIAGRAMS

Descriptive treatment of the following: - Analog and digital signal transmission, A/D, D/A converter, analog and digital computer control system – microprocessor, distributed control system – computer control of process plants.

Instrumentation diagram for the following:- Heat exchangers, Distillation column, Dryers, Filters, Reaction vessels, Control room – panels and control room functions

REFERENCES

1. Process Instrumentation – Donald.P.Eckman
2. Chemical Engg., – Handbook

SUBJECT TITLE : CHEMICAL ENGINEERING EQUIPMENT DRAWING
SUBJECT CODE : CH 505
PERIODS/WEEK : 4
PERIODS/SEMESTER : 64

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Vessel Elements	14
	Test	2
II	Vessels	14
	Test	2
III	Chemical Engineering Equipments and Process Instrumentation Diagrams	14
	Test	2
IV	Pipe Joints and Valves	14
	Test	2
	Total	**64**

CONTENT DETAILS

UNIT – I: VESSELS ELEMENTS

1.1.0 Formed ends – Ends for closing the cylindrical vessels (Free hand sketch)
- 1.1.1 Flat heads
- 1.1.2 Torrispherical head
- 1.1.3 Conical head
- 1.1.4 Semi-elliptical head
- 1.1.5 Semi spherical head

1.2.0 Different types of flanges
- 1.2.1 Male and female flange
- 1.2.2 Tongue and groove

1.3.0 Supports
- 1.3.1 Saddle support
- 1.3.2 Skirt support (Centred bolting chair)
- 1.3.3 Skirt support (Anchor Bolting chair)
- 1.3.4 Lug support
- 1.4.0 Man holes
- 1.4.1 Loose bolted type
- 1.4.2 Hinged cover type

UNIT – II: VESSELS

2.1.0 Distillation column
- 2.1.1 Tray lay-out with down comer
- 2.1.2 Bubble cap
- 2.1.3 Sieve tray column
- 2.1.4 Packed column
  - a) Random packing b)Stacked packing

2.2.0 Storage tank
- 2.2.1 Vertical cylindrical
- 2.2.2 Horizontal cylindrical
- 2.2.3 Conical
- 2.2.4 Floating head

UNIT – III: CHEMICAL ENGINEERING EQUIPMENTS AND PROCESS INSTRUMENTATION DIAGRAMS

3.1.0 Free hand proportionate sketch of the following
- 3.1.1 Rotary drier
- 3.1.2 Spray drier

3.2.0 Extraction equipments
- 3.2.1 Boll man extractor
- 3.2.2 Rotocel – extractor

3.3.0 Crystallizer
- 3.3.1 Agitated batch crystallizer
- 3.3.2 Swenson walker crystallizer

3.4.0 Process instrumentation diagram
- 3.4.1 Heat exchanger
- 3.4.2 Dryer
- 3.4.3 Reaction vessel
- 3.4.4 Distillation column

UNIT – IV, VALVES

4.1.0 Sectional views of valves
- 4.1.1 Gate valves
- 4.1.2 Stop valve
- 4.1.3 Globe valve
- 4.1.4 Non return valve

SUBJECT TITLE	**:**	**CHEMICAL TECHNOLOGY LABORATORY**
SUBJECT CODE	**:**	**CH 506**
PERIODS/WEEK	**:**	**6**
PERIODS/SEMESTER	**:**	**96**

Content Details

Analysis of water - Acidity – alkalinity – pH – Chloride content – hardness – BOD – COD – Disolved Oxygen (DO)
Estimation of available chloride in bleaching powder
Estimation of available Alumina (Al2O3) Content in Alum
Analysis of oils and facts -Acid value – Saponification value – iodine value
Analysis of soap – Free alkali – Total Alkali – Total Fatty Matter
Analysis of fuels

1) Analysis of solid fuels – coal
    a) Percentage of Fixed Carbon – Moisture content – Volatile Combustible Matter – Ash
2). Analysis of liquid fuel
    a) Flash and fire point – open and closed flash point of kerosene and Lube.Oil

SUBJECT TITLE	**:**	**HEAT TRANSFER LABORATORY**
SUBJECT CODE	**:**	**CH 507**
PERIODS/WEEK	**:**	**4**
PERIODS/SEMESTER	**:**	**64**

Content Details

Thickness of Insulation - Radiation Constant – Thermal Conductivity of Materials – Stefen – Bollzmann Constant – Heat transfer in Double Pipe Heat Exchanger – Parallel and Counter Current Flow – Heat transfer in Shell and Tube Heat Exchanger – Heat Exchange in Jacketed Kettle – Heat transfer in Agitated Vessel – Open Pan Evaporator – Single and Multiple Effect Evaporation

List of Experiments

1. Radiation constant
2. Stefen Bollzmann Constant
3. Heat Transfer in Double Pipe Heat Exchanger
4. Heat Transfer Shell and Tube Heat Exchanger
5. Heat Transfer in Jacket kettle
6. Heat Transfer in Agitated Vessel

Demonstration Experiments

1. Single Effect Evoparator
2. Multiple Effect Evaporator
3. Thickness of insulation
4. Thermal conductivity of materials

SUBJECTS OF STUDY AND SCHEME OF EVALUATION
SEMESTER VI

Branch : Chemical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
GE 601	Industrial Management & Enterpreneurship	5		5	75		25	100
CH 601	Maintenance, Safety & Environmental Engineering	5		5	75		25	100
CH 602	Mass Transfer Operations - II	5		5	75		25	100
CH 603	Organic Technology	5		5	75		25	100
CH 604	Mass Transfer Laboratory		4	4		75	25	100
CH 605	Particle Technology Laboratary		4	4		75	25	100
CH 606	Project work ** Seminar		5 2	5 2		50 -	25 25	100
	TOTAL	20	15	35	300	200	200	700

SUBJECT TITLE : **INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP**
SUBJECT CODE : **GE 601 (COMMON TO ALL)**
PERIODS/WEEK : **5 + 1 Tutorial**
PERIODS/ SEMESTER : **80 + 16**

TIME SHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Principles of Management	10
	1.2 Human Resource Management	5
II	2.1 Quality Planning and Control	5
	2.2 ISO-9000 & Installation	5
	2.3 TQM and Organizational Excellence	5
	Test – I	2
III	3.1 Project Management PERT / CPM	6
	3.2 Marketing & Sales	2
	3.3 Wages & Incentives	4
	3.4 Material Requirement Planning (MRP)	3
IV	4.2 Operations Research and Applications	10
	4.3 Management by Objectives (MBO)	3
	4.4 Management Information System (MIS)	2
	Test – II	2
V	5.1 Industrial Psychology	3
	5.2 Entrepreneurship Development	4
	5.3 Industrial Safety	4
	5.4 Environmental Pollution & Control	4
	Test – III	1
	Total	**80 + 16**

OBJECTIVES

UNIT – I

1.1.0 Understand the Principle of Management

1.1.1 Explain the meaning and concepts of management
1.1.2 Outline the characteristics of management
1.1.3 Illustrate the development of management theory
1.1.4 Illustrate the Taylor's scientific management and contributions
1.1.5 Illustrate Henry Fayol's principles of management
1.1.6 Compare the contributions of Taylor and Fayol
1.1.7 State the functions of management
1.1.8 Explain various administrative steps of each function

1.1.9 Describe different types of ownership
1.1.10 Explain different types of organization structure
1.1.11 Explain the concept of Leadership, Motivation & communication.

1.2.0 Appreciate the functions of Human Resource Management

1.2.1 Outline the importance of HRD
1.2.2 Explain the process of man power planning
1.2.3 Explain Job analysis, job evaluation, merit rating, performance appraisal
1.2.4 Training & Methods of Training

UNIT – II

2.1.0 Understand quality planning & control

2.1.1 Define quality
2.1.2 List the dimensions of quality
2.1.3 List the objectives of quality planning
2.1.4 Describe various quality control measures in brief
2.1.5 Explain quality assurance concept and definition
2.1.6 Describe in brief the Three Prong Approach to Quality Planning
2.1.7 Explain the need for quality management system
2.1.8 Draw quality loop

2.2.0 Understand the elements of ISO 9000, its Installation and audit

2.2.1 Describe the concept and role of ISO 9000
2.2.2 List the elements of ISO 9000
2.2.3 List the steps for installing quality system
2.2.4 Explain different ways of quality audit
2.2.5 Identify the agencies who give ISO certification
2.2.6 Discuss the role of accreditation board
2.2.7 Explain various stages of ISO 9000 implementation
2.2.8 Describe briefly the benefits of becoming an ISO 9000 company

2.3.0 Understand the concept of TQM and Organizational Excellence

2.3.1 Explain the concept of TQM
2.3.2 Outline the ten "Manthras" of TQM
2.3.3 Discuss in brief the link between ISO 9000 and TQM with TQM model
2.3.4 Draw the organizational structure of TQM
2.3.5 Explain the different techniques of TQM
2.3.6 Discuss the concepts and characteristics of Quality Circle
2.3.7 Discuss the brain storming technique used in quality circle for arriving at solutions
2.3.8 Explain the organizational excellence by TQM approach and through "SWOT" analysis
2.3.9 Write mission statement

UNIT – III

3.1.0 Apply the principles of CPM & PERT

3.1.1 Outline the network technique
3.1.2 List different applications of CPM & PERT
3.1.3 Out line scope of PERT & CPM
3.1.4 Define the terms used in CPM & PERT
3.1.5 Explain the procedure for finding the critical path
3.1.6 Compute the project duration, slack and critical path by using AON &AOA
3.1.7 Distinguish between CPM & PERT
3.1.8 Define the terms used in PERT
3.1.9 Explain the procedure for pert
3.1.10 Estimate activity time

3.1.11 Compute the project duration slack and mark the critical path
3.1.12 Solve the problems in PERT & CPM

3.2.0 Understand various steps in Marketing & Sales planning

3.2.1 Define marketing
3.2.2 List the objectives of marketing
3.2.3 Outline the core marketing concepts with the help of block diagrams
3.2.4 Discuss in brief the marketing mix, buying process and behaviour
3.2.5 Outline the importance of sales of products and services
3.2.6 List the functions of sales department
3.2.7 Explain the steps in market planning, market segmentation
3.2.8 Discuss the importance and functions of sales management
3.2.9 Discuss sales planning
3.2.10 Explain the market research and market information system

3.3.0 Understand the Principles of a good Wage Payment System

3.3.1 Outline the importance of a good wage plan
3.3.2 Define the different types of wages
3.3.3 List the requirements of a good wage plan
3.3.4 Define Incentives
3.3.5 Identify financial, non financial and semi financial incentives
3.3.6 Discuss different types of financial incentives plan
3.3.7 Compute the wages under different incentive plans with examples
3.3.8 Understand the concept of MRP
3.3.9 Understand the application of MRP

UNIT – IV

4.1.0 Understand various methods in Operations Research and its application

4.1.1 Outline the concept of optimization
4.1.2 Outline the scope of O.R
4.1.3 List the phases and processes of O.R
4.1.4 List the different methods of O.R.
4.1.5 Explain Linear programming graphical method & analytical method
4.1.6 Compute maximization of profit by linear programming - graphical method and analytical method (simple problems only)
4.1.7 Compute minimization of total cost by Linear programming - graphical method and analytical method (simple problems only)
4.1.8 Explain the transportation problem
4.1.9 Compute the initial feasible solution by north west corner rule and Vogel approximation method (simple problems only)
4.1.10 Explain the game theory
4.1.11 Compute the saddle point of the game two – person – zero sum using maximize and minimize principle (simple problems only)
4.1.12 Explain the queuing theory
4.1.13 List information required for formulating a mathematical model

4.2.0 Understand the concept of Management By Objective (MBO)

4.2.1 Outline the nature and purpose of MBO
4.2.2 Identify sequential MBO processes
4.2.3 List the merits and demerits of MBO
4.2.4 List the steps required for MBO
4.3.5 List the guidelines for setting objectives for MBO

4.3.0 Appreciate Management Information System (MIS)

4.3.1 Define MIS
4.3.2 Distinguish between data and information, data processing & MIS
4.3.3 State the need for information
4.3.4 Discuss the systems concept of management
4.3.5 Discuss a firm and its environment
4.3.6 List the objectives and inputs of an effective MIS
4.3.7 Explain the integrated MIS
4.3.8 List major functional and activity subsystems in MIS
4.3.9 Describe MIS development (system development) with the help of a line diagram
4.4.10 List applications of MIS

UNIT – V

5.1.0 Justify the concept of Industrial Psychology

5.1.1 Describe the meaning of Industrial Psychology
5.1.2 Outline the importance of good working conditions and environment
5.1.3 Explain the concept of Behavioural dynamics
5.1.4 Distinguish the interpersonal behaviour and interpersonal needs
5.1.5 Discuss the development of interpersonal relationship
5.1.6 Describe the development of better qualities (personality traits)

5.2.0 Formulate the feasible project report to start a small scale industry

5.2.1 Explain the concept of entrepreneurship
5.2.2 Describe the profile of an entrepreneur
5.2.3 List the functions of an entrepreneur
5.2.4 List the risk taking qualities of an entrepreneur
5.2.5 Explain the concept of entrepreneurial development
5.2.6 List the different factors contributing to the failure of entrepreneurial ventures
5.2.7 Identify industrial support needed programs existing in India
5.2.8 State the concept of small scale and ancillary industrial undertaking
5.2.9 List the steps involved in starting small-scale industry
5.2.10 Describe the procedure of registration of SSI
5.2.11 Identify the net work of financial assistances given to SSI
5.2.12 Identify the different constituents of feasibility study
5.2.13 Prepare the feasibility report / project report

5.3.0 Recognize the features of Industrial Safety

5.3.1 Explain the importance and need for safety measures in industries
5.3.2 Define the meaning of the term – factory, accident, frequency rate, security rate, accident pronnes, unsafe acts, unsafe conditions, job safety analysis, plant safety inspections
5.3.3 Identify the various accident factors, mechanical factors, environmental factors, personal factors
5.3.4 Discuss the 4 E's of accident prevention technique
5.3.5 List the precautions to be observed while working in an hazardous environment
5.3.6 Explain briefly the artificial respiration methods

5.4.0 Recognize the causes of environmental pollution and steps to be taken to control the pollution

5.4.1 Define the terms Ecology and Ecosystem
5.4.2 Explain the impact of industrial development on environment
5.4.3 Explain the causes and effects of air and water pollution on plant, animal life and materials
5.4.4 Identify the characteristics of industrial and municipal waste
5.4.5 Outline the various treatment processes

5.4.6 Identify the sources of air pollutants
5.4.7 State the effects of air pollution
5.4.8 Outline the methods of prevention and control of air pollution
5.4.9 Explain the term solid waste management
5.4.10 List the salient features of environmental pollution control legislation
5.4.11 State the functions of pollution control board
5.4.12 Define NOISE
5.4.13 Identify the causes of noise pollution
5.4.14 Explain the various methods of noise control

CONTENT DETAILS

UNIT – 1

1.Principles of management

Introduction – meaning of management: - Management as an art of getting things done, management as a process, management as an activity

Management and administration – Development of management theory: - Taylor's scientific management, contributions of F.W. Taylor, Henry Fayols principles of management (Brief description), compare F.W. Taylor & Henry Fayol's contributions

Functions of management: -

a) Planning: - concept, steps in planning
b) Organizing: - concept and process steps, steps in organizing
c) Staffing: - concept, list functions of staffing
d) Directing: - concept, list the elements of directing
e) Controlling: - Concept, list the steps in controlling process
f) Decision making: - concept, steps in decision making, scientific approach to decision making

Different types of ownership: - Sole proprietorship, partnership, private Ltd., company, public Ltd., company, co-operative society (brief description only)

Organizational structure: - Definition of organization, different types of organizational structure: - line, functional, line & staff organization (brief description with advantages & disadvantages)

Leader ship - Define leadership, different types of leadership, qualities of a good leader

Motivation - characteristic of motivation, importance, Marlow s need hierarchy theory, Techniques of motivation

Communication – Types of communication, Barriers in communication.

2. Human Resource Management

Concept of HR Management – Development of HR Management – Components of HRD – Job analysis – Job description – Job speciation , Manpower planning – Requirements of manpower planning – Factors affecting the manpower planning – Job evaluation – Steps required for job evaluation – Methods for job evaluation – Merit rating – objectives and methods – performance appraisal. Training – Importance of training – Methods of training – advantages of training (Brief description only)

UNIT - II

1. Quality Planning and Control

Definitions of quality, Requirements of quality, list objectives of quality planning – quality control: - operator's quality control, inspectors quality control, Mangers quality control, total quality control.

Quality Assurance: - Concept, definition, responsibility of quality assurance department, planning for quality assurance – three prong approach to quality planning: - (1) Product planning (2) Managerial & Operational planning (3) Documentation. Quality management system, quality loop.

2.ISO 9000 & Installation

Concept and role of ISO 9000, what is ISO 9000, whom does it help, elements of ISO 9000, steps for installation of quality system - preparatory step, implementation step, registration & certification step.

Quality Audit - objectives, types off audits: - Adequacy audit, compliance audit, system audit, product audit, first party audit, second party audit, third party audit. Steps required to apply for ISO – 9000 Registration. Benefits of becoming an ISO 9000 company.

3. Understand the concept of TQM and Organizational Excellence

Concept, ten mantras of TQM, the link between ISO 9000 and TQM with the help of TQM Model – organization of TQM. Techniques of TQM - PDCA, Total Employee Inolvement (TEI), POKA – YOKA – Failure proofing, JIT manufacturing.

Quality Circles - concept, characteristics, Brain storming method for solving Q.C. Problems. Organizational excellence through TQM - List the strength, weakness, opportunity and threat (SWOT analysis) of an organization by an example and analyse the current status – mission statement.

UNIT – III

1. Management Techniques – CPM & PERT

Introduction to Network analysis, application of CPM & PERT, scope of CPM & PERT commonly used terms in CPM: - Operation, pre-operation, post operation, concurrent operation, earliest finish time EFT), latest finish time (LFT), Critical activities, critical path, EVENT, SLACK or FLOAT, Dummy activity, - procedure for CPM, problems on CPM, projects duration, slack, mark critical path (by AOA and AON method).

PERT - comparison between CPM & PERT, procedure for PERT, Estimation of activity time, commonly used terms in PERT, Event, Activity, successor Event, Predecessor event, Earliest Expected Time, Latest allowable time, slack – problems in PERT.

2. Marketing & Sales

Marketing - introduction, definitions, objectives, core concepts: - block diagram, distinguish between marketing and sales, marketing MIX. Buying process & behaviour of consumer, steps in market planning – market segmentation. Sales - importance of sales, functions of sales management, market research, market information system. Fore casting related to marketing and sales

3. The Principles of a good wage payment system

Importance of good wage plan, types of wages - nominal, real, living, fair, minimum wages – requirement of a good wage payment system. Incentives - definitions, types of incentive plan for direct workers - non financial and semi financial incentives – financial incentive plans - straight piece rate system, straight piece rate with guaranteed minimum wage, differential piece rate system, Halsey plan, Rowan plan, Gantt (simple illustrative problems)

4. Material requirement planning (MRP)

MRP objectives & functions – Terminology – MRP systems – MRP outputs – Management information from MRP – Lot sizing considerations – Examples – applications – introduction to MRP – II - Just in time (JIT). (Brief description only)

UNIT – IV

1. Operations Research & Application

Concepts of OR, scope of OR, phases and process of OR, methods of OR -

1. Linear programming: - a) graphical & analytical method b) transportation method: - North west corner rule, Vogel approximation method
2. Waiting line or Queuing theory
3. Game theory

Linear programming: - concepts, formulation of LPP, Do problems on maximization of profit, minimum of total cost (by graphical & analytical method)

Transportation problem: - meaning, compute the initial feasible solution by northwest corner rule & Vogel approximation method (simple problems)

Game theory: - concept, two-persons zero sum game, the maxi-min- mini-max principle –optimal strategy, saddle point, example problems to compute saddle point – waiting line or queuing theory - concept, the information required for formulating a mathematical model (simple problems)

2. Management by objectives (MBO)

Concepts & definition, contents of MBO, sequence of MBO process with block diagram, steps required for MBO, guidelines for setting objectives

3. Management Information Systems (MIS)

Definition of MIS, Data, Information, management, systems concepts of management, a firm and its environment, objectives, contents of MIS, need for information, integrated MIS, functional and activity subsystems, MIS development - line diagram, application of MIS - inventory management, Human resource management, personal decision making.

UNIT – V

1. Industrial Psychology

Meaning, importance of good working conditions and environment: - physical working conditions, psychological working conditions, working conditions related to time, related to social situation. Behavioural dynamics: - self concept and self understanding, inter personal needs, developing interpersonal relationship: - framing fint impression, developing mutual expectations, hounouring psychological contracts, developing trust & influence, projecting positive qualities and hiding negative points – developing better behaviour and qualities a TQM approach: - conducting 'SWOT' analysis for self understanding, prepare incremental projects to reduce weakness and threats - mission statement

2. Small Scale Industries – Entrepreneur

List steps required to start small scale industry, procedure for registration (provisional and permanent registration) – sources of financial assistance, govt., assistance for development of SSI, preparation of project report, Tax: - an overview of income tax – excise duty, sales tax – procedure to be followed for sales tax

3. Industrial Safety

Define Accident, Frequency rate, severity rate, and accident proneness.

List the causes of accidents: - Mechanical, Environmental, personnel factors accident prevention techniques – 4 E'S of Accident prevention technique

4. Environmental Pollution and control

Ecology and Eco system, Impact of industrial development on environment, Causes and effects of air and water pollution on plant, animal life and material, Characteristics of industrial and municipal waste, Treatment processes:- Primary, secondary and territory, Sources of air pollutants on human beings, Effects of air pollutants on human beings, Prevention and control of air pollution, Solid waste management, Environment pollution control legislation and functions of pollution control boards, Causes of noise pollution and its control

Special Instruction to Question Setters

1. All units should be given equal weightage of marks
2. Problems from wage plan, CPM-PERT, and O.R should be included in every question paper in order to measure the application capability of students

REFERENCE BOOKS

1. Industrial Engineering & production management – Martand.T.Telsang S.chand & Company
2. Industrial Engineering & Management - O. P. Khanna
3. Operations Research - Premkumar Guptha, D.S. Hira
4. TQM - Productivity Council
5. ISO - Tapan.P.Bagachi
6. Entrepreneurship Development - Jagmer Singh Saihi
7. Industrial Management & Engineering Economics - Banga & Sharma
8. TQM - B. Senthil Arasu & J.Praveen Paul Scitcch Publications

SUBJECT TITLE : **MAINTENANCE, SAFETY & ENVIRONMENTAL ENGINEERING**
SUBJECT CODE : **CH 602**
PERIODS/WEEK : **5**
PERIODS/SEMESTER : **80**

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Operational Maintenance of Chemical Plant Equipments, Plant Inspection	14
	Test	2
II	Safety & Fire Engineering	14
	Test	2
III	Water Pollution and Control	14
	Test	2
IV	Air Pollution and Control	14
	Test	2
V	Noise Pollution, Solid Waste Management	14
	Test	2
	Total	**80**

OBJECTIVES

UNIT – I: OPERATIONAL MAINTENANCE OF CHEMICAL PLANT EQUIPMENTS AND PLANT INSPECTION

1.1.0 Interpret the principles of maintenance management

1.1.1 List the need for maintenance
1.1.2 List the three types of maintenance
1.1.3 Prepare a sample maintenance schedule for any equipments
1.1.4 Describe the cost factors in maintenance
1.1.5 List the main elements in a maintenance records
1.1.6 List the tree types of equipment replacement

1.2.0 Perform maintenance of Chemical Plant equipments

1.2.1 List the methods of cleaning tubular equipments
1.2.2 State why cleaning of tubular equipment is essential
1.2.3 Explain method and procedures of chemical cleaning of tubular equipment
1.2.4 Describe the mechanical methods of cleaning tubular equipments
1.2.5 List the method for cleaning towers and columns
1.2.6 Explain the common causes of troubles and remedial action in the following equipments: Centrifugal pumps, Reciprocating compressor, Filter press, Agitator
1.2.7 Explain the decoking methods of furnace tubes

1.3.0 Perform start up and commissioning of some plant equipments

1.3.1 Evaluate the procedure for starting of centrifugal pumps
1.3.2 List the precautions to be taken before starting the reciprocating pump
1.3.3 List the precautions to be taken before starting of the reciprocating compressor
1.3.4 Outline various steps to be taken for the start up and commissioning of the heater
1.3.5 Outline various steps to be taken for start up and commissioning of a distillation column

1.3.6 Outline various steps to be taken for start up and commissioning of the absorption columns

1.4.0 Perform chemical plant inspection

1.4.1 Explain the precautions to be taken before opening and entry in the vessels for cleaning
1.4.2 List the types of inspections
1.4.3 Explain conventional monitoring methods
1.4.4 List the standard testing methods of a high pressure vessels before and after fabrication
1.4.5 List the non-destructive testing methods
1.4.6 Describe the ultrasonic test for pressure vessel
1.4.7 Describe the radiographic test for pressure vessel

UNIT – II: SAFETY and Fire Engineering

2.1.1 Interpret safety practices in a chemical industry,
2.1.2 List the characteristics of Hazardous chemical
2.1.1 Define TLV (Threshold Limit Value)
2.1.2 Define STEL (Short Term Expeure Limit)
2.1.3 Define TLV-C
2.1.4 Define LD50 and LC50
2.1.5 Classify flammable liquids
2.1.6 Define flammable liquid
2.1.7 Define inflammable liquid
2.1.8 Define highly inflammable liquid
2.1.9 Distinguish between flammable and inflammable liquid
2.1.10 Define the term explosive range
2.1.11 Define auto ignition temperature
2.1.12 Discuss the dangers of dust, fumes and vapours in work places
2.1.13 Explain industrial plant lighting and ventilation
2.1.14 Interpret fire engineering practices
2.1.15 Describe the chemistry of fire
2.1.16 Define fire triangle
2.1.17 Classify the fire based on extinguishing media
2.1.18 Evaluate the principle of water type fire extinguisher
2.1.19 List the different type of fire extinguishers
2.1.20 Describe the classification of air breathing apparatus
2.1.21 Explain the personal protective equipments
2.1.22 Describe the selection of a suitable breathing apparatus for different hazards
2.1.23 List the protective devices for the following parts of human body1Head, eye, face, etc
2.1.24 Explain the footwear and clothing
2.1.25 Explain how to prevent oil fire in a petroleum refinery

UNIT – III: Water Pollution and Control

3.1.0 Understand the effects of water pollution

3.1.1 Define water pollution
3.1.2 Evaluate the sources of water pollution
3.1.3 Describe the effects of water pollution on human being
3.1.4 Describe the effects of water pollution on animals
3.1.5 List the waste water characteristics
3.1.6 List the control standards of state pollution control board
3.1.7 Define B.O.D
3.1.8 Define C.O.D
3.1.9 Explain the procedure for determination of BOD

3.1.10 Explain the procedure for determination of COD

3.2.0 Appreciate various methods of waste water treatment

3.2.1 Explain the various steps of primary treatment with a flow diagram
3.2.2 Define coagulation
3.2.3 List the different types of coagulants
3.2.4 Explain the anaerobic effluent treatments
3.2.5 Explain the aerobic effluent treatment
3.2.6 List the types of anaerobic process
3.2.7 Explain working of Tricking filter
3.2.8 Explain the working anaerobic filters
3.2.9 Draw the figure and name the parts of Tricking Filter
3.2.10 Explain secondary process of waste water treatment
3.2.11 Distinguish between aerobic and anaerobic process of effluent treatments
3.2.12 Explain the effects of nutrients in the oxidation pond
3.2.13 Explain the activated sludge process
3.2.14 Explain the use of activated carbon in waste water treatment
3.2.15 Evaluate different aerators used in waste water treatment
3.2.16 Explain sewage treatment

UNIT – IV: AIR POLLUTION AND CONTROL

4.1.0 Understand the effects of Air pollution and its control

4.1.1 Define air pollution
4.1.2 List the major air pollutant and their sources
4.1.3 Describe the effects of air pollution to human beings
4.1.4 Describe the effects air pollution to animals
4.1.5 Explain the effects of air pollution on materials
4.1.6 List the methods for monitoring air pollutant
4.1.7 Describe the methods of controlling dust emissions and their sources
4.1.8 Explain the working of Electro static Precipitator (ESP)
4.1.9 Draw the sketch of ESP
4.1.10 Explain the working of Bag filter
4.1.11 Draw the figure and name the parts of Bag filter
4.1.12 Draw the sketch and name the parts of venturi scrubber
4.1.13 Explain the working of venturi scrubber
4.1.14 Explain the application of Bag filters, venturi scrubber and ESP
4.1.15 List the various gaseous pollutants
4.1.16 Explain the measurement of air quality
4.1.17 List the measurement for air qualities
4.1.18 Explain with sketches the equipments used for controlling gaseous pollutant
4.1.19 Specify control limit of gaseous pollutants

UNIT – V: NOISE POLLUTION, SOLID WASTE MANAGEMENT AND RADIO ACTIVE POLLUTION

5.1.0 Understand the effects of Noise Pollution and precautionary measures

5.1.1 Define “Noise” pollution
5.1.2 List the various “Fifteen sound sources” and their decibel scale
5.1.3 List the physical and psychological effects at different decibel levels
5.1.4 Describe the physiological effects of Noise
5.1.5 Evaluate the noise control programme in industries
5.1.6 Describe the control criteria for noise
5.1.7 List the equipments used for noise measurement

5.1.8 Explain the noise pollution control programme in industries
5.1.9 Explain the psychological effect of noise pollution
5.1.10 State TLV, SIL, NEI
5.1.11 Explain "Noise barriers"
5.1.12 Describe the working of Muffler of Silencers

5.2.0 Understand the methods of solid waste disposal and solid waste management

5.2.1 State pedology
5.2.2 List the basic composition of earth
5.2.3 Evaluate the different steps of earth crust
5.2.4 Define pedogenesis
5.2.5 List the three composition of the soil
5.2.6 Explain the sources of soil pollution
5.2.7 Describe effects of soil pollutants on Human beings and plants
5.2.8 Explain the effects of industrial effluent on land
5.2.9 Define 'Green chemistry'
5.2.10 List the Ten principles of Green chemistry
5.2.11 List the objectives of environmental management
5.2.12 State EIA and EIS
5.2.13 Define "Environmental inventory"
5.2.14 List the various six environmental protection Act
5.2.15 Discuss the control and soil pollution
5.2.16 Classify the solid waste
5.2.17 Discuss the public health aspects regarding solid waste managements
5.2.18 Explain the various disposal methods of solid waste
5.2.19 List the potential methods of disposal
5.2.20 Explain the potential methods of disposal

5.3.0 Understand the pollution due to the Radio Activity and its control

5.3.1 Describe the source of radio active pollution
5.3.2 Explain the effects of radio active pollution
5.3.3 Explain the monitoring of radio active pollution
5.3.4 Describe the control of radio active pollution
5.3.5 Explain radiations effect to the human body from radio active wastes

CONTENT DETAILS

UNIT – I: MAINTENANCE – PLANT INSPECTION

Principle of management – types of maintenance – maintenance schedule – records – replacement – maintenance of chemical plant equipments – Troubles and remedial actions – start up and commissioning of equipments – plant inspection – vessel entry – testing methods – non destructive testing methods – radio graphic & ultrasonic test.

UNIT – II: SAFETY, FIRE ENGINEERING..

Safety practices in a chemical industries – Explosive limit - Flammable limit – Inflammable limit – Safety precautions.

characteristics of hazardous material – TLV, STEL, TLV-C, LD 50, LC 50 – flammable liquids – lighting and ventilation – chemistry of fire – fire extinguishers – personal protective equipments

UNIT – III: WATER POLLUTION

Sources of water pollution – effects of water pollution – control standards of KSPCB – BOD, COD determination – primary, secondary, Tertiary waste water treatment – aerobic and anaerobic digestion – activated sludge process – activated carbon process – sewage treatment

UNIT – IV: AIR POLLUTION AND CONTROL

Definition of air pollution – sources – effects of air pollution on man, material and animals control of dust emissions – ESP, Bog filters, absorbers, scrubbers, etc – sources of gaseous pollutants – measurement of air quality – control limits of gaseous pollutants

UNIT – V: NOISE POLLUTION – SOLID WASTE – RADIOACTIVE POLLUTION

Noise pollution – source of sound – effects of sound – psychological and physiological – criteria of noise – pollution control programme – TLV, SIL, NEI – Noise barriers – Composition of earth – effects of soil pollutant – green chemistry - E.I.A and EIS – environmental protection act – disposal methods of slid waste – potential methods of disposal. Sources of radio active waste – effects of radio active pollution – monitoring methods – – controlling methods of radio active pollution – radiation effect to human body from radio active waste.

REFERENCES

1. Text book of environmental chemistry and pollution control – S.S.Dara
2. Environmental Pollution – N.Manivasakam
3. Environmental Engg., and Pollution – C.S.Rao

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SUBJECT TITLE : MASS TRANSFER OPERATIONS – II
SUBJECT CODE : CH 603
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Fractionation		14
		Test	2
II	Leaching		14
		Test	2
III	Liquid –Liquid Extraction		14
		Test	2
IV	Crystallization		14
		Test	2
V	Adsorption		14
		Test	2
		Total	**80**

OBJECTIVES

UNIT – I

FRACTIONATION.

1.1.0 Explain the principle of rectification

- 1.1.1 Draw the lay out of distillation column and accessories
- 1.1.2 Explain the functions reboiler and condenser in a distillation column
- 1.1.3 List the applications of rectification
- 1.1.4 Define an ideal plate
- 1.1.5 Prepare material balance and heat balance equation for an ideal plate
- 1.1.6 Define constant molal over flow and constant molal vapourisation
- 1.1.7 Explain the McCabe & Thicle method
- 1.1.8 Derive an equation for rectifying lineDerive an equation for stripping line
- 1.1.9 Define ‘q’ factor and derive equation for ‘q’ line
- 1.1.10 Explain the values of ‘q’ based on five different feed conditions
- 1.1.11 Draw the McCabe’s Thiele diagram
- 1.1.12 Explain the procedure for solving problems using McCabe and Thiele method
- 1.1.13 Calculate the number of theoretical plates required for a given separation and locate the feed plate graphically, and calculate the plate efficiency
- 1.1.14 Explain minimum reflex and total reflux
- 1.1.15 Calculate graphically the minimum reflex ratio and the minimum number of theoreticalplates for rectification
- 1.1.16 Explain the concept HETP
- 1.1.17 Differentiate between extractive and azeotropic distillation
- 1.1.18 Explain the applications of azeotropic and extractive distillationDraw and explain molecular distillation still

1.2.0 Appreciate the construction of equipments used for various distillation methods

- 1.2.1 Describe the construction details of plate columns
- 1.2.2 Sketch a bubble cap
- 1.2.3 Describe the construction and working of a bubble cap
- 1.2.4 Explain the construction of sieve plate, kittle plate and valve plate
- 1.2.5 Compare the performance of bubble cap and sieve plate columns

1.2.6 Define the following terms which effect the efficiency of plate column
1.Flooding 2.Entrainment 3.Weeping 4.Dumping 5.Corning

UNIT – II

LEACHING

2.1.**0 Importance of Leaching.**

2.1.1 Define the following terms. (1) Leaching (2) Elutrition or Elution (3) Lixiviation (4) Cossettes.
2.1.2 Understand the importance of leaching operation
2.1.3 Differentiate between leaching and extraction
2.1.4 List the applications of leaching
2.1.5 Differentiate between batch and continuous leaching operations
2.1.6 Explain heap leaching
2.1.7 Explain percolation tanks
2.1.8 Explain shank system
2.1.9 Describe the working of agitated vessel with a neat sketch
2.1.10 Explain the process continuous counter current decantation
2.1.11 Explain the construction details and working of Boll man extractor
2.1.12 Explain the working of a Rotocel extractor with a neat sketch
2.1.13 Describe the working of a Kennedy extractor with a neat sketch

UNIT – III

Liquid –Liquid extraction

3.1.0 Understand the importance of Liquid –Liquid extraction

3.1.1 Differentiate between Distillation and Extraction
3.1.2 Explain the principles of liquid – liquid extraction
3.1.3 Field of application of Liquid – Liquid extraction
3.1.4 Explain triangular diagram for Liquid – liquid extraction
3.1.5 Define distribution Co-efficient
3.1.6 Define the terms Raffinate and Extract
3.1.7 Explain the construction details and working of mixer settlers
3.1.8 Describe the working of spray and packed extraction towers with a sketch
3.1.9 Explain the perforated plate towers
3.1.10 Describe the working of baffle towers
3.1.11 Explain the construction details and working of agitated tower extractor
3.1.12 Explain the working of pulse column
3.1.13 Describe the working of centrifugal extractor
3.1.14 List the important factors to be considered for selecting a suitable solvent

UNIT – IV

CRYSTALLIZATION

4.1.0 Importance of Crystallization in Chemical Industries.

4.1.1 Define Crystallization
4.1.2 Differentiate between the Evaporation and Crystallization
4.1.4 Explain the applications of crystallization operation
4.1.5 Describe the principles of crystallization
4.1.6 Draw and explain the equilibrium curve for a solid-liquid system
4.1.7 Define the yield of crystals
4.1.8 Explain the following terms solubility, saturation, super saturation and rate of crystal growth
4.1.9 Explain four methods of super saturation

4.1.10 Preepare the material balance equation and calculate the yield of crystals, both anhydrated and hydrated

4.1.11 Explain the constructional details and working of the tank crystallizer, cooling crystallizer, evaporator crystallizer, Swenson Walker Crystallizer,Krystal Crystallizer.

4.1.12 fine caking of crystals and explain the phenomenon

4.1.13 Define critical humidity and explain the effect of humidity on storage

UNIT – V: ADSORPTION

5.1.0 Appreciate the mechanism of adsorption in exchange process

5.1.1 Differentiate between physical and chemical adsorption

5.1.2 List the various adsorbents used and their applications

5.1.3 Briefly explain the manufacture of various adsorbents

5.1.4 Briefly explain the theory of adsorption

5.1.5 Explain the principles, technique and applications of ion exchange

5.1.6. List the various ion exchange resins

5.2.0 Understand the principles of membrane separation methods

5.2.1 Explain molecular sieves with their application

5.2.2 Define the term 'membrane'

5.2.3 Explain the equipments used for membrane separation

5.2.4 Explain Reverse Osmosis

5.2.5 List the applications of Reverse Osmosis

5.2.6 Define Dialysis

5.2.7 Explain the working of dialysis cell

5.2.8 Define ultrafilteration

5.2.9 Batch and continuous ultrafilteration and its application

CONTENT DETAILS.

UNIT I Fractionation

Rectification, Azeotropic distilation, extractive distillation, and molecular distillation, rectification – principle – application – construction of reboiler and condenser.

UNITII Leaching

Applications of leaching – batch and continuous – heap leaching – percolation tanks – shank system – agitated vessel – continuous countercurrent decantation – boll man extractor – Rotocel extractor – Kennedy extractor

UNIT III Liquid –Liquid Extraction

Liquid – Liquid extraction – Raffinate – Extract – construction details of mixer settlers – spray and packed towers – perforated plate towers – baffle towers – agitated tower extractor – pulse column – centrifugal extractor – choice of solvent

UNIT IV Cristallization

Application – equilibrium curve for a solid – liquid system – yield of crystals – solubility – saturation – super saturation – crystal growth – methods of super saturation – material balance equation- simple problems.

Construction details of Tank crystallizer – cooling crystallizer, evaporator crystallizer. Caking of crystals – critical humidity – effect of humidity on storage.

UNIT – V: ADSORPTION

Physical and chemical adsorption – various types of adsorbents – applications – manufacture of adsorbents; ion exchange – principle – various ion exchange resins – molecular sieves – membrane – equipments for membrane separation – reverse osmosis – applications.

REFERENCE BOOKS

1 Unit Operations – McCabe and Smith
2 Mass Transfer Operations – Treybal.R.E
3 Unit Operations of Chemical Engg., Vol. – I – P.Chathopadhya
4 Mass Transfer Operations – By Surya NarayanaB

SUBJECT TITLE : ORGANIC TECHNOLOGY
SUBJECT CODE : CH 604
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPIC		PERIODS
1.	Oils and fats, Soaps and Detergents		14
		Test	2
2.	Pulp & Paper,		14
		Test	2
3.	Explosives and insecticides		14
		Test	2
4.	Sugar, Starch, and Leather		14
		Test	2
5.	Bio Technology		14
		Test	2
		Total	**80**

OBJECTIVES

UNIT – I: OILS AND FATS, SOAPS AND DETERGENTS

1.1.0 Understand the chemistry of fats and oils

1.1.1 Distinguish between fats and oils
1.1.2 Define saturated and unsaturated fatty acids
1.1.3 Define iodine value, saponification value and acid value of oils
1.1.4 Distinguish between drying and non-drying oils
1.1.5 Describe rancidity of oil
1.1.6 Understand extraction process of oils and fats
1.1.7 Specify six important raw materials available in India for oil manufacture
1.1.8 Describe the extraction process of oil by expellers
1.1.9 Describe solvent extraction
1.1.10 Differentiate the merits and demerits of extraction by expeller and solvent extraction

1.2.0 Appreciate refining of vegetable oils

1.2.1 Describe neutralization of oils
1.2.2 Describe bleaching of oils
1.2.3 Describe deodourisation of oils
1.2.4 Draw the flow diagram for the refining of oil
1.2.5 Specify the purpose of hydrogenation process
1.2.6 Describe the hydrogenation
1.2.7 Specify the catalysts used for hydrogenation

1.3.0 Understand the manufacturing of soap

1.3.1 Define soap

1.3.2 Differentiate toilet soap and laundry soap
1.3.3 Draw a flow diagram for the manufacture of soap
1.3.4 State different raw materials for soap manufacture
1.3.5 Differentiate batch and continuous process
1.3.6 Describe batch process for soap manufacture
1.3.7 Describe continuous process
1.3.8 State different types of additives added to soap
1.3.9 List the importance of perfumes in soap

1.4.0 Know the importance of spent lye recovery

1.4.1 Describe the separation of spent lye
1.4.2 Describe neutralization of spent lye
1.4.3 Describe concentration of spent lye
1.4.4 Describe separation of salt from spent lye
1.4.5 Describe vacuum evaporation of lye
1.4.6 Describe refining of crude glycerine

1.5.0 Understand the importance of synthetic detergents

1.5.1 List the uses of detergents
1.5.2 Define detergency
1.5.3 Describe the mechanism of detergents
1.5.4 Differentiate anionic, catatonic and non-ionic Detergents.
1.5.5 Describe the manufacture of Dodecyl benzene
1.5.6 Describe the manufacture of Alkyl benzene Sulphonate (ABS)

UNIT – II: PULP, PAPER

2.1.0 Understand the manufacture of Pulp

2.1.1 List the raw materials for pulp making
2.1.2 Describe the preparations of raw materials for pulping
2.1.3 Describe manufacture of pulp from waste paper
2.1.4 Distinguish chemical, mechanical and semi chemical process for pulp manufacture
2.1.5 Describe the mechanical process for pulp manufacture using pocket grinders and magazine grinders
2.1.6 Draw the flow diagram for sulphate process
2.1.7 Describe sulphate process
2.1.8 Describe soda process for pulping
2.1.9 Describe the different methods of bleaching using different bleaching agent

2.2.0 Understand the manufacturing of paper

2.2.1 Describe preparation of pulp for paper manufacture
2.2.2 List the additives mixed with pulp
2.2.3 Explain the purpose of using additives
2.2.4 Draw a line diagram of Fourdinier paper making machine
2.2.5 Describe the working of paper making machines
2.2.6 Describe the manufacture of laminated paper
2.2.7 List the advantages of laminate paper

UNIT -III EXPLOSIVES AND INSECTICIDES

3.1.0 Interpret the characteristics of explosives

3.1.1 Define and explain sensitivity, power and permissibility
3.1.2 Differentiate properties of primary and secondary explosives
3.1.3 Differentiate military and commercial explosives
3.1.4 Describe a complete ground of high explosive ammunition
3.1.5 Draw a flow diagram for the manufacture of nitrocellulose

3.1.6 Describe the manufacture of nitrocellulose and smokeless powder
3.1.7 Describe briefly the manufacture of PETN, RDX & Lead Oxide
3.1.8 Describe the manufacture of nitro-glycerine and Dynamite

3.2.0 Understand the properties and manufacturing of insecticides

3.2.1 Outline the important properties of insecticides
3.2.2 Describe the mode of action of insecticides giving examples
3.2.3 Describe the manufacture of B.H.C
3.2.4 Describe the manufacture of D.D.T

UNIT – IV: SUGAR, STARCH, AND LEATHER

4.1.0 Understand the properties and manufacturing of cane sugar

4.1.1 Specify the composition of cane juice
4.1.2 Describe the different steps involved in the preparation of cane for milling
4.1.3 Describe milling and extraction of cane juice
4.1.4 Describe purification of cane juice for evaporation
4.1.5 Describe evaporation and crystallization of juice for the manufacture of sugar
4.1.6 Explain centrifuging and drying
4.1.7 Describe refining of sugar
4.1.8 Describe utilization of by-products form sugar mill
4.1.9 Understand manufacturing of starch
4.1.10 Describe the manufacture of starch from Tapioca and Corn
4.1.11 Describe bleaching, centrifuging and drying of starch

4.2.0 Understand conversion of skin into leather

4.2.1 Describe preparation of skin and hide for tanning
4.2.2 Describe vegetable tanning and chrome tanning
4.2.3 Describe finishing operations of leather

UNIT – V: BIOTECHNOLOGY

5.1.0 Appreciate structure and classification of micro organisms

5.1.1 Classify micro organisms
5.1.2 Explain environmental conditions for the growth of micro organisms
5.1.3 Define enzymes
5.1.4 Evaluate functions of enzymes
5.1.5 Evaluate structure of micro organisms
5.1.6 List the types of enzymes
5.1.7 Define substrate
5.1.8 Define nutrients
5.1.9 Explain nutrients inhibition and immobilized enzyme technology
5.1.10 Define fermentor and mention the components of a fermentor
5.1.11 List the types of fermentors
5.1.12 List the uses of fermentors
5.1.13 Understand manufacturing of ethyl alcohol from molasses
5.1.14 Describe the manufacture of ethyl alcohol by fermentation of molasses
5.1.15 Describe the manufacture of rectified spirit
5.1.16 Describe preparation of absolute alcohol from rectified spirit

5.2.0 Understand the production of Alcohol and Antibiotics

5.2.1 Explain about the conversion of biomass into fuels
5.2.2 Describe the production of ethanol from biomass
5.2.3 Describe Brewing-Production of alcoholic beverages by fermentation
5.2.4 Explain the production of antibiotics through fermentation

5.3.0 Comprehend the impact of biotechnology upon chemical industry

5.3.1 Describe the future impact of biotechnology upon chemical industry
5.3.2 Explain the basic principles of aerobic processing of wastes
5.3.3 Explain the basic principles of anaerobic digestion of waste
5.3.4 Explain the principle of recombinant DNA technology and its applications in medicine

CONTENT DETAILS

UNIT – I: OILS AND FATS

Chemistry of saturated and unsaturated fats and oils – drying and non drying oils – causes of rancidity – acid value, saponification value and iodine value. Extraction of oils – oil expellers and solvent extraction. Advantages and disadvantages of each.

Refining of vegetable oils, neutralization, bleaching and deodourisation

Hydrogenation – Purpose of hydrogenation, chemistry and process details, preparation of catalysts

Soaps and detergents – study of different types of toilet soaps and washing soaps. Raw materials, manufacturing process for toilet & laundry soaps. Batch and continuous process, glycerine recovery, different types of fillers and perfumes

Chemistry of important detergents, Alkyl aryl sulphonate, alkyl sulphonates – condensates, comparison with soap. Biodegradability of detergents, detergent additives and formulation for liquid and powdered detergent

UNIT – II: PULP & PAPER

Paper – Paper industry in India and its future.

Manufacture of pulp and paper – Raw materials – Chemistry of wood pulping process. Sulphate, Soda mechanical pulping – details of process and plant.

Treatment of pulp: - Bleaching – sizing, loading, filling, colouring, beating, and refining of pulp for paper manufacture. Details of paper machine

UNIT – III EXPLOSIVES AND INSECTICIDES

Explosives – General characteristics of Industrial and military explosives – dynamite, nitro-glycerine, cellulose nitrate, smokeless powder, trinitrotoluene manufacture.

Insecticides – Classifications – Inorganic – organic and natural – classification based on mode of action – inorganic – sulphur compounds – phosphorus compounds – chemistry – mode of action and application – manufacture and process details of D.D.T. and B.H.C

UNIT – IV: SUGAR, STARCH AND LEATHER

Sugar: - Manufacture of raw cane sugar – composition of cane and cane juice, chipping, streadding and classification by liming, evaporation, crystallization and centrifuging. Refined sugar, bleaching, concentration, crystallization, centrifuging and drying. Direct consumption sugar – Extraction, carbonation and sulphitation, filtration, concentration, vacuum operation centrifuging and drying, modern development in refining sugar, utilization of by-products (molasses and Baggase)

Starch: - Manufacture – from tapioca and corn, steeping disintegrating – determination fibres and glusers removal, bleaching, filtration and drying. Different grades of starch – bleaching.

Leather: - Animal skin – preparation of raw hides and skins, vegetable tanning, chrome tanning, synthetic tanning agents, and finishing operations

UNIT – V: BIOTECHNOLOGY

Structure and classification of micro organisms, Environmental conditions for the growth of micro organisms. Enzymes – definition, functions and types. Definition of substrate, nutrients inhibition and

immobilized enzyme technology. Fermentation – Historical background, definition of a fermentor and their uses. Types of fermentors.

Conversion of Biomass into fuels – production of ethanol from biomass (a schematic outline). Brewing – Production of alcoholic beverages by fermentation (a schematic outline). Production of antibiotics through fermentation (a schematic outline). Future impact of biotechnology upon the chemical industry. Biotechnology in the processing of waste – aerobic process and anaerobic digestion (Basic principles only). Principle of recombinant DNA Technology and applications in medicine. (Introduction only). Industrial Alcohol from Molasses – Rectified Spirit – Absolute Alcohol.

REFERENCES

1 Biotechnology – Principles and applications - I.J.Higgins, D.J.Best & J.Jones (Ed)
2 Biochemical Engineering Fundamentals - James.E.Bailey and David.F.Olis
3 Out lines of chemical Technology - Dryden
4 Chemical Process Industries - Shreev

SUBJECT TITLE	**:**	**MASS TRANSFER LABORATORY**
SUBJECT CODE	**:**	**CH 605**
PERIODS/WEEK	**:**	**6**
PERIODS/SEMESTER	**:**	**96**

Content Details

Determination of mass transfer coefficient in surface evaporation – Simple Distillation – Steam Distillation – Simple leaching – Single stage and Multi stage Leaching – Oil Seed Extraction – Ternary Liquid Equilibrium – Atmospheric batch drying – Humidity dtermination by Wet Bulb – Dry bulb method – Psychrometric method – H.E.T.P determination

List of Experiments

1. Simple Distillation
2. Steam Distillation
3. Leaching Single Stage
4. Leaching Multi Stage
5. Oil Seed Extraction
6. Ternary Liquid Equillibrium
7. Atmospheric batch Drying
8. Humidity Determination
9. H.E.T.P Determination

Demonstration Experiments

1. Fractional Distillation Column
2. Extraction Battery

SUBJECT TITLE	**:**	**PARTICLE TECHNOLOGY LABORATORY**
SUBJECT CODE	**:**	**CH 606**
PERIODS/WEEK	**:**	**6**
PERIODS/SEMESTER	**:**	**96**

Content Details

Sieve Analysis - Ball Mill – Effectiveness of Screen – Pipette Analysis – Beaker Decantation – Sedimentation – Filtration - Leaf Filter – Plate and Frame Filter – Froath Floation - Centrifuge

List of Experiments

1. Sieve Analysis
2. Effectiveness of Screens
3. Pipette Analysis
4. Beaker Decantation
5. Sedimentation
6. Leaf Filter

Demonstration Experiments

1. Ball Mill
2. Jaw Crusher
3. Plate and Frame Filter Press
4. Froath Floatation Process
5. Super Centrifuge

SUBJECT TITLE : PROJECT WORK AND SEMINAR
SUBJECT CODE : CH 607
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

PROJECT WORK

Any of the following project work or others assigned by staff- in – charge has to be carried out satisfactorily by the candidate. A diary is to be maintained to record the progress of work. The detailed final report is to be submitted at the end of the academic year.

OBJECTIVES

a. To study in detail an industrial process equipment like evaporator, distillation unit, reactor etc.
b. To conduct an overall study of any industrial process plant

SEMINAR

For each student a subject is allotted by staff – in – charge. The presentation of seminar has to be conducted and submitted bonafied report at the end of the academic year.

List of Faculty who made Contributions to the Curriculum Revision 2006

Sl. No	Name	Designation
1	Dr. Abi Santhosh Aprem	Manager, Hindustan Lates
2	Sri. Benny	Manager, Hindustan Latex
3	Sri. Venugopal	Manager, Hindustan Latex
4	Sri. Philip Kurian	Asst. Professor&Head in Charge, NITTTR Extn Centre, Kalamassery
5	Sri. C. K. Mohanan	Principal
6	Sri. Satheesh A.T	Lecturer in Chemical Engg
7	Sri. K.G Valsala	Lecturer in Chemical Engg
8	Sri. C.T Shaju	Lecturer in Chemical Engg
9	Sri. P.S. Prasannan	Lecturer in Chemical Engg