

STUDY AND EVALUATION SCHEME FOR
THREE YEAR DIPLOMA COURSE IN CHEMICAL TECHNOLOGY (FERTILIZER TECHNOLOGY)
(Effective From The Session)

I Year

Curriculum						S U B J E C T	Scheme of Examination								
Periods Per Week							Theory				Practical			Grand Total	
Le	Tut	Dr	Lab	Work	Tot		Examination	Sess.	Total	Examination	Sess.	Total			
c.	ori	aw	Shop	Shop	al		Dur.	Marks	Marks	Dur.	Marks	Marks			
3	-	-	2	-	5	1.1 Professional Communication	2.5	50	20	70	3	20	10	30	100
3	2/2	-	-	-	4	1.2 Applied Mathematics-I	2.5	50	20	70	-	-	-	-	70
3	2/2	-	2	-	6	1.3 Applied Physics	2.5	50	20	70	3	40	20	60	130
3	-	-	2	-	5	1.4 Applied Chemistry	2.5	50	20	70	3	40	20	60	130
-	-	8	-	-	8	1.5 Engineering Drawing	3.0	50	20	70	-	-	-	-	70
2	2/2	-	2/2	-	4	1.6 Applied Mechanics	2.5	50	20	70	3	40	20	60	130
2	1	-	2	--	5	1.7 Mechanical Operation And Solid Handling	2.5	50	20	70	3	60	30	90	160
2	2/2	-	-	--	3	1.8 Measuring Instrument and Measurements	2.5	50	20	70	--	--	--	--	70
-	-	-	-	8	8	1.9 Workshop Practice	--	--	--	--	4	60	30	90	90
18	5	8	9	8	48	<-----TOTAL----->	--	400	160	560	--	260	130	390	950
												Games/NCC/Social and Cultural Activity + Discipline (30 + 20)		50	
												Aggregate		1000	

- NOTE:-
- (1) Each period will be 50 minutes duration.
 - (2) Each session will be of 32 weeks.
 - (3) Effective teaching will be at least 25 weeks.
 - (4) Remaining periods will be utilised for revision etc.
 - (5) Field visit and extension lectures are to be organised and managed well in advance at institute level as per need.

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II Year

Curriculum						Scheme of Examination									
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total		
Le	Tut	Dr	Lab	Work	Tot		Examination	Sess.	Total	Examination	Sess.	Total			
c.	ori	aw		Shop	al	Dur.	Marks	Marks	Dur.	Marks	Marks	Tot			
al												al			
3	1	--	--		4	2.1 Applied Mathematics-II	2.5	50	20	70	--	--	70		
3	1	--	--		4	2.2 Process Plant Utilities	2.5	50	20	70	--	--	70		
3	1	--	--		6	2.3 Elect.Tech. & Electronics.	2.5	50	20	70	3	40	20	60	130
3	1	--	--		4	2.4 Fuel & Material Technology	2.5	50	20	70	--	--	--	70	
3	1	--	6		8	2.5 Chemical Technology	2.5	50	20	70	3	60	30	90	160
3	1	--	--		4	2.6 Material Energy Balances	2.5	50	20	70	--	--	--	70	
3	1	--	6		10	2.7 Fluid Mechanics	2.5	50	20	70	3	100	50	150	220
3	1	--	--		4	2.8 Chem. Engg. Thermodynamics	2.5	50	20	70	--	--	--	70	
1	--	--	3		4	2.9 Computer Application For Engineering	--	--	--	--	3	60	30	90	90
<-----TOTAL----->						--	400	160	560	--	260	130	390	950	
Games/NCC/Social and Cultural Activity + Discipline (30 + 20)												50			
Aggregate												1000			

- NOTE:-
- (1) Each period will be 50 minutes duration.
 - (2) Each session will be of 32 weeks.
 - (3) Effective teaching will be at least 25 weeks.
 - (4) Remaining periods will be utilised for revision etc.
 - (5) Field visit and extension lectures are to be organised and managed well in advance at institute level as per need.
 - (6) 4 weeks structured and supervised, branch specific, task oriented Industrial/field exposure to be organised during summer vacation. Student will submit a report. There will be 150 marks for this exposure. These marks will be awarded by project examiner in the final year (Examination Marks : 100, Sessional Marks : 50). (See Annuxure-I)

STUDY AND EVALUATION SCHEME FOR
THREE YEAR DIPLOMA COURSE IN CHEMICAL TECHNOLOGY (FERTILIZER TECHNOLOGY)
(Effective From The Session)

III Year

Curriculum						Scheme of Examination									
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total		
Le c.	Tut ori al	Dr aw	Lab	Work Shop	Tot al		Dur.	Marks	Sess. Marks	Total Marks	Dur.	Marks		Sess. Marks	Total Marks
3	1		2		6	3.1 Heat Transfer Operations	2.5	70	30	100	4	100	50	150	350
3	1		2		6	3.2 Mass Transfer Operations	2.5	70	30	100					
3	1		--		4	3.3 Chemical Reaction Engineering	2.5	70	30	100	--	--	--	--	100
3	1		4		8	3.4 Automatic Process Control	2.5	70	30	100	4	100	50	150	250
2	1		--		3	3.5 Industrial Management and Enterprenurship Development	2.5	50	20	70	--	--	--	--	70
3	1		--		4	3.6 Process Equipment Design	2.5	70	30	100	--	--	--	--	100
3	1		--		4	3.7 Pollution Control & Indust- rial Safety	2.5	70	30	100	--	--	--	--	100
2	1		--		3	3.8 Fertilizer Technology-I	2.5	70	30	100					
2	1		2		5	3.9 Fertilizer Technology-II	2.5	70	30	100	3	80	40	120	320
	1		4		5	3.10 Project a. Project Problem b. Field Exposure	--	--	--	--	3	80 100	30 50	110 150	110 150
24	10		14		48	<-----TOTAL----->	--	610	260	870	--	460	220	680	1550
Games/NCC/Social and Cultural Activity + Discipline (30 + 20)														50	
Aggregate														1600	
30% carry over of Ist year														300	
70% carry over of IInd year														700	
Grand Total														2600	

- NOTE:-
- (1) Each period will be 50 minutes duration.
 - (2) Each session will be of 32 weeks.
 - (3) Effective teaching will be at least 25 weeks.
 - (4) Remaining periods will be utilised for revision etc.
 - (5) Field visit and extension lectures at institute level as per need be organised.

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MAIN FEATURES OF THE CURRICULUM

1. Title of the Course : Diploma in Chemical Engineering (Fertilizer)
2. Duration of the Course : Three Years Duration
3. Type of the Course : Full Time Institutional
4. Pattern of the Course : Annual System
5. Intake : 20
6. Entry Qualification : 10 + with Science II and Mathematics II
7. Admission Criteria : State Joint Entrance Examination

LIST OF EXPERTS

List of experts whose deliberation helped the development of curriculum for three year diploma course in Chemical Engg. at I.R.D.T. U.P., Kanpur on 30.01.99 are honourably named below -

1.	Shri D. N. Saxena	Professor & Head Chemical Engg. Deptt.	H.B.T.I., Kanpur.
2.	Dr. S. K. Awasthi	Professor Chemical Engg. Deptt.	H.B.T.I., Kanpur.
3.	Shri D. D. Singh	Principal	Govt. Polytechnic Gorakhpur
4.	Shri B. N. Singh	Deputy Director	Directorate of Technical Educ. Kanpur
5.	Shri A. P. Agarwal	Head Chem. Engg. Deptt.	Govt. Polytechnic Kanpur
6.	Shri F.R. Khan	Lecturer Chem. Engg. Deptt.	Govt. Polytechnic Kanpur
7.	Shri J.P. Yadav	Dy. Director	I. R. D. T., Kanpur
8.	Shri K.M. Gupta	Asst. Professor	I. R. D. T., Kanpur
9.	Shri M.P. Singh	Asst. Professor	I. R. D. T., Kanpur
10.	Shri M. R. Khurana	Asst. Professor	I. R. D. T., Kanpur
11.	Dr. Anita Bajpai	Asst. Professor	I.R.D.T., Kanpur

List of experts whose deliberation helped the revision of curriculum for three year diploma course in Chemical Engg. at I.R.D.T. U.P., Kanpur on 30.10.07 & 31.10.07 are honourably named below -

1.	Dr. Ram Prasad	Professor, Chem Engg.	H.B.T.I., Kanpur
2.	Dr. Deepak Srivastav	Asstt. Prof., Plastic Tech.	H.B.T.I., Kanpur
3.	Dr. Brist Mitra	H.O.D., Chem. Engg.	I.E.T., C.S.J.M. University, Knp.
4.	Sri Radhey Shyam	Regional Officer	U.P. Pollution Con. Board, Kanpur
5.	Dr. Manju	Scientific Officer	U.P. Pollution Con. Board, Kanpur
6.	Sri D.D. Singh	Principal	Govt. Poly. Knp.
7.	Sri A.P. Agarwal	H.O.D., Chem. Engg.	S.G.P., Jagdishpur
8.	Sri R. K. Srivastav	H.O.D., Chem. Engg.	G.P. Gorakhpur
9.	Sri F. R. Khan	H.O.D., Chem. Engg.	G.P., Lakhmipur Kheri
10.	Sri A. K. Agarwal	Lecturer, Chem. Engg.	G.P., Kanpur
11.	Sri Yogesh Sharma	Lecturer, Chem. Engg.	PMV Poly. Mathura
12.	Sri S. P. Pal	Lecturer, Plastic Tech.	G. P. Badaun
13.	Sri Durgesh Chandra	Assistant Professor	I.R.D.T., Kanpur

NEED ANALYSIS

Learning in general goes on with life informally but in Education systems there are always some patterns to partake knowledge to desirous ones in definite period and systematic manners, developing their knowledge and skill both. The world of knowledge is evergrowing and there always remains something to aid to make the students update, so it is inperative to make relevant changes in the curriculum in the form and content both. Chemical Engg. Diploma curriculum in the state was a four year course since long and it was felt that it should be consolidated to fit in the frame of three year span without damaging its meaningful features and including all that is important in the present scenario of Industries today. Reducing the time span was due to make it uniform like many other diploma courses running in the state polytechnics, also it is to releive the parents from the burdens of expensive training of their wards not only this, the feed back from the Institution too suggested this, with all these considerations in the view, a number of formal and informal workshops were held in this Institute itself and other institution also for this purpose and upshots of these workshops have been properly arranged to systematise classroom teaching.

The important features of the presently proposed curriculum are as given below -

1. It has been made more skillful oriented, emphasizing more practical auspects the list of practicals have been thoroughly revised and enriched with additional important practicals, like other courses here too. Industrial training has been given due weightage.
2. In first year level, the paper Chemical Technology-I has been removed and clubbed with "Chemical Technology-II" and placed in Second Year and renamed as "Chemical Technology" .
3. In the First Year level " Chemical Technolog-I lab" has been removed and clubbed with "Chemical Technology-II Lab" and placed in Second Year and renamed as "Chemical Technology Lab".
4. In the Second Year level the paper :Fluid Mechanics and Solid Handling" has splitted in two papers as "Mechanical Operation and Solid Handling" and placed in First Year and other one is "Fluid Mechanics" placed in Second Year.
5. Mechanical Operation and Solid Handling Lab is introduced with the subject Mechanical Operation and Solid Handling and placed in First Year and Fluid Mechanics Lab is placed in Second Year.
6. In the Final Year level the "Fertilizer Lab" is renamed as "Fertilizer and Pollution Control Lab" and Six new practical of pollution control has been added with Fertilizer Lab. It is very useful lab in present scenario.

With all these changes, it is hoped that the new proposed course will prove conducive to students for employment point of view.

V- PROFILE DEVELOPMENT

A tool in form of a questionnaire was designed and sent to various organisations, industries, higher technological institutes and polytechnics for getting informations about job opportunities, man power requirements and job activities of diploma holders in chemical engineering.

Feed back was taken from experts through questionnaire, personal interviews and workshops was analysed and a draft structure of curriculum was prepared in the workshop held at I.R.D.T., U.P., Kanpur adopting the following procedure.

1. Listing job potential and job activities.
2. Analysing activities into knowledge and skill.
3. Deriving the course objectives.
4. Deriving subject areas from course objectives.
5. Planning horizontal and vertical organisation of subjects.
6. Developing study and evaluation scheme.
7. Developing detailed course contents and coverage time keeping in view the knowledge and skill requirement.
8. Determining resource input in terms of human and information resources, space & equipments etc.

VI-JOB POTENTIAL/JOB OPPORTUNITIES :

- (A) The diploma pass outs can seek the job opportunities in following type of organisations

S.NO	DEPARTMENT/ORGANISATION	POSITION/DESIGNATION
1.	O.N.G.C.	Supervisor
2.	Oil Refineries	Supervisor
3.	Pharmaceutical	Technician
4.	Fertilizer Factories	Shift Engineer
5.	Process Industries	Foreman
6.	Chemical Industries	Senior Operator
7.	Petro Chemical Industries	Foreman
8.	GAIL India Limited	Jr. Engg./Operator
9.	Indian Oil Corporation	Production - Jr. Engg./Operator
10.	Research Organisationsing Chemical Engineering	Technician

- (B) Names of specific industries where diploma pass outs were empolyed.

11.	Bharat Petroleum Corporation Ltd.	Jr. Engg./Operator
12.	Indian Glysol Ltd, Kashipur	Trainee Operator Shift Engineer
13.	Pashupati Acrilon Ltd., Kashipur	-----Do-----
14.	Prakash Pipe Tubes, Kashipur	Chemist In Lab
15.	Dynora T. V., Kashipur	ory. Chemist
16.	Flow More Ltd., Kashipur	Operator
17.	Nepa, Pulp Paper Industry, Aliganj, Kashipur	Chemist/Operator
18.	Paper Industry, Lalkuawan(Pantnagar)	Chemist/Operator
19.	Heavy Electrical Ltd., Haridwar	Chemist
20.	IFFCO, Aonla, Bareilly	Tranee Operator
21.	Bhaba Atomic Research Centre Bombay	Shift Chemist/ Supervisor
22.	Bhaba Atomic Research Centre Kota, Rajasthan	Shift Chemist/ Supervisor
23.	Indo Gulf Fertilizer Ltd. Jagdishpur	Supervisor/Shift Engineer
24.	Hindustan Salt Ltd., Ram Nagar	Supervisor
25.	J. K. Synthetic, Kota	Supervisor
26.	Cement Corporation of India	Supervisor
27.	Hindustan Insecticides Ltd Delhi.	Supervisor
28.	Sri Ram Fertilizer & Chemicals New Delhi.	Supervisor
29.	Easter India Ltd., Khatima (Nainital)	Supervisor
30.	Sumaia Chemicals, Barabanki	Supervisor
31.	Mohan Mekien Distilleries Ltd., Ghaziabad	Operator
32.	Steel Authority of India Ltd.	Supervisor

S.NO	DEPARTMENT/ORGANISATION	POSITION/DESIGNATION
33.	Bharat Electronics, Ghaziabad	Supervisor
34.	Vam Organic Gajrola Moradabad	Supervisor
35.	Atomic Power Project, Naraura	Operator
36.	Synthetics & Chemical, Bareilly	Supervisor
37.	U. P. Straw & Agro Products, Agvanpur (Moradabad)	Supervisor
38.	Camphor & Allied Products, Bareilly	Supervisor
39.	Khaitan Fertilizer, Rampur	Supervisor
40.	Rampur Distillaries & Chemicals Rampur.	Chemical Analyst
41.	Modi Zerox, Rampur	Supervisor
42.	Modi Olivetti (Computer), Rampur	Supervisor
43.	Modi Rubber & Chemical Industries Modi Nagar.	Supervisor
44.	Modi Pon, Modi Nagar	Supervisor
45.	Modi distilleries, Modi Nagar	Supervisor
46.	Bajpur Distillery. Bajpur	Supervisor
47.	Dauralla Distillery & Chemicals Dauralla, Meerut	Supervisor
48.	U. P. Tiwiga Fibre Glass Ltd. Secundrabad (Ghaziabad)	Supervisor
49.	Dewan Rubber Industries, Meerut	Supervisor
50.	Dewan Tyres Ltd., Meerut	Supervisor
51.	Kanoria Chemicals Ltd., Mirzapur	Supervisor
52.	Indian Petrochemicals & Complex Ltd., Baroda	Operator
53.	Mathura Refinery, Mathura	Operator
54.	National Organics & Chemicals Ltd., Bombay	Operator
55.	Indian Drugs & Pharmaceuticals Ltd., Rishikesh.	Operator
56.	Ramganga Fertilizer Ltd, Gajrola (Moradabad)	Supervisor
57.	Shree Chemicals & Industries Ltd., Gajrola (Moradabad)	Supervisor
58.	Steel Authroithy India Ltd., Delhi	Supervisor
59.	Dunkan Industries Ltd. Panki Kanpur	Supervisor/Operator
60.	Lohia Group	Supervisor/Operator
	A- Injectoplast Ltd., Panki	Supervisor/Operator
	B- Startinger Ltd., Panki	Supervisor/Operator
	C- Machinery Manufacture Ltd. Chaubepur Kanpur Dehat.	Supervisor/Operator
61.	Pepsico, Kanpur Dehat	Supervisor/Operator
62.	Goodlass Merolac Paints Ltd., Jainpur, UPSIDC, Industrial Area, Kanpur Dehat.	Supervisor/Operator
63.	M.L.A. Group of Industries, Harsh Nagar, Kanpur	Supervisor/Operator
64.	Scooter India Ltd. Paints Shop, Sarojini Nagar Lucknow.	Supervisor/Operator
65.	L.M.L., Ltd., Paints shop, Panki.	Supervisor/Operator
66.	India Polyfibre Ltd., Barabanki	Supervisor/Operator

67.	Somaiya Organics Ltd., Barabanki.	Supervisor/Operator
68.	Superhouse Leather Ltd.Unnao.	Supervisor/Operator
69.	Raymonds Synthetics Ltd.,Karchhena,Allahabad	Supervisor/Operator
70.	Oswal Fertilizers & Chemicals Ltd, Fertilizer Div., Babrala, Shahjahanpur	Supervisor/Operator
71.	Tata Chemicals Ltd., Badayun	Supervisor/Operator
72.	U.P. Asbertos Ltd. Lucknow	Supervisor/Operator
73.	Hindustan Lever Ltd., Orai	Supervisor/Operator
74.	Hindustan Lever Ltd., Hamirpur	Supervisor/Operator
75.	Vegipro Ltd., Orai	Supervisor/Operator
76.	Larsan & Toubro, Bombay	Supervisor/Operator
77.	KTI, Ltd., Delhi	Supervisor/Operator
78.	Mc Dowell Industries, Ltd, Bangalore	Supervisor/Operator
79.	IPCL, Baroda	Supervisor/Operator
80.	Panjab Tractor, Bhewani	Supervisor/Operator
81.	Hindalco Ltd., Renukut, Mirzapur	Supervisor/Operator
82.	Hindustan Lever Ltd., Bangalore (Research Division)	Supervisor/Operator
83.	Indian oil Corporation Ltd.	Supervisor/Operator
84.	GAIL India Limited	Supervisor/Operator
85.	Reliance Industries Ltd., Bombay	Supervisor/Operator
86.	Reliance Petrochemical Ltd.(Refinery) Jamnagar	Supervisor/Operator
87.	MRPL, Mangalore	Supervisor/Operator
88.	ESSAR Refinery Ltd. Jamnagar	Supervisor/Operator
89.	Chambal Fertilizers Ltd., Kola Rajasthan	Supervisor/Operator
90.	Nagarjuna Fretilizers, Andhra Pradesh	Supervisor/Operator
91.	R.C.F.(Rashtriya Chemical & Fertilizers Bombay)	Supervisor/Operator
92.	Insilco , Gujralla, Moradabad	Supervisor/Operator
93.	Malvika Steel Industries, Jagdishpur, Sultanpur	Supervisor/Operator
94.	K.M. Sugar Mills & Distillery Div.,Masoudha	Supervisor/Operator
95.	Yash Paper Mills, Faizabad	Supervisor/Operator
96.	H.P.C.L.(Hindustan Petroleum Co. Ltd.) Bombay	Supervisor/Operator
97.	Balrampur Chinee Mill & Distillery Div. Balrampur	Supervisor/Operator
98.	Oil Refinery India, Ltd., Digboi (Assam)	Supervisor/Operator
99.	NALCO, Orissa	Supervisor/Operator
100.	BALCO, Korba (M.P.)	Supervisor/Operator
101.	NALCO Chemicals, Bombay	Supervisor/Operator

(C) SELF EMPOLYMENT:

A diploma pass out in Chemical Engineering can start his enterprenurial activities in the following small scale industries.

- (i) Manufacturing of Paints & Varnishes.
- (ii) Manufacturing of Plastic & rubber Articles.
- (iii) Manufacturing of domestic utility articles such as Soap, Detergent, Edible oils, Hair oils etc.
- (iv) Small scale packing industries.

VII. JOB ACTIVITIES :

(A) GENERAL:

1. OPERATION OF CHEMICAL PLANT:

- 1.1 Supervises the operation of chemical plants.
- 1.2 Supervise the process control
- 1.3 Training of crafts man
- 1.4 Manages labour materials and utilities
- 1.5 Safety of workers and equipments

2. CHEMICAL ANALYSIS :

- 2.1 Analysis of sample
- 2.2 Interpretation of results of analysis

3. ERECTION AND COMMISSIONING OF CHEMICAL PLANT :

- 3.1 Reading and inter-pretng the sketches, drawings
- 3.2 Preparing inventory control and costing.

4. INSPECTION AND TESTING OF CHEMICAL EQUIPMENT :

- 4.1 Inspection and testing performance of individual equipment.
- 4.2 Fault finding or trouble shooting and its rectification.

5. MARKETING :

- 5.1 Explaining the salient features and performance of the product and comparison with regard to other such available equipments in the market.
- 5.2 Preparing estimates and contract documents
- 5.3 Booking of orders and making relevent documents and correspondence.
- 5.4 Servicing of equipments and instruments.
- 5.5 Inventory control and determination of material requirement.
- 5.6 Preparation of tender documents and investing tenders.

5.7 Placing orders and receiving the supplies.

6. PROJECT PREPARATION AND EVALUATION :

6.1 To scrutinise the project reports for Chemical plants from the point of view of feasibility and finances involved.

7. TEACHING, RESEARCH AND TRAINING :

7.1 To assist the teachers in imparting instructions to students.

7.2 To set up laboratory equipments for experimental work.

7.3 Preparation of specifications of various equipments and instruments.

7.4 Preparing of tender.

7.5 Receipt of supplies and their inspection and testing according to specifications.

7.6 Maintains the equipments and instruments in the laboratory.

(B)SELF EMPLOYMENT:

(a) Setting up of small scale chemical industry

(b) Setting up an ancillary industry for big chemical plants.

ACTIVITY ANALYSIS:

S.No.	Activity	Knowledge Required	Skill Required
GENERAL:			
1.1	Supervisors / Technicians / Sr. Operators in Chemical and allied industries :		
1.1.1	Supervises the Operation of Chemical Plants.	Knowledge of : - Inorganic and organic chemistry and part of physical chemistry. - Unit operations such as fluid flow heat transfer, mass transfer, mechanical operation etc. - Unit process of inorganic and organic industries. - Process testing instrument- their principle of operation, working and constructional details.	Skill in operation of individual chemical equipment and related instrument.
1.1.2	Supervises the process control.	- Knowledge of : - Unit process of inorganic and organic chemical industries. - Instruments used in process control, their principle of operation, working and constructional details. - Various types of break downs their causes and rectification. Effect of break down on the working of industry.	Skill in the use of instruments. Skill in attending the break downs.
1.1.3	Training of Crafts man	- Knowledge of subject matter of chemical plants i.e. equipments and processes. - Collection of feed data and effective communication methods.	Skill in planning and supervising of training, communication techniques.

S.No.	Activity	Knowledge Required	Skill Required
1.1.4	Manages labour materials and utilities.	<ul style="list-style-type: none"> - Modern methods of labour management, labour welfare activities. - Labour laws and acts, workman compensation act, strikes and lock-outs etc. - Principles of material management. - Departmental purpose, rules and specification of materials. - Inventory control. - Stores management layout, method of storage, and stores maintenance i.e. bincards, ledger etc. - Use of utilities in the plant. 	<ul style="list-style-type: none"> Skill in leadership, Skill in communication techniques.
1.1.5	Safety of workers and equipments.	<ul style="list-style-type: none"> - Safety rules and other departmental precautions in this respect. - Importance of safety in an industry. - Knowledge of different safety procedures. - Different safety equipment its principle of working, layout and operation. 	<ul style="list-style-type: none"> Skill in operation of plants and equipment. Skill in conducting safety operations. Skill in operating safety equipments. Skill in first aid operations.
1.2 SUPERVISOR FOR CHEMICAL ANALYSIS :			
1.2.1	Analysis of sample	<ul style="list-style-type: none"> - Knowledge of chemical analysis. - Knowledge of qualitative and quantitative analysis. - Knowledge of analytical instruments. 	<ul style="list-style-type: none"> Skill in handling various instruments and requirements in the lab.
1.2.2	Interpretation of results of analysis.	<ul style="list-style-type: none"> - Knowledge to present the results in a qualitative form. - Knowledge of basic chemical calculations. 	<ul style="list-style-type: none"> Skill in reaching at conclusion.

S.No.	Activity	Knowledge Required	Skill Required
1.3	SUPERVISOR FOR COMMISSIONING OF	ERECTION AND CHEMICAL PLANTS:	
1.3.1	Reading and interpreting the sketches, drawings.	<ul style="list-style-type: none"> - Principle of projections first angle projection & third angle projection. - Descriptions, working and use of various drawing instruments & equipments. - Knowledge of various process and equipment. - Methods of reading and interpreting the drawings and blue prints. - Preparation of detailed manufacturing drawing from line diagrams. 	<p>Skill in reading and interpreting drawing & sketches.</p> <p>Skill in use of drawing instrument and equipment.</p> <p>Skill in reprography , preparations of detailed manufacturing drawings.</p>
1.3.2	Preparing inventory control and costing.	<ul style="list-style-type: none"> - Inventory control methods - Store-keeping - Cost estimation 	Skill in maintenance of stores and ordering procedures.
1.3.3	Preparation of working schedule.	<ul style="list-style-type: none"> - Realistic time estimates for various jobs. 	Skill to handle labour.
1.3.4	Erection and commissioning of plant.	<ul style="list-style-type: none"> - Knowledge of plant and machinery and process. - Workshop Practice - Foundation practice - Handling equipment - Transportation of equipment. - equipments used for erection. - Knowledge of safety of equipment - Simple design calculations. 	<p>Skill to handle labour.</p> <p>Skill in workshop practice, skill in demonstration.</p> <p>Skill in testing of commissioned equipments.</p>

S.No.	Activity	Knowledge Required	Skill Required
1.4	Supervisor for equipment testing and inspection :		
1.4.1	Inspection & testing performance of individual equipment.	<ul style="list-style-type: none"> - Necessity of inspection at various stages of manufacture, operation and maintenance. - Modern methods of conducting inspections. - Various tests and testing procedures to determine the process-performance of the individual equipment. - Importance of performance test for equipment and to fix its periodicity. 	<ul style="list-style-type: none"> Skill in inspection techniques. Skill in testing the equipment.
1.4.2	Fault finding or trouble shooting and its rectification.	<ul style="list-style-type: none"> - Knowledge of various process and equipment. - Various probable fault which are likely to occur in processes and equipments. - Techniques in fault investigation and trouble shooting. - Methods of repair and overhauling. - Importance of maintenance in running of a factory. - Preventive maintenance and preparation of its schedule. 	<ul style="list-style-type: none"> Skill in conducting preventive maintenance and process monitoring. Skill in trouble shooting. Skill in repair and overhauling of equipment.
1.5	Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units :		
1.5.1	Explaining the salient features & performance if the product and comparison with regard to other such available equipments in the market.	<ul style="list-style-type: none"> - Knowledge of the manufacturing processes of the product & its utilities. - Description, principle of working and special features of the equipment. - Modern methods of sales promotion. 	<ul style="list-style-type: none"> Skill in explaining the performance of the product. Skill in good Sales-manship. Skill in demonstrating the working of the equipment.

S.No.	Activity	Knowledge Required	Skill Required
		<ul style="list-style-type: none"> - Knowledge of other similar products in the market. - Operation of the equipment and demonstrating the performance. 	
1.5.2	Preparing estimates & contract documents.	<ul style="list-style-type: none"> - Principle of estimation. - Various methods of estimation. - Knowledge of departmental rules and general sale/purchase conditions such as earnest money, security deposits, warranty claims etc. - Preparation of estimates and contract documents. 	<ul style="list-style-type: none"> Preparation of estimates. Preparation of contract documents. Skill in setting warranty claims.
1.5.3	Booking of orders and making relevant documents and correspondence.	<ul style="list-style-type: none"> - Knowledge of office procedures initiating a correspondence, putting the notes, drafting letters and coresspondence. - Techniques in procedure of placing orders. - Knowledge of market demand and trend. - Methods of conducting market survey to determine market trend. 	<ul style="list-style-type: none"> Skill in making official correspondence. Skill in office procedure.
1.5.4	Servicing of equipment and instruments.	<ul style="list-style-type: none"> - Importance of service after sales in promotion of product sale. - Principle of working of various equipment and instruments manufactured. - Various defects and its repair. - Explaining the importance of preventive and routine maintenance to customer. 	

S.No.	Activity	Knowledge Required	Skill Required
1.5.5	Inventory control and determination of material requirement.	<ul style="list-style-type: none"> - Principle of inventory control. - Knowledge for consolidating the requirement of material and lead time. 	
1.5.6	Preparation of tender documents and investing tenders.	<ul style="list-style-type: none"> - Detailed specification of materials. - Preparation of tender documents with various conditions. - Inviting tenders according to departmental rules and regulations. 	Skill in preparing tender documents.
1.5.7	Placing orders and receiving the supplies.	<ul style="list-style-type: none"> - Method of making comparative statement. - Decision making for ordering the material on quality-cum-cost basis. - Preparing the orders laid down clearly the various conditions of supply. - Receipt of supplies and inspection of materials according to specification for accepting and rejecting. 	<p>Skill in preparing the supply orders.</p> <p>Skill in inspection of material for accepting and rejection.</p>
1.6	Technical assistants in financial corporation, banks for the scrutinizing project reports for the purpose of loaning :		
1.6.1	To scrutinise the project reports for Chemical plants from the point of view of feasibility and finances involved.	<ul style="list-style-type: none"> - Specifications of various raw material used in chemical industry. - Knowledge of availability of man power in the area where industry is likely to be setup. - Various concessions provided by the Govt. such as cheap electricity water, land on concessional rates etc. 	Skill in scrutinizing the report.

S.No.	Activity	Knowledge Required	Skill Required
		<ul style="list-style-type: none"> - Knowledge of processes and products its market availability. - To make comparative study and analysis of project report for its feasibility. 	
1.7	To work as a technician in teaching / research organisation and in training organisation of large chemical unit :		
1.7.1	To assist the teachers in imparting instructions to students.	<ul style="list-style-type: none"> - Knowledge of the subjects. - Teaching methodology. - Students psychology. 	Communication Skill.
1.7.2	To set up laboratory equipments for experimental work.	<ul style="list-style-type: none"> - Description and working of the equipment. - Method of setting the equipment. - Knowledge of the experiment. 	Operation of equipment and conduct the experiments.
1.7.3	Preparation of specifications of various equipments and instruments.	<ul style="list-style-type: none"> - Principle of specifying the machines, equipments and instruments. - Methods of laying down specifications. - Knowledge of various machines, equipments and instruments. 	Skill in preparing the specifications.
1.7.4	Preparing of tender.	<ul style="list-style-type: none"> - Specifications of various equipments and materials required. - Preparation of tender documents. - Knowledge of various sources of availability of chemical equipments and material. - Preparation of comparative statement and recommending the item on quality-cum-cost basis. 	<p>Skill in inviting tenders</p> <p>Skill in preparation of tender documents</p>

S.No.	Activity	Knowledge Required	Skill Required
1.7.5	Receipt of supplies and their inspection & testing according to specification.	<ul style="list-style-type: none"> - Receipt of the material. - Method of inspection and testing the materials. - Conducting inspection and testing of materials according to specification for acceptance and rejection. 	Skill in inspection and testing of the equipments and materials.
1.7.6	Maintenance of equipments and instruments in the laboratory.	<ul style="list-style-type: none"> - Importance of maintenance in institution and engineering industry. - Various maintenance methods. - Importance of preventive maintenance preparation of preventive maintenance, schedule for each machine, equipments & instrument. - Types of fault, its detection repair and overhauling. - Keeping the maintenance record of each machine equipment and instrument. 	<p>Skill in conducting preventive maintenance.</p> <p>Skill in repairing and overhauling of machines, equipments and instruments.</p>

(B) SELF EMPLOYEMENT :

Self employment in small scale unit such as manufacturing of paints, varnishes, chemicals, rubber and plastic :

(a)	Setting of small scale chemical industry.	<ul style="list-style-type: none"> - Methods of conducting market survey for the feasibility of the industry. - Factor affecting site selection. - Knowledge of various financial sources with their norms and conditions. - Knowledge of various concessions provided by government to young entrepreneurs. - Knowledge of process 	Skill in conducting market survey.
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S.No.	Activity	Knowledge Required	Skill Required
		<ul style="list-style-type: none"> - market trends for the sale of product. - Safety and waste treatment. 	
(b)	Setting up an ancillary industry for big chemical plants.	<ul style="list-style-type: none"> - Market survey to collaborate with big industry. - Various financial sources for financing ancillary industry. - Concessions provided by government. - Knowledge of manufacturing processes for the item. - Effective and efficient management of the industry. 	Skill in setting up of unit.

VIII- COURSE OBJECTIVE

At the end of course the students should be able to get:

(A) KNOWLEDGE :

- (1) Understand the various unit operation and unit processes and their application in different chemical industries like fertilizer, process industry, sugar and plastic etc.
- (2) Understand various instruments used in process control of chemical industry including use of computer.
- (3) Understand the organisation and his place in it. Understanding the general procedures of stores, purchase and inventory etc.
- (4) Understand the techniques of installation, erection and commissioning of equipments/instruments in chemical plants.
- (5) Understand, interpret and prepare plant layout and flow diagrams.
- (6) Understand, interpret and prepare project reports.
- (7) Understand safety goals, waste control and waste treatment (effluent control)
- (8) Understand the energy conservation and balance.
- (9) Develop attitude for safety consciousness

(B) SKILL :

- (10) Acquire skill in operation, testing and adjustment of chemical equipment/materials used in chemical industry.
- (11) Acquire the skill in diagnosis of common faults and troubles in process, equipment and instrument and their rectification, repair and overhauling.
- (12) Acquire skill in reading interpreting and prepare plant layout and flow diagrams.
- (13) Acquire skill in preparing erection schedule/charts and knowledge of coordination of the organisation using CPM and PERT.
- (14) Develop skill in operation of chemical plants.
- (15) Develop skill in use of instruments in chemical industry.
- (16) Develop skill in communication oral/written/through devices.
- (17) Develop skill in repair and maintenance of chemical instruments and equipments.

IX- CURRICULUM ANALYSIS FOR IDENTIFICATION OF SUBJECTS

SNo. Course Objective	Subject(s) of study
(A) KNOWLEDGE :	
(1) To understand the various unit operations and unit processes and their application in different chemical industries like fertilizer, process industry, sugar and plastic etc.	<ul style="list-style-type: none"> - Chemical Technology - Unit Operations - Electives - Fluid Mechanics - Mechanical Operation & Solid Handling - Heat transfer - Mass transfer
(2) To understand various instruments used in process control of chemical industry including use of computers.	<ul style="list-style-type: none"> - Instrumentation - Computer Application For Engineering
(3) To understand the organisation and his place in it. understanding the general procedure of stores, purchase and inventory etc.	<ul style="list-style-type: none"> - Industrial Management & Enterprenurship Development
(4) To understand the technique of installation, erection and commissioning of equipments/ instruments in chemical plants.	<ul style="list-style-type: none"> - Process equipment design - Workshop Practice (Installation and commissioning)
(5) To understand, interpret and prepare plant layout and flow diagrams.	<ul style="list-style-type: none"> - Chemical Technology
(6) To understand, interpret and prepare project reports.	<ul style="list-style-type: none"> - Project work
(7) To understand safety goals, waste control and waste treatment (effluent control).	<ul style="list-style-type: none"> - Pollution Control & Industrial Safety - Safety and Chemical hazards.
(8) To understand the energy conservation and balance.	<ul style="list-style-type: none"> - Material Energy Balance
(9) To develop attitude for safety consciousness.	<ul style="list-style-type: none"> - Industrial Safety .

SKILL :

- | | |
|--|---|
| (1) To acquire skill in operation, testing and adjustment of chemical equipment / materials used in chemical industry. | - Workshop Practice.
- Field Exposure |
| (2) To acquire the skill in diagnosis of common faults and troubles in process - equipment and instrument and their rectification, repair and overhauling. | - Workshop Practice relating chemical engineering.
- Field Exposure |
| (3) To acquire the skill in reading, interpreting and prepare plant layout and flow diagrams. | - Engineering Drawing
- Chemical Tech.
- Process - Equipment Design.
- Field Exposure |
| (4) To acquire skill in preparing erection schedule/ charts and knowledge of coordination of the organisation using CPM and PERT. | - Industrial Management
- Process Equipment Design
- Workshop Practice.
- Field Exposure |
| (5) To develop skill in operation of chemical plants. | - Field Exposure
- Chemical Technology
- Workshop |
| (6) To develop skill in use of instruments in chemical industry. | - Measuring Instruments & Measurements
- Field Exposure |
| (7) To develop skill in communication oral/ written/ through devices. | - Communication Techniques
- Industrial Management |
| (8) To develop skill in repair and maintenance of chemical instruments and equipments. | - Workshop Practice
- Field Exposure |

Theory Papers	Practicals
I YEAR	
1.1 Professional Communication	
1.2 Applied Mathematics-I	
1.3 Applied Physics	1. Applied Physics Lab
1.4 Applied Chemistry	2. Applied Chemistry Lab
1.5 Engineering Drawing.	3. WorkShop Practice.
1.6 Applied Mechanics	4. Applied Mechanics Lab.
1.7 Mechanical Operation & Solid Handling	5. Mechanical Operation & Solid Handling Lab
1.8 Measuring Instruments & Measurement	
II Year	
2.1 Applied Mathematics-II	
2.2 Process Plant Utilities	
2.3 Elec. Tech. & Electronics	1. Electrical Tech. & Elex. Lab.
2.4 Fuel & Material Technology	
2.5 Chemical Technology	2. Chemical Tech. Lab
2.6 Material Energy Balances	
2.7 Fluid mechanics	3. Fluid mechanics Lab
2.8 Chemical Engg. Thermodynamics	
2.9 Computer Application For Engg	4. Computer App. For Engg. Lab.
III Year	
3.1 Heat Transfer Operations	1. Heat Transfer Operations-Lab
3.2 Mass Transfer Operations	2. Mass Transfer Operations-Lab
3.3 Chemical Reaction Engg.	
3.4 Automatic Process Control	3. Automatic Process Control Lab.
3.5 Industrial Management & Entrepreneurship Development	
3.6 Process Equipment Design	
3.7 Pollution Control & Industrial Safety	
3.8 Fertilizer Technology-I	
3.9 Fertilizer Technology-II	
3.10 Project	
A. Equipment Design Project	A. Equipment Design Project
B. Field Exposure	

I YEAR

1.1 PROFESSIONAL COMMUNICATION

[Common to All Engineering/Non Engineering Courses]

L T P
3 - 2

Rationale:

Communication forms an important activity of diploma holder. It is essential that he/she should be in a position to communicate in writing and orally with superiors, equals and subordinates. This subject aims at providing working knowledge of languages like Hindi and English so as to train the students in the art of communication. It is suggested that maximum attention should be given in developing Communication abilities in the students while imparting instructions by giving maximum emphasis on practice.

Sr.No.	Units	Coverage time		
		L	T	P
1.	Introduction to communication methods meaning, channels & media written and verbal.	5	-	-
2.	Development of comprehension of English & Hindi through study of text material & language exercises.	20	-	-
3.	Development of expression through			
	A. Letters (English & Hindi)	10	-	-
	B. Report writing (English) Note making and minutes writing	10	-	-
4.	Composition	10	-	-
5.	Grammar	20	-	-
		75	-	50

1. PART I : COMMUNICATION IN ENGLISH

1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writing and speaking, Barriers in communication, Modern tools of communication- Fax, e-mail, Telephone, telegram, etc.

1.2 Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Letters :

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters. Application for a job.

1.3.2 Report writing and Note making and minutes writing.

1.4 Grammer : Transformation of sentences, Preposition, Articles, Idioms and Phrases, One word substitution, Abbreviations.

1.5 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. PART II : COMMUNICATION IN HINDI

2.1 Development of comprehension and knowledge of Hindi usage through rapid reading and language exercises based on prescribed text material developed by IRDT.

2.2 Development of expression through ;

Letter writing in Hindi:

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters, Application for a job.

(1) Paper should be in two parts, part I - English and part II Hindi.

COMMUNICATION AND PRESENTATION PRACTICES

1.A. Phonetic transcription

B. Stress and intonation :

(At least 10 word for writting and 10 word for pronunciation)

2. ASSIGNMENT : (Written Communication)

Two assignment of approximately 400 word each decided by the teachers.

SUGGESTED ASSIGNMENTS :

1. a picture/photograph
2. an opening sentence or phrase
3. a newspaper/magzine clipping or report
4. factual writting which should be informative or argumentative.

3. Oral Conversation:

1. Short speeches/declamation : Bid farewell, Felicitate somebody, Celebrate a public event, Offer condolences

2. Debate on current problems/topics
3. Mock Interview : Preparation, Unfolding of personality and Expressing ideas effectively
4. Group discussion on current topics/problems
5. Role Play/ general conversation : Making polite enquiries at Railway Station, Post Office, Banks and other Public places, Replying to such enquiries, enquiring about various goods sold in the market and discussing their prices. Complaining about service at Hotel, restaurant, Offering apologies in reply to such complaints, complain to a company about a defective product you have brought, reply to such complaints.
6. Presentation skill, Use of OHP and LCD.

4. Aural :

Listening to conversation/talk/reading of short passage and then writing down the relevant or main points in the specified number of words and answering the given questions

The assignments/project work are to be evaluated by the internal/ external examiner. The distribution of 30 marks e.g.

10 marks for assignment (Given by subject teacher as sessional marks)

10 marks for conversation and viva-voce

10 marks for phonetic transcription

STRUCTURE OF COMMUNICATION TECHNIQUE PAPER

Distribution of Marks

Theory Paper : 50 Marks

Sessional : 20 Marks

Practices : 30 Marks

- Q1. Question based on the topics prescribed text material will be set to test the candidates ability to understand the content, explain words and phrases, making sentence of given words and ability to summarise will be included. All questions will have to be answered.

A. from English Text Book 10 Marks

B. from Hindi Text Book 5 Marks

- Q2. Candidates will be required to write one letter (English) and one letter in (Hindi) from a choice of two -

A. English Letters 5 Marks

B. Hindi Letters 5 Marks

- Q3. Report Writing on given outlines 5 Marks

- Q4. There will be a number of short answer questions to test the candidates knowledge of functional grammar, structure and

usage of the language. All the items in this question will be compulsory. The grammar questions has four parts -

(Total Part: A For 5 Marks, B For 3 Marks, C For 3 Marks and D For 4 Marks)

A. This part of the question has to do with the transformation of sentences. English uses several patterns of sentence formation and the same meaning can be expressed by several patterns e.g. Active to Passive voice and vice versa, Direct to Indirect and vice versa, Reframing sentences by changing part of speech e.g. Noun to Adjective, Interchanging degree of comparison.

Interchanging Moods - Affirmative to Negative, Assertive to Interrogative or to exclamatory

B. The second part usually requires blanks in a sentence to be filled in with a suitable preposition and articles.

C. The third part is usually an exercise on tenses.

D. The fourth part concerns with one word substitution and abbreviation, uses of idioms and Phrases.

Q5. COMPOSITION : (About 300 Words) (5 marks)

Candidates will be required to select one composition topic from a choice of five. The choice will normally include narrative descriptive, argumentative, discussion and factual topics. The main criteria by which the composition will be marked are as follows

A. the quality of the language employed, the range and appropriateness of vocabulary and sentence structure the correctness of grammatical construction, punctuation and spelling.

B. The degrees to which candidate have been successfully in organising both the composition as a whole and the individual paragraphs.

1.2 APPLIED MATHEMATICS I

[Common to All Engineering Courses]

L T P
3 2/2 -

Rationale:

The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.

S.N.	Units	Coverage Time		
		L	T	P
1.	Algebra-I	18	6	-
2.	Trigonometry	7	2	-
3.	Coordinate Geometry	15	5	-
4.	Differential Calculus-I	15	5	-
5.	Integral Calculus-I	20	7	-
		75	25	-

DETAILED CONTENTS:

1. ALGEBRA-I :
 - 1.1 Series : AP and GP; Sum, nth term, Mean
 - 1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.
 - 1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Cramer's rule
 - 1.4 Vector algebra : Dot and Cross product, Scaler and vector triple product. Application to work done, Moment of a force, Plane geometry.
2. TRIGONOMETRY :
 - 2.1 Relation between sides and angles of a triangle : Statement of various formulae showing relationship between sides and angle of a triangle.
 - 2.2 Complex number.

Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..
3. CO-ORDINATE GEOMETRY :

3.1 Standard form of curves and their simple properties -

Parabola $x^2=4ay$, $y^2=4ax$,

Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Tangent and normals

3.2 Straight lines, planes and spheres in space -

Distance between two points in space, direction crossing and direction ratios, Finding equation of a straight line, and shortest distance between two lines

Under different conditions equation of a plane $lx+my+nz=c$, relation between lines and planes, sphere $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz=d$

4. DIFFERENTIAL CALCULUS - I :

4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.

4.2 Methods of finding derivative, - Function of a function, Logarithmic differentiation, Differentiation of implicit functions, Higher order derivatives, Leibnitz theorem.

4.3 Special functions (Exponential, Logarithmic, Hyperbolic, Inverse circular and function), Definition, Graphs, range and Domain and Derivations of each of these functions.

4.4 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, sketching of some simple curves (without assumptions, question, not to be asked in the examination), Rate, Measure, velocity, Acceleration, Errors and approximation.

5. INTEGRAL CALCULUS - I :

5.1 Methods of Indefinite Integration :- Integration by substitution, Partial fraction and by parts, Integration of special function of 4.3.

5.2 Meaning and properties of definite integrals, Evaluation of definite integrals.

5.3 Application : Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution, centre of mean of plane areas.

5.4 Simpsons and Trapezoidal Rule : their application in simple cases, Concept of error for simple function.

1.3 APPLIED PHYSICS

[Common to All Engineering Courses]

L T P
3 2/2 2

Rationale:

Engineering physics is a foundation Course. Its purpose is to develop proper understanding of physical phenomenon and scientific temper in the students. While teaching the subject, teachers should make maximum use of demonstrations to make the subject interesting to the students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Measurement	4	1	-
2.	Vector	3	1	-
3.	Force and Motion	4	1	-
4.	Dynamics of rigid body (Rotational Motion)	4	1	-
5.	Fluid Mechanics and Friction	4	1	-
6.	Work, Power and Energy	4	2	-
7.	Elasticity	2	1	-
8.	Simple Harmonic Motion	4	1	-
9.	Heat Transfer & Radiation	4	2	-
10.	Application of Sound Waves, Acoustics and Ultrasonics	6	2	-
11.	A. Optics	4	1	-
	B. Fiber Optics	4	1	-
12.	D.C. Circuits	4	1	-
13.	Dielectrics	4	2	-
14.	Magnetic Fields and Materials	4	2	-
15.	Semi Conductor Physics	5	1	-
16.	Nuclear Physics	4	2	-
17.	Laser & its Application	4	1	-
18.	Non-conventional energy sources	3	1	-
		75	25	50

DETAILED CONTENTS:

1. Measurement

a) Units and Dimensions

Fundamental and derived units :

S.I. Units & Dimensions of physical quantities, Dimensional formula and dimensional equation. Principle of homogeneity of dimensions and applications of homogeneity principle to:

- i) Checking the correctness of physical equations,

- ii) Deriving relations among various physical quantities,
 - iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.
- b. Errors in measurements, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement (Combination of errors in addition, subtraction, multiplication and powers). Significant figures, and order of accuracy in respect to instruments, Standard deviation, Variance.
- 2. Vector :

Scalar and vector quantities; Addition, Subtraction, Resolution of vector- Cartesian components of vector, Scalar and vector product of two vector.
- 3. Force and Motion

Parabolic motion, projectiles thrown horizontally and at an angle. Problems on time of flight, horizontal range, and maximum horizontal range. Central forces. Circular motion, angular velocity, angular acceleration and centripetal acceleration. Relationship between linear and angular velocity and acceleration. Centripetal and centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge. Gravitational force, Motion of satellites, Kepler's laws, Escape velocity, Geostationary satellite, Concept of Black holes, Jet propulsion theory, Motion of Multi-stage Rocket, SLV, PSLV and GSLV Rockets.
- 4. Dynamics of Rigid Body (Rotational Motion)

Rigid body, Rotational motion, Moment of inertia, Theorems (Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. of regular bodies, Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling down the slant planes.
- 5. Fluid Mechanics & Friction

Surface tension, Capillaries, Equation of continuity ($A_1V_1=A_2V_2$), Bernoulli's theorem, stream line and Turbulent flow, Reynold's number.

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Static and dynamic frictional forces. Coefficients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.
- 6. Work, Power and Energy

Work done by force on bodies moving on horizontal and inclined planes in the presence of frictional forces, Concept of power and its units. Calculation of power (simple cases). Concept of kinetic and potential energy, various forms of energy, Conservation of energy. Force constant of spring, potential energy of a stretched spring.

7. Elasticity

Elasticity, stress and strain. Hooke's law, elastic limit. Yielding point and breaking point. Modulus of elasticity Young's modulus, bulk modulus and modulus of rigidity, Poisson ratio, Resilience.

8. Simple Harmonic Motion

Periodic Motion, characteristics of simple harmonic motion; equation of S.H.M. and determination of velocity and acceleration. Graphical representation. Spring-mass system. Simple pendulum. Derivation of their periodic time. Energy conservation in S.H.M. Definition of free, forced, undamped and damped vibrations, Resonance and its sharpness, Q-factor.

9. Heat Transfer and Radiation

Modes of heat transfer, coefficient of thermal conductivity and its determination by (i) Searle's method for good conductors, and (ii) Lee's method for poor conductors. Conduction of heat through compound media, Conduction and convection, Radial flow of heat, Blackbody radiation, Stefan's law, Wien's displacement and Rayleigh-Jeans laws, Planck's Law.

10. Application of Sound Waves

Acoustics

Standing waves, Closed and Open organ pipes, Resonance, End-correction. Definition of pitch, loudness, quality and intensity of sound waves. Echo and reverberation and reverberation time. Sabine's formula. Control of reverberation time (problems on reverberation time). Acoustics of building defects and remedy.

Ultra-Sonic :

Generation, Magnetostriction, Piezoelectric effect, Application in new technology

11.A Optics

Quantum nature of light, Coherence (Spatial and temporal), Duality of wave and particle, Concept of Interference, Biprism, Fraunhofer single and N-slit diffraction, Grating, Resolving and dispersive power, Elementary concept of

polarisation.

B. Fibre Optics :

Critical angle, Total internal reflection, Principle of fibre optics, Optical fibre, Pulse dispersion in step-index fibres, Graded index fibre, Single mode fibre, Optical sensor.

12. D.C. Circuits

Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); potentiometer, Kirchoff's Law and their simple application. Principle of Carey-Foster's bridge. Electric potential, potential energy, Energy of a charged capacitor. Fleming left hand rule, torque on a current loop, Moving coil, Galvano meter. Charging/discharging of capacitors, Ballistic galvanometer, its charge sensitivity and Current sensitivity.

13. Dielectrics :

Electric dipole; effect of electric field on dielectrics, polarisation.

14. Magnetic Fields & Materials :

Dia, Para and Ferro-magnetism, Ferrites, Hysteresis, Methods of plotting, Hysteresis curve of a ferro magnetic materials and their uses, Magnetic circuits, Energy stored in magnetic fields, Basic idea of super conductivity, Meissner's effect, Applications.

15. Semiconductor Physics

Energy bands in solids, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semiconductors, Electrons and holes as charge carriers in semiconductors, Effect of temperature in conduction in semiconductors, P-type and N-type semiconductors, P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor-action, Majority and Minority charge carriers, Base, emitter and collector currents and their relationship LED's, Photo-electric effect and photo devices.

16. Nuclear physics

Radioactivity, Nuclear stability, Radioactive emission, radiation damage, Nuclear fission and fusion, Nuclear reactors (PHWR-type and fast breeder) and their application, Mass-energy relation, Atomic mass unit, Mass defect and binding energy.

17. Lasers and its Applications

Absorbtion and Emission of energy by atom, Spontaneous and Stimulated Emission, Einstein's co-efficients, Poluation inversion, Main component of laser and types of laser- Ruby Laser, He-Ne and Semi-conductor laser and their applications. Principles of Holography, Introduction to MASER.

18. Non-conventional energy sources:

- (a) Wind energy : Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill, Indian wind energy programme.
- (b) Solar energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, Solar constant measurement of solar radiation by pyrometer, and by Insolation meter (suryamapi) uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector, Solar PV plants in India, Modern applications in technology.

PHYSICS LAB

Note: Any ten experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.
2. Determination of 'Y' (Young's Modulus) by Searle's Method.
3. Determination of 'g' by plotting a graph T² verses l and using the formula $g=4\pi^2/\text{Slope of the graph line}$
4. Determination of Spring constant.
5. Determination of viscosity coefficient of a lubricant by Stoke's law.
6. Determination of 'k' for good conductor (Searle's Method).
7. Determination of frequency of AC mains by melde's methods (Transverse and Longitudinal Mode)
8. Determination of velocity of sound by resonance tube.
9. Determination of E₁/E₂ by potentiometer.
10. Determination of specific resistance by Carry Foster bridge.
11. Determination of resistivity by P.O.Box.
12. Verification of Kirchoff's Law.
13. To observe Characteristics of p-n Junction diode on oscilloscope.
14. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.
15. To measure solar intensity (determine solar constant) with the help of Insolation meter (Suryamapi).
16. Demonstration of He-Ne laser (Interferometer)
17. Determination of internal resistance by potentiometer.

NOTE :

Students should be asked to plot a graph in experiments (where possible) and graph should be used for calculation of results. Results should be given in significant figures only.

1.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L T P
3 - 2

Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge alongwith productive practice to the students of the diploma engineering. The teachers are expected to guide the students in the classroom and the laboratories according to the curriculum by demonstrations and by showing relevant materials and equipments to inculcate interests in learning among students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Atomic Structure	4	-	-
2.	Chemical Bonding	6	-	-
3.	Classification of Elements	3	-	-
4.	Instrumental Methods	4	-	-
5.	Electro Chemistry	6	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	3	-	-
8.	Solid State	3	-	-
9.	Colloids	3	-	-
10.	Lubricants	3	-	-
11.	Environmental Pollution and Control	3	-	-
12.	Water Treatment	5	-	-
13.	Corrosion	3	-	-
14.	Fuels	3	-	-
15.	Glass and Ceramics	3	-	-
16.	Streochemistry of Organic Compounds	4	-	-
17.	Organic Reactions	6	-	-
18.	Organic Materials	9	-	-
		75	-	50

DETAILED CONTENTS:

1. ATOMIC STRUCTURE :

Basic concept of atomic structure, Matter wave concept, Schrodinger wave equation, Quantum number, Haisenberg's Uncertainty Principle, Shaples of orbitals.

2. CHEMICAL BONDING :

Overview of basic concept, Hydrogen bonding, Valence bond theory, Hybridisation, VSEPR theory, Molecular orbital

theory, Co-ordination bond, Crystal field theory for tetrahedral carbon.

3. CLASSIFICATION OF ELEMENTS :

Modern classification of elements (s,p,d and f block elements), Periodic properties : Ionisation potential, electro negativity, Electron affinity, Born-Haber cycle.

4. INSTRUMENTAL METHODS :

UV-visible, IR and NMR spectroscopy, Basic principles, Beer-Lamberts Law and Application of spectroscopy.

5. ELECTRO CHEMISTRY :

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and its measurement by pH meter. Buffer solutions, Indicators, Solubility product, Common ion effect with their application, Redox reactions, Electrode potential(Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electro chemical series and its application.

Concentration cells, reference electrodes (Hydrogen electrode) cells - Primary, Secondary and Fuel cell, Laclanche's or dry cell, Acid storage cell (Lead accumulator) and Alkali storage cell (Edison accumulator), Fuel cell, Solar cell (Photovoltaic cell), Numerical problems based on topics.

6. CHEMICAL KINETICS :

Introduction, order and molecularity of reaction. Activation energy, Rate law, rate constants, 1st order reactions and 2nd order reactions.

7. CATALYSIS :

Definition Characteristics of catalytic reactions, Catalytic promoters and poison , Autocatalysis and Negative catalysis, Activation energy, Theory of catalysis, Application

8. SOLID STATE :

Types of solids (Amorphous and Crystalline), Classification (Molecular, Ionic, Covalent, Metallic), Band theory of solids (Conductors, Semiconductors and Insulators), types of Crystals, FCC, BCC, Crystal imperfection.

9. COLLOIDAL STATE OF MATTER :

Concept of colloidal and its types, Different system of colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electro dialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation. relative stability of hydrophillic and hydrophobie colloids. Protection and protective colloids. Emulsion, Types, preparation, properties and uses. Application of colloids chemistry in different industries.

10. LUBRICANTS :

Definition, classification, Necessasity and various kinds of lubricants. Function and mechanism of action of lubricants and examples. Properties of lubricants, Importance of additive compunds in lubricants, Synthetic lubricants and cutting fluids. Industrial application, its function in bearing.

11. ENVIRONMENTAL POLLUTION AND ITS CONTROL :

Concept and various types of environmental pollution with special reference to air pollution and water pollution. General measures to control environmental pollution. depletion of Ozone layer, Green house effect, Acid rain, Smog formation, Chemical and photochemical reaction, Various species in atmosphere. Specific industrial pollution like Euro-I and Euro-II.

12. WATER TREATMENT :

Concept of hard and soft water, Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Sods lime, Zeolote and Ion exchange resin process). Disadvantage of hard water in different industries, Boiler feed water boiler scale formation, Corrosion, Caustic embrittlement, priming and foarming.

Characteristics imparted by various impurities or contaminants such as colour, odour, taste and sediments and their analysis.

Analysis of Water :

- A. Estimation of chlorides in water.
- B. Determination of dissolved oxygen.

Disinfecting of Water :

By Chloramic, Ozone and Chlorination with its mechemism, Advantage and disadvantage of chlorinational, Break point chlorination (Free residual chlorination). Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Recycling of water-Theory and Process. Numerical problems based on topics.

13. CORROSION :

Concept of metallic corrosion, Types of corrosion and factors affecting the corrosion rate, Chemical and electrochemical theory of corrosion, Oxide film formation and its characteristics, tarnishing fogging and rusting, Prevention of corrosion by various methods.

14. FUELS :

Definition of fuel, its classification and their composition, Calorific value and determination of calorific value of solid and liquid fuels by Bomb calorimeter by Dulong's formula.

Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Diesel and Petrol), Benzol and Power alcohol.

Knocking, Anti-knocking agents, Octane number and Cetane number.

Cracking and its type, Gasoling from hydrogenation of coal (Bergius process and Fischer tropesch's process)

Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG, CNG and Solar energy

Numerical Problems based on topics

15. GLASS AND CERAMICS :

Concept of glass and its constituents, Classification and uses of different glass, Elementary idea of manufacturing process of glass. Introduction to ceramics materials, Its constituent. Industrial application of glass and ceramic.

16. STEREOCHEMISTRY OF ORGANIC COMPOUND:

- Isomerism
- Types of isomerism
 1. Structural isomerism
 2. Stereoisomerism (a) Geometrical (b) Optical
- Definition of chiral, achiral stereogenic centre, plane of symmetry.
- Types of stereoisomers-
 1. Conformers or Rotamers (Only ethanes)
 2. Configurational isomers
 - a. Enantiomers
 - b. Diastereoisomers

17. ORGANIC REACTIONS :
 1. Fundamental aspects -
 - A. Regents electrophiles and nucleophiles
 - B. Reaction Intermediates
 - i. Free radical
 - ii. Carbocation
 - iii. Carbanion
 - C. Various effects of substituents - Inductive, Mesomeric, Electromeric.
 - 2.A. Mechanism of addition reaction (Markonivov's Rule, Cyanohydrin and Peroxide effect),
 - B. Mechanism of Substitution reactions (Nucleophilic-hydrolysis of alkyl halide, electrophilic substitution halogenation, Sulphonation, Nitration and Friedel-Craft reaction.
 - C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehydrohalogenation of primary alkyl halide.
18. ORGANIC MATERIALS :
 - A. POLYMERS :
 1. Introduction to basic terms used in polymer chemistry and technology. Monomers, Average degree of polymerisation, Average molecular weight, Polymers, Polymerisation.
 2. Characteristics of Polymers and their classification
 - A. Addition polymers and their industrial application- Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.
 - B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.
 3. Free radical polymerisation (Mechanism)
 4. General idea of Bio polymers
 5. Brief idea of bio degradable polymers.
 6. Inorganic polymers - Silicones
 - B. SOAPS AND DETERGENTS :
 1. Introduction - A. Lipids, B. Fats and Oils
 2. Saponification of fats and oils , Manufacturing of soap.
 3. Synthetic detergents, types of detergents and its manufacturing.
 - C. EXPLOSIVES: TNT, RDX, Dynamite.
 - E. Paint and Varnish
 - F. Adhesives

LIST OF PRACTICAL

1. To analyse inorganic mixture for two acid and basic radicals from following radicals
 - A. Basic Radicals :
NH₄⁺, Pb⁺⁺, Cu⁺⁺, Bi⁺⁺⁺, Cd⁺⁺, As⁺⁺⁺, Sb⁺⁺⁺,
Sn⁺⁺, Al⁺⁺⁺, Fe⁺⁺⁺, Cr⁺⁺⁺, Mn⁺⁺, Zn⁺⁺, Co⁺⁺
Ni⁺⁺, Ba⁺⁺, Sr⁺⁺, Ca⁺⁺, Mg⁺⁺
 - B. Acid Radicals :
CO₃⁻⁻, S⁻⁻, SO₃⁻⁻, CH₃COO⁻, NO₂⁻,
NO₃⁻, Cl⁻, Br⁻, I⁻, SO₄⁻⁻
2. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.
3. To determine the total hardness of water sample in terms of CaCO₃ by EDTA titration method using E Br indicator.
4. To determine the strength of given HCl solution by NaOH solution using pH meter
5. To determine the Chloride content in supplied water sample by using Mohr's methods.
6. Determination method of temporary hard ness of water sample by O-hener's method.

1.5 ENGINEERING DRAWING

[Common to Three years Diploma Course in Civil Engg., Electrical Engg., Mechanical Engg., Dairy, Ceramic, Textile Technology, Textile Chemistry]

[Also Common to Four year Part-time Diploma Course in Electrical Engineering, Mechanical Engineering (Specialization in Production Engineering)]

[Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L T P
- - 8

Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, draftmen and craftsmen in the industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus, for the effective and efficient communication among all those involved in an industrial system, it becomes necessary that the personnel working in different capacities acquire appropriate skills in the use of this graphic language in varying degrees of proficiency in accordance with their job requirements.

Generally speaking, an engineering technician working at the middle level of the threetier technical manpower spectrum, is required to read and interpret the designs and drawings, provided to him by technologists and subsequently to translate them to the craftsmen for actual execution of the job.

This course in Engineering Drawing has been designed, keeping in view, the above referred job functions of a technician in the industry. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects. The contents of the course have been selected as to form a core for the various diversified fields of engineering. It is expected that at the end of this session, the students acquires sufficient skill drafting and some ability in spetial visualization of simple objects.

Sl.N.	Units	Coverage Time		
		L	T	P
1.	Drawing Instruents and their use	-	-	4
2.	A. Lettering techniques	-	-	8
	B. Introduction to scales	-	-	8
3.	Conventional Presentation	-	-	8
4.	Principles of projections	-	-	16
5.	Orthographic projection of simple geometrical solids	-	-	24
6.	Section of Solids	-	-	20
7.	Isomatic Projection	-	-	20
8.	Free Hand Sketching	-	-	16
9.	Development of surfaces	-	-	24
10.	Assembly and dissembly drawing	-	-	24

11.	Orthographics Projection of Machine Parts	-	-	12
12.	Practice on Auto Cad	-	-	16
				- - 200

C O N T E N T S

NOTE : Latest Indian Standards Code of Practice to be followed.

1. Drawing, instruments and their uses.
 - 1.1 Introduction to various drawing, instruments.
 - 1.2 Correct use and care of Instruments.
 - 1.3 Sizes of drawing sheets and their layouts.
2. (a) Lettering Techniques 1 Sheet

Printing of vertical and inclined, normal single stroke capital letters.

Printing of vertical and inclined normal single stroke numbers.

Stencils and their use.
- (b) Introduction to Scales 1 Sheet

Necesssity and use, R F

Types of scales used in general engineering drawing. Plane, diagonal and chord scales.
3. Conventional Presentaion : 2 Sheet

Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts.
4. (a) Principles of Projection 1 Sheet

Orthographic, Pictorial and perspective.

Concept of horizontal and vertical planes.

Difference between I and III angle projections.

Dimensconing techniques.
- (b) Projections of points, lines and planes. 1 Sheet

- 5 (a) Orthographic Projections of Simple Geometrical Solids 3 Sheet
- Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making given angles with reference planes.
- (b) Orthographic views of simple composite solids from their isometric views.
- (c) Exercises on missing surfaces and views
6. Section of Solids 1 Sheet
- Concept of sectioning
- Cases involving cutting plane parallel to one of the reference planes and perpendicular to the others.
- Cases involving cutting plane perpendicular to one of the reference planes and inclined to the others plane, true shape of the section
7. Isometric Projection. 2 Sheet
- Isometric scale
- Isometric projection of solids.
8. Free hand sketching 1 Sheet
- Use of squared paper
- Orthographic views of simple solids
- Isometric views of simple job like carpentary joints
9. Development of Surfaces 1 Sheet
- Parallel line and radial line methods of developments.
- Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).
10. Assembly and Disassembly Drawings 2 Sheet
- Plummer block
- Footstep bearings
- Couplings etc.
- Rivetted & Welded Joints

11. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet

Nut and Bolt, Locking device, Wall bracket

12. PRACTICE ON AUTO CAD :

To draw geometrical figures using line, circle, arc, polygon, ellipse, rectangle - erase and other editing commands and osnap commands (two dimensional drawing only)

NOTE :

The drawing should include dimension with tolerance wherever necessary, material list according to I.S. code. 25% of the drawing sheet should be drawn in first angle projection and rest 75% drawing sheet should be in third angle figure

1.6 APPLIED MECHANICS

[Common to three years Diploma Course in Civil Engg., Agriculture, Dairy, Ceramic, Civil & Rural Engg., Chemical Engineering, Architecture Assistantship, Computer Engineering]

[Also Common to Four year Part-time Diploma Course in Mechanical Engineering (Specialization In Production Engineering)]

[Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L T P
2 2/2 2/2

RATIONALE

The subject Applied Mechanics deals with fundamental concepts of mechanics which are useful for the students for further understanding of the second & final year subjects like S.O.M. and theory and design of steel & masonry structures as well as RCC designs. The subject enhances the method ability of the students.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.No.	Topic	L	T	P
1.	Introduction	2		
2.	Force Analysis	8	4	
3.	Moment and Couple	4	2	
4.	General condition of equilibrium	4	3	
5.	Friction	6	3	
6.	Machines	6	3	
7.	Stress & Strain	8	4	
8.	Beam & Trusses	6	3	
9.	Thin cylindrical & spherical shells	6	3	
Total		50	25	25

DETAILED CONTENTS

1. Introduction:

Mechanics and its utility. Concept of scalar and vector quantities. Effect of a force. Tension & compression. Rigid body. Principle of physical independence of force. Principle of transmissibility of a force.

2. System of Forces :

Concept of coplaner and non-coplaner forces including

parallel forces. Concurrent and non-concurrent forces. Resultant force. Equilibrium of forces. Law of parallelogram of forces. Law of triangle of forces and its converse. Law of polygon of forces. Solution of simple engineering problems by analytical and graphical methods such as simple wall crane, jib crane and other structures. Determination of resultant of any number of forces in one plane acting upon a particle, conditions of equilibrium of coplaner concurrent force system.

3. Moment & couple:

Concept of Varignon's theorem. Generalised theorem of moments. Application to simple problems on levers-Bell crank lever, compound lever, steel yard, beams and wheels, lever safety valve, wireless mast, moment of a couple; Properties of a couple; Simple applied problems such as pulley and shaft.

4. General Condition of Equilibrium:

General condition of equilibrium of a rigid body under the action of coplaner forces, statement of force law of equilibrium, moment law of equilibrium, application of above on body.

5. Friction:

Types of friction:statical,limiting and dynamical friction, statement of laws of sliding friction, Coefficient of friction, angle of friction; problems on equilibrium of a body resting on a rough inclined plane, simple problems on friction. Conditions of sliding and toppling.

6. Machines:

Definition of a machine. Mechanical advantage, velocity ratio, input, output, mechanical efficiency and relation between them for ideal and actual machines. Law of a machine Lifting machines such as levers, single pulley, three system of pulleys. Weston differential pulley, simple wheel and axle, differential wheel and axle. Simple screw jack, differential screw jack, simple worm and worm wheel.

7. Stresses and strains:

Concept of stress and strain. Concept of various types of stresses and strains. Definitions of tension, compression shear, bending, torsion. Concept of volumetric and lateral strains, Poisson's ratio. Changes in dimensions and volume of a bar under direct load (axial and along all the three axes). Ultimate stress, working stress. Elasticity, Hook's law, load deformation diagram for mild steel and cast iron. Definition of modulus of elasticity, yield point, modulus of rigidity and bulk Modulus. Stresses and strains for homogeneous materials and composite sections.

8. Beams & Trusses:

Definition of statically determinate and indeterminate trusses. Types of supports. Concept of tie & strut, Bow's notation, space diagram, polar diagram, funicular polygon; calculation of reaction at the support of cantilever and simply supported beams and trusses graphically and analytically; graphical solution of simple determinate trusses with reference to force diagram for determining the magnitude and nature of forces in its various members. Analytical methods: method of joints and method of sections.(simple problems only)

9. Thin cylindrical and spherical shells:

Differentiation between thick and thin shells, cylindrical and spherical shells, thin spherical and cylindrical shells subjected to internal pressure, longitudinal stresses, circumferential or hoop stresses. longitudinal, circumferential and volumetric strains. Changes in the dimensions and volume of a thin shell subjected to internal fluid pressure.

Applied Mechanics Lab : Practicals

1. To verify the law of Polygon of forces.
2. To verify the law of parallelogram and triangle of forces.
3. To verify the law of principle of moments.
4. To find the coefficient of friction between wood, steel, copper and glass.
5. To find the reaction at supports of a simply supported beam carrying point loads only.
6. To find the forces in the jib & tie of a jib crane
7. To find the forces in the members of a loaded roof truss.
(King / Queen post truss)
8. To find the mechanical advantage, velocity ratio and efficiency of any three of the following machines:
 - (i) Simple wheel & axle
 - (ii) Differential wheel & axle
 - (iii) Differential pulley block
 - (iv) Simple Screw jack
 - (v) Simple Worm & worm wheel
 - (vi) System of Pulleys (any type).

1.7 MECHANICAL OPERATION AND SOLID HANDLING

[Common to Chemical Technology (Fertilizer), Chemical Engineering (Petrochemical)]

L T P
2 1 2

Rationale:

Solid handling is the fundamental of different machine and equipments used in the chemical industries such as grinding, crushing, ball mills etc. chain belts and screw conveyor, filtration & mixing equipments. Theoretical and experimental work will indicate their interest in learning and teaching among the students and teachers.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	6	3	-
2.	Characterisation of Solid Particles	6	3	-
3.	Size Reducation	8	4	-
4.	Fluidization of Solid Particles	10	5	-
5.	Mechanical Separation	10	5	-
6.	Mixing Equipments	10	5	-
		50	25	50

DETAILED CONTENTS

1. INTRODUCTION:

Concept and role of unit operation in Industries.

2. CHARACTERISATION OF SOLID PARTICLES:

Characterisation of solid particles, screening equipments, standard screens, screen analysis, Grizzlies, trommels.

3. SIZE REDUCTION:

Theory of crushing, Rittinger's law, Kick's law, Crushing and grinding machinery; their classification, general description of jaw crusher, gyratory crusher, roll crusher, hammer mills, ball mills, open circuit and closed circuit Systems.

4. FLUIDIZATION OF SOLIDS PARTICLES:

Conveying equipments, their classification general construction and industrial application, Belt conveyors, chain conveyors and screw conveyors.

5. MECHANICAL SEPARATIONS:

(i) Types of filtration equipment, their application and operation, sand filters, filter press, leaf filters, rotary filters, filter aids. Centrifugal filtration.

(ii) Classifiers.

(iii)Thickener

(iv) Cyclones.

6. MIXING EQUIPMENTS:

Mixing equipments used for liquid-liquid, liquid-solid and liquid-gas system.

MECHANICAL OPERATION AND SOLID HANDLING LAB

1. To draw a layout of Chemical Engineering lab.
2. To analyse the given sample on a set of screens and report the analysis.
3. To determine the critical speed of a ball mill.
4. To determine the efficiency of disintegrator.
5. To determine filtration constant by a plate and frame filter press.
6. To determine the rate of settling of slurries of various concentration draw a height VS time curve.
7. To determine the efficiency of Jaw crusher.
8. To study and sketch a Rotary filter.

1.8-MEASURING INSTRUMENTS AND MEASUREMENTS

[Common to Three year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L T P
2 2/2 -

Rationale:

The curriculum of measuring instruments and measurements deals with various measuring instruments like pressure and vacuum gauges, thermometers, pyrometers, orifice, venturimeters, rotameters etc. The students will be well aware of use of these instruments which will inculcate their knowledge.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction and Classification of Instruments.	10	5	-
2.	Pressure and Vacuum gauges	10	5	-
3.	Thermometers and Pyrometers	10	5	-
4.	Flow meters	10	5	-
5.	Liquid level meters	10	5	-
		50	25	-

DETAILED CONTENTS

1. INTRODUCTION & CLASSIFICATION OF INSTRUMENTS:

Importance of instruments in chemical process industries. General classification of industrial instruments. Indicating and recording type of instruments. Static & Dynamic characteristics of instruments. Description and constructional details, working principle, ranges and application of following instruments.

2. PRESSURE AND VACUUM GAUGES:

Liquid column gauges, Bourdan tube gauge, Melleod gauge, Ionization and thermal conductivity meters.

3. THERMO METERS AND PYROMETERS:

Bimetallic thermometers, liquid expansion thermometers, thermocouples, resistance thermometers, optical and radiation pyrometers.

4. FLOW METERS:

Orifice, venturi and nozzle type flow meters, pitot tube, rotameters positive displacement type flow meters.

5. LIQUID LEVEL METERS:

Visual indicators, Float actuated level meters, static pressure type instruments. The bubbler system, diaphragm box and air trap system. Electrical contact type liquid level indicators.

1.9 WORKSHOP PRACTICE

[Common with Civil Engg., Civil Engg. (sp. in Rural Engg.), Electrical, Ceramic, Dairy, Agriculture, Chemical Technology (Rubber & Plastic), Chemical Technology (fertilizer), Four year chemical Engg.]

[Four year Part time Mechanical Engg. (sp. in Production Engg.)]

L	T	P
-	-	8

Rationale

A diploma holder in any branch of engineering has to work in between a skilled workman and an Engineer. In order to have effective control over skilled workmen it is necessary that the supervisory staff must have adequate knowledge and skill. For development of skills workshop practice is very essential.

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Carpentry shop	-	-	24
2.	Painting & polishing shop	-	-	16
3.	Sheet metal and soldering shop	-	-	24
4.	Fitting shop	-	-	24
5 A.	Plumbing shop	-	-	16
5 B.	Foundry shop	-	-	20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
9.	Fastening Shop	-	-	12
		-	-	200

DETAILED CONTENTS

1. Carpentery Shop :
 - EX-1 Introduction & demonstration of tools used in carpentry shop
 - EX-2 Planing and sawing practice
 - EX-3 Making of lap joint
 - EX-4 Making of mortise and tenon joint
 - Ex-5 Making of bridle joint
 - EX-6 Making of dovetail joint
 - Ex-7 Making of any one utility article such as wooden-picture frame, hanger, peg, name plate, etc.

2. Painting and Polishing Shop:
 - EX-1 To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other

- side.
- Ex-2 To prepare metal surface for painting, apply primer and paint the same.
 - EX-3 To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.
 - * EX-4 Buffing and abrasive polishing of brass job.
 - Ex-5 Zinc coating by electroplating method.
 - Ex-6 To prepare any utility job.
- * The sequence of polishing will be as below:
- i) Abrasive cutting by leather wheel.
 - ii) Polishing with hard cotton wheel and with polishing material.
 - iii) Buffing with cotton wheel or buff wheel.
3. Sheet Metal Working and Soldering Shop :
- EX-1 Introduction & demonstration of tools used in Sheet metal working shop.
 - EX-2 Cutting, shearing and bending of sheet.
 - EX-3 To prepare a soap case by the metal sheet.
 - EX-4 To make a funnel with thin sheet and to solder the seam of the same.
 - EX-5 To make a cylinder and to solder the same.
 - EX-6 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired joints.
 - EX-7 Study and sketch of various types of stakes/anvil.
 - EX-8 To braze small tube/conduit joints.
4. Fitting Shop :
- EX-1 Introduction & demonstration of tools used in Fitting Shop.
 - EX-2 Hacksawing and chipping of M.S. flat.
 - EX-3 Filing and squaring of chipped M.S. job.
 - EX-4 Filing on square or rectangular M.S. piece.
 - EX-5 Making bolt & nut by tap and die set.
 - Ex-6 To drill a hole in M.S. Plate and tapping the same to create threads as per need.
 - EX-7 Utility article-to prepare a screw driver or paper weight, double open mouth spanner for 18" hexagonal head of a bolt.
- 5 A. Plumbing Shop :
- EX-1 Cutting and threading practice for using socket, elbow and tee etc. and to fit it on wooden practice board.
 - EX-2 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc.
- 5 B. Foundry Work
- Ex-1 Study & sketch of the foundry tools.
 - Ex-2 Study & sketch of cupola & pit furnace.
 - Ex-3 To prepare the green moulding sand and to prepare moulds (single piece and double piece pattern sweep

- mould)
- Ex-4 Casting of non ferrous (lead or aluminium) as per exercise 3.
6. Smithy Shop :
- EX-1 Study & Sketch of Tools used in smithy shop.
- EX-1 To prepare square or rectangular piece by the M.S. rod.
- EX-2 To braze M.S. Flats/Tipped tools on M.S. shank.
- EX-3 To make a screw driver with metallic handle.
- EX-4 To make a square or hexagonalhead bolt.
- EX-5 To make a ring with hook for wooden doors.
- EX-6 Utility article-to preapre a ceiling fan hook.
7. Welding Shop :
- EX-1 Welding practice-gas and electric.
- EX-2 Welding for lap joint after preparing the edge.
- EX-3 Welding of Butt joint after preparation of the edge.
- EX-4 'T' joint welding after preparation of edge.
- EX-5 Spot welding, by spot welding machine.
- EX-6 Welding of plastic pieces by hot strip method.
- EX-7 Welding practice by CO2 gas welding
8. Machine Shop
- EX-1 Study & sketch of lathe machine.
- Ex-2 Plain and step turning & knurling practice.
- Ex-3 Study and sketch of planning/Shaping machine and to plane a Ractangle of cast iron.
9. Fastening Shop
- EX-1 Practice of bolted joints
- EX-2 To prepare a rivetted joint
- EX-3 To make a pipe joint
- EX-4 To make a threaded joint
- EX-5 Practice of sleeve joint

2.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L	T	P
3	1	-

Rationale :

The study of mathematics is an important requirement for the understanding and development of concepts of Engg. The purpose of teaching mathematics to the Diploma Engg. students is to give them basic foundation and understanding of mathematics so that they can use the same for the understanding of engineering subjects and their advancements.

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Matrices	15	5	-
2.	Ordinary Differential Equations	15	5	-
3.	Differential Calculus-II	15	5	-
4.	Integral Calculus-II	15	5	-
5.	Probability & Statistics	15	5	-
		75	25	-

DETAILED CONTENTS

1. MATRICES :

1.1 Algebra of Matrices, Inverse :

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Determinant of a matrix, Cofactors, Definition and Computation of inverse of a matrix.

1.2 Elementary Row/Column Transformation :

Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence, Rank of a Matrix :

Linear dependence/independence of vectors, Definition and computation of a rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.

1.4 Types of Matrices :

Symmetric, Skew symmetric, Hermitian, Skew hermitian, Orthogonal, Unitary, diagonal and Triangular.

1.5 Eigen Pairs, Cayley-Hamilton Theorem :

Definition and evaluation of eigen values and eigen vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

2. ORDINARY DIFFERENTIAL EQUATION :

2.1 Formation, Order, Degree, Types, Solution :

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree and Meaning of solution of a differential equation, Linear, Nonlinear equation.

2.2 First Order Equations :

Variable separable, equations reducible to separable forms, Linear and Bernoulli form exact equation and their solutions.

2.3 Second Order Linear Equation :

Property of solution, Linear equation with constant coefficients, Cauchy type equation. Homogeneous and Non-homogeneous equations, equations reducible to linear form with constant coefficients.

2.4 Simple Applications :

LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

3. DIFFERENTIAL CALCULUS-II :

3.1 Function of two variables, identification of surfaces in space

$$z = \sqrt{x^2 + y^2}, \quad x^2 + y^2 = a^2, \quad x + y = z$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

3.2 Partial Derivatives :

Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians.

3.3 Vector Calculus :

Vector function, derivatives, gradient, divergence and curl

Some identities among these. Five integrals, double and triple integral, surface integral, Green, Gauss and Stokes theorem and application

4. INTEGRAL CALCULUS - II

4.1 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, Solution of ordinary differential equations.

4.2 Beta and Gamma Functions :

Definition, Use, Relation between the two, their use in evaluating integrals.

4.3 Fourier Series :

Fourier series of $f(x)$ - $a < x < b$, Odd and even function, Meaning of the sum of the series at various points.

5. PROBABILITY AND STATISTICS :

5.1 Probability :

Laws and Conditional probability

5.2 Distribution :

Discrete and continuous distribution.

5.3 Binomial Distribution :

Properties and application through problems.

5.4 Poisson Distribution :

Properties and application through problems

5.5 Normal Distribution :

Properties and applications through problems

5.6 Method of Least-square.

2.2-PROCESS PLANT UTILITIES

L T P
3 1 -

Rationale:

Air, water and steam are principal plant utilities in any chemical process. Detailed knowledge concerning these utilities will enable the supervisor on chemical shop floor to run the various process equipment efficiently.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Generation, Process & Steam Properties	12	5	--
2.	Types of fuels used in boilers	4	1	--
3.	Steam Generator.	8	2	--
4.	Steam Distribution	8	2	--
5.	Pressure & Vaccum system	8	4	--
6.	Water	8	2	--
7.	Water Treatment Technique	9	3	--
8.	Demmiralization	9	3	--
9.	Cooling Water	9	3	--
Total		75	25	--

DETAILED CONTENTS

1. GENERATION, PROCESS & STEAM PROPERTIES :

Generations of steam at constant pressure, phases of transformation. Pressure-temperature, curve for steam. Latent Heat-external work of evaporation, Sensible heat of water, dry & saturated steam. Dryness fraction, Latent heat of wet steam, detail of wet steam, total heat of super-heated steam, specific volume of wet & super-heated steam. Simple problems using steam-table,

2. TYPES OF FULES USED IN BOILERS :

Types of fuels used in boilers, Coal, Fuel Oil, Rice husk, Natural gas, etc. produced/forced draught concept.

3. STEAM GENERATOR:

Type of steam generators (boilers)-Fire tube & water tube and their principles. Elementry concept and principles of modern water tube boilers. Boiler mountings and accessories. Quantity of heat spent in generation. Ideal cycle of a steam plant. Ways of increasing the efficiency to steam

power plant (No numerical question).

4. STEAM DISTRIBUTION:

Pipe quality, lay out of piping, steam trap, pressure reducing station : Steam ejectors.

5. PRESSURE & VACCUM SYSTEM:

COstruction and working of Blowers, Fan, Compressures, Vaccum Pump, Steam Ejectors.

6. WATER :

Different water resources, storage, quality parameters like hardness, suspended solids, turbidity, etc.

7. WATER TREATMENT TECHNIQUES

Water treatments techniques, Flow diagram, Coagulation by Iron compounds like Alum, sedimentation, filtration, Softened by Sodium Carbonate and Bi-carbonate.

8. DEMINERALIZATION :

Demmiralization flow diagram, Cation and Anion exchangers milded bed, Regeneration of cation and anion exchangers and degasor.

9. COOLING WATER :

Recycling of water, Cooling towers, Principals, details and problems like sealing use of inhibitors, like sodium and chromates.

2.3 ELECTRICAL TECHNOLOGY & ELECTRONICS

(Common with Diploma in Mech., Dairy Engg.)

L	T	P
3	1	2

Rationale :

The superiority of electricity as power over other means in use in home or industry can not be denied. So it is imperative to introduce the mechanical engineering students with electrical machines and their various uses.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Electric Induction	2	1	-
2.	A. C. Theory	4	2	-
3.	Three Phase Circuits	8	3	-
4.	Measurement & Measuring Instruments	14	3	-
5.	Electronics	8	3	-
6.	D. C. Machines	6	2	-
7.	Transformers	8	3	-
8.	Synchronous Machines	8	2	-
9.	Induction Motors	6	2	-
10.	Electro Heating	6	2	-
11.	Electro Plating	5	2	-
		75	25	50

1. ELECTRIC INDUCTION:

Faraday's Laws of electromagnetic induction. Self and mutual induction. Statically and Dynamically induced e.m.f., Lenz's law. Fleming's left hand and right hand rule.

2. A. C. THEORY:

Production of alternating e.m.f. Definition of cycle, Frequency, Amplitude, Time period, Instantaneous, Average, R.M.S. maximum values of sinusoidal wave. Form factor, peak factor.

Representation of a sinusoidal quantity by a mathematical expression and phasor, phase and phase difference, Relationship of voltage and current for pure resistance, pure inductance and pure capacitive reactance, impedance. Solution and phasor diagrams of simple R.L.C. series and

parallel circuits. Active and reactive power. Significance of P.F.

3. THREE PHASE CIRCUITS:

Production of Three phase voltage, advantages of three phase supply. Concept of star and delta connections. Relationship between phase and line values of currents and voltages, Power in three phase circuits, simple numerical problems.

4. MEASUREMENT & MEASURING INSTRUMENTS:

(i) Primary and secondary instruments-Indicating, Recording and Integrated instruments.

(ii) Working principle and construction of the following instruments.

(a) Ammeter & Voltmeter (Moving coil & Moving Iron).
Extension of their ranges.

(b) Dynamometer type wattmeter.

(c) Single Phase A. C. Energy Meter.

(iii) Measurement of power in a single phase and three phase circuits by wattmeter, Use of digital multimeter for measurement of voltage, Current and testing of devices.

5. ELECTRONICS:

Basic idea of semi conductors P & N type. Semi conductor diodes, Zener diodes and their applications in rectifiers. Transistors-PNP and NPN-their characteristics and uses as an amplifier (Brief description only). Principle characteristics and application of SCR. Devices like UJT, FET, DIAC, TRIAC (Brief introduction, Introduction to operational amplifier, Introduction to basic logic gates and microprocessors.

6. D. C. MACHINES:

D. C. Generator:

Working principle, Constructional details, e.m.f. equation, Types of generators and their applications.

D. C. Motor:

Working principle, Back e.m.f., Types of D. C. motor and elementary idea of their characteristics. Torque equation, Methods of speed control (Description Only).

7. TRANSFORMERS:

Working principle and constructional details of a single phase and 3 phase transformers, e.m.f. equation, Losses and efficiency, Cooling of transformers, Elementary idea of auto transformers and welding transformers.

8. SYNCHRONOUS MACHINES:

(a) Alternators:

Working principle, Types of alternators, Constructional details, E.M.F. equation, Condition for parallel operation.

(b) Synchronous Motors:

Working principle, Constructional details, Vector diagram, Effect of excitation on armature current and power factor, Synchronous condenser.

9. INDUCTION MOTORS:

(a) Three Phase Induction Motors:

Working principle and constructional details-Types of induction motors-Slipring and Squirrel cage. Slip in induction motors. Speed torque characteristic, Starting and speed control. Application of induction motors in industry. General faults and their remedies.

(b) Single Phase Induction Motors:

Working principle and constructional details and application of single phase motors (Split phase, Capacitor start and Run Motor). A. C. series motors, General faults and their remedies.

10. ELECTRO HEATING:

Types of electro heating. Brief description of resistance ovens and induction furnace and core furnaces.

11. ELECTROPLATING:

Importance of electroplating, Principle of electroplating and equipment used. Processes used in electroplating, Anodising.

ELECTRICAL TECHNOLOGY & ELECTRONICS LAB

1. To change the speed and direction of rotation of d.c. shunt motor by
 - (a) Armature control method.
 - (b) Field control method.
2. To change the speed and direction of rotation of d.c. compound motor by
 - (a) Armature control method.
 - (b) Field control method.
3. To measure the terminal voltage with variation of load current of
 - (a) D.C. shunt generator.
 - (b) D.C. compound generator.
4. To perform load test on a single phase transformer and determine its efficiency.
5. To start and run a induction motor by
 - (a) Star Delta Starter.
 - (b) Auto Transformer Starter.
6. To measure slip of an induction motor by direct loading.
7. To start and change the direction of rotation of an induction motor.
8. To measure transformation ratio of a single phase transformer.
9. To measure power and P.F. in a single phase circuit by Ammeter, Voltmeter and Wattmeter.
10. To measure power and P.F. in a 3 phase/A.C. circuit by two wattmeter method.
11. To calibrate a single phase energy meter at different P.F.'s and different loads.
12. To locate the faults in an electrical machine by a megger.
13. To connect a fluorescent tube and note its starting and running current.
14. To draw characteristics of Silicon Controlled Rectifier (SCR).
15. Testing of electrical devices - Zenor, Diode, Transistor, FET, UJT, SCR.
16. Use of operational amplifier as adder, subtractor, comparator, differentiator and integrators.

2.4-FUEL & MATERIAL TECHNOLOGY

L T P
3 1 -

Rationale:

The student of chemical engineering has to deal with various types of fuels and materials. The fuels generally used are solid liquid and gaseous. Their properties advantages and disadvantages are included in the curriculum. Materials like Ferrous Metals, Plastics and Refractories are commonly in use in chemical plants. The student will enhance their knowledge in the field of fuel and material technologies related to chemical industries.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
PART-A : FUEL TECHNOLOGY				
1.	Introduction	5	2	-
2.	Solid Fuels	10	3	-
3.	Liquid Fuels	10	3	-
4.	Gaseous Fuels	8	2	-
5.	Combustion Calculation	8	2	-
PART-B : MATERIAL TECHNOLOGY				
1.	Introduction	5	2	-
2.	Ferrous Materials	7	2	-
3.	Other Materials	8	3	-
4.	Heat Treatment	7	3	-
5.	Corrosion	7	3	-
Total		75	25	-

DETAILED CONTENTS

PART-A : FUEL TECHNOLOGY

1. INTRODUCTION

Introduction of various Solid, Liquid and Gaseous fuels.

2. SOLID FUELS:

Wood, Charcol, Coal (Peat, Lignite, Bituminous and Anthracite) and Coke . Calorific value Definition and experimental determenation by bomb callorimeter and calculations. Washing of coal, Purpose of washing, Principle description and operation of Jigs and washers, Carbonization

(Low temperature and High temperature).

3. LIQUID FUELS:

(i) Fuel Oil, Gasoline, Desel Fules, Kerosine.

(ii) Properties (Density, Viscosity, Flash & fire Point, Octane no, Cetane no. & Ignition delay).

(iii Advantages and disadvantages of liquid fuels.

4. GASEOUS FUELS:

Natural Gas, LPG -Advantages and disavantages of gaseous fuels.

5. COMBUSTION CALCULATION:

Calculation of percentage of products of combustion, numerical Quostions.

PART-B : MATERIAL TECHNOLOGY

1. INTRODUCTION:

Factors affecting the selection of material for construction purposes in chemical industries, structure of solid phase, different types of structures BCC, HCC, FCC. Various modes of deformations-crystal defects.

2. FERROUS MATERIALS:

Cast Iron, Plain Carbon Steel, Low Alloy Steel, High Alloy Steel.

3. OTHER MATERIALS:

A. Introduction of non ferrous material, copper, Brass, Bronze, Aluminiumium,

B. Non-metallic materials of construction

(a) Ceramics- Various types specially glasses & refractories, properties and application.

(b) Polymers - Classification, comparision of properties of various polymers and their applications.

4. HEAT TREATMENT:

Various types of heat treatment like anealing, hardening, edge hardening and cold work of metals.

5. CORROSION:

Electro chemical theory of corrosion, Various types of corrosion, Various method of corrosion control.

2.5. CHEMICAL TECHNOLOGY

L T P
3 1 6

Rationale:

A comprehensive study of the following chemical industries involving process technology, availability of raw materials, production trend, preparation of flow sheet, engineering problems involving material of construction and uses.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Industrial Gases	8	3	
2.	Fertilizer Industries	8	3	
3.	Chlor-Alkali Industries	8	2	
4.	Sulphur Industries	3	1	
5.	Cement Industries	3	1	
6.	Description of various unit process	3	1	
7.	Process Industries	-	-	
A.	Petroleum Refining	6	2	
B.	Suger Industries	6	2	
C.	Fermentation Industries	6	2	
D.	Soap & Detergent Industries	6	2	
E.	Pulp & Paper	6	2	
F.	Polymer Industry	12	4	
		75	25	150

DETAILED CONTENTS

1. INDUSTRIAL GASES :
 Manufacture and uses of Oxygen, Hydrogen, Nitrogen, Carbon Dioxide.
2. FERTILIZER INDUSTRIES :
 Ammonia, Nitric acid, Ammonium Sulphate, Urea, Ammonium Nitrate, Phosphorus, Phosphoric Acid, Calcium Phosphates-Super Phosphates, Triple Super Phosphate, Nitro Phosphate, N-P-K fertilizer.
3. CHLOR-ALKALI INDUSTRIES :
 Common Salt, Caustic Soda, Chlorine, Hydrochloric Acid, Soda-Ash, Bleaching Powder.
4. SULPHUR INDUSTRIES :
 Manufacture of Sulphuric acid, Oleum.

5. CEMENT INDUSTRIES :
 - Manufacture of Portland Cement.

6. DESCRIPTION OF VARIOUS UNITS PROCESS
 - General description of unit processes involved in following compounds given in the brackets.
 - Alkylation -(toluene)
 - Halogenation -(Chlorobenzene, D.D.T., Benzene Hexa Chloride)
 - Nitration -(Nitrobenzene)
 - Amination -(Aniline)
 - Diazotization (Benzene diazonium Chloride)
 - Sulphonation -(Benzene sulphonic acid)
 - Hydroxy benzene -(Phenol)

7. PROCESS INDUSTRIES
 - A. Petroleum Refining :
 - Constituent of petrolium including petrolium gases, products of refining, distillation- atmospharic distillation unit and vaccum distillation unit.

 - B. Suger Industry :
 - Manufacture of cane suger.

 - C. FERMENTATION INDUSTRY :
 - Industrial alcohol, manufacture of industrial alcohol-, Beers, Wines & Liquors.

 - D. SOAP & DETERGENTS INDUSTRY :
 - Manufacturing of soap, glycerine as by products from soap manufacturing Detergents, Detergents raw material and manufacturing of detergents. House disinfectant (Phynyle).

 - E. PULP AND PAPER INDUSTRY:
 - Sulfite & ground wood pulp for paper manufacture of paper, specially paper.

 - F. POLYMER INDUSTRY :
 - Types of polymer, Polymerization Process, Manufacture of Polyethylene, Styrene Nylon 6, Nylon 66

CHEMICAL TECHNOLOGY LAB.

1. Purification of potash-alum, sodium chloride by crystallization method.
2. Preparation of ferrous Ammonium Sulphate, lead chromate.
3. Preparation of Alum
4. Preparation of Phenyl (domestic disinfectant).
5. Preparation of Soap.
6. Preparation of Detergent/liquid detergent.
7. Atmospheric distillation of Petroleum Fraction.
8. Manufacture of Nitrocellulose Thinner

2.6-MATERIAL ENERGY BALANCE

L	T	P
3	1	-

Rationale:

The subject deals with the different units such as S. I. units and their conversion, behaviour of ideal gas, Dalton and Amgat's law, humidity and saturation, material balances, crystalization, evaporation, drying, chemical reactions. Different forms of energy like exothermic and endothermic. The students of chemical engineering will enhance their knowledge in this field.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Scope	2	-	-
2.	Dimension, Units	8	3	-
3.	Stricheometric relationship	8	3	-
4.	Behaviour of Ideal Gases	8	2	-
5.	Humidity and saturation	12	4	-
6.	Material balance	12	4	-
7.	Combustion processes			
	(A) Analysis of product	3	1	-
	(B) Problems on fuel analysis	3	1	-
	(C) Problems on fuel gas analysis.	3	1	-
	(D) Oxidation of sulphur	4	2	-
8.	Energy Balance	12	4	-
Total		75	25	-

DETAILED CONTENTS

1. Scope of material & energy balance in process industries.
2. (a) Dimensions, Units and their conversion factors, S.I units, mole unit, Concept of gm mole, gm atom
Use of gravitational conversion factor gc.

Problems relating conversion of one set of units in a function of equation into another equivalent set for mass, length, time, temperature, area, volume, pressure, energy and force of an expression for heat capacity from one set of units to another.

- (b) Density & specific gravity, mole fraction (or percent) mass fraction (or percent). conversion of the composition of a mixture from mole fraction (or percent) to mass(wt.) fraction (or percent) and reverse.

Transform a material from one measure of concentration

to another, including mass/volume, moles/volume, PPM, molality, normality and molarity.

3. THE CHEMICAL EQUATION AND STICHEOMETRY :

Definition of excess and limiting reactant, conversion, degree of completion and yield in a reaction. Relating problems. Identification of limiting and excess reactant and calculation of percent excess reactant, the percent conversion, Degree of completion of reaction, Yield for a chemical reaction with reactants being in nonstoichiometric proportion.

4. BEHAVIOUR OF IDEAL GASES :

P V T relationship, standard conditions, partial pressure and pure component volume. Dalton's and Amagat's laws, average molecular weights of a gaseous mixture. Problems relating calculation of composition, average molecular weight, density and molar density, concentration of a gaseous mixture.

5. HUMIDITY & SATURATION : (Definitions Only)

Vapour pressure, Raoult's law, Saturation & partial saturation, relative saturation (humidity), absolute saturation (humidity) and percent saturation (humidity), humid volume, humid heat, dry bulb & wet bulb temperature, Dew point, Use of humidity chart.

6. MATERIAL BALANCE :

Tie substance, by pass streams, recycle and purge, simple problems relating various chemical reactions and without chemical reactions.

7. COMBUSTION PROCESS:

(a) Analysis of products of combustions :- Proximate and ultimate analysis.

(b) Problems of fuel analysis, Air-fuel ratio, Theoretical oxygen/air required.

(c) Problems on flue gas analysis .

(d) Oxidation of sulphur and its compounds.

8. ENERGY BALANCE :

Forms of Energy, Definition of

(i) Exothermic and endothermic reaction.

(ii) Standard heat of reaction.

(iii) Heat of combustion.

- (iv) Heat of formation.
- (v) Heat capacity & mean heat capacity.
- (vi) Net and gross heating value (LHV & HHV).

Calculation of:

- (i) Enthalpy changes (without change of phases).
- (ii) Standard heat of reaction from heat of formation and combustion data.
- (iii) Heat of formation and combustion from combination of heat of reactions at reference temperature. (250 c).
- (iv) Heat of reaction at constant pressure or constant volume.
- (v) Heat of reaction at a temperature different from standard conditions i.e. 250 c (when reactant & products are not at 250 c).

2.7-FLUID MECHANICS

L	T	P
3	1	4

Rationale:

The subject will enhance the knowledge of students about fluids and their properties like shear, laminar, turbulent, continuity equation, friction losses and other properties of incompressible fluids. Time of emptying a tank, transportation of fluids and measurement of flowing liquids. Theoretical and experimental work will inculcate their interest in learning and teaching among the students and teachers.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Fluids	10	4	-
2.	Flow of incompressible fluids	20	6	-
3.	Measurement of flowing fluids	20	6	-
4.	Pipe and Pipe Fittings	10	4	-
5.	Transportation of fluids	15	5	-
Total		75	25	100

DETAILED CONTENTS

PART - A

1. FLUIDS

- (i) Properties
- (ii) Classification of Fluids.
- (iii) Fluid manometers, description and simple numerical problems.

2. FLOW OF INCOMPRESSIBLE FLUIDS:

- (i) Shear stress distribution in a cylindrical tube, velocity distribution for Newtonian fluid.
- (ii) Reynold No. Elementary knowledge of laminar and turbulent flow, Reynold experiment.
- (iii) Continuity equations, Bernoulli's theorem, fluid heads and power requirement calculation.
- (iv) Friction factor, Fanning equation and Hagen Poiseuille equation friction losses in pipes, calculation of friction loss due to enlargement, contraction, fittings and valves.
- (v) N.P.S.H., cavitation, pipes, tubing, fittings & (Valves numerical problems)

3. MEASUREMENT OF FLOWING FLUIDS:

Orifice meter, venturimeter, pitot tube, rotameter, weirs and notches (Their construction and derivation of formulae simple numerical problems, Definition:-Coefficient of contraction, Coefficient of velocity, coefficient of discharge (Simple numerical problems).

4. PIPE AND PIPE FITTINGS :

Tupes. Pipes, Schedule Number, Difference between tube and pipes, Various type of valves (Gate, Close, Check, Pressure Reducing valve, Steam Traps, etc). Pipe fittings (Flange, Socket, Albow, Tees, Star, etc.).

5. TRANSPORTATION OF FLUIDS:

A. Classification of pumps, construction and operation of Air lift, reciprocating, rotary, centrifugal and gear pumps.

B. NPHS, Cavitation, Simples numerical problems.

FLUID MECHANICS LAB

1. To determine the co-efficient of discharge of orifice-meter.
2. To determine the co-efficient of discharge of venturimeter.
3. To determine the co-efficient of discharge of V-Notches.
4. To determine the co-efficient of discharge of Rectangular Notches.
5. To determine coefficient of velocity (C_v), coefficient of discharge (C_d), coefficient of contraction (C_c) and verify the relation between them.
6. To determine friction losses in pipes and fittings.
7. To verify loss of head due to
 - (a) Sudden Enlargement.
 - (b) Sudden Contraction.
8. To verify Bernoullie's Theorem .
9. To perform Reynold's experiments.
10. To determine the efficiency of a centrifugal pump.
11. Study the following.
 - (a) Reciprocating Pump.
 - (b) Pressure Gauge/Water Meter/Mechanical Flow Meter/Pitot Tube.

2.8-CHEMICAL ENGINEERING THERMODYNAMICS

L T P
3 1 -

Rationale:

The subject involves the laws of thermodynamics, refrigeration process, chemical reactions and their equilibrium and chemical kinetics. The student will be well conversant the strategies involved in the processes.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Definitions	10	4	-
2.	First Law	16	4	-
3.	Second Law	20	6	-
4.	Entropy	10	4	-
5.	Refrigerations & Liquefaction	10	4	-
6.	Vapour Liquid Equilibria	9	3	-
Total		75	25	-

DETAILED CONTENTS

1. INTRODUCTION

Scope of Thermodynamics, open & closed system, Thermodynamic properties-Temperature, Volume, Pressure, Specific heat at constant volume, Isothermal & Adiabatic process, irreversible & reversible process, Intensive & Extensive properties.

Thermodynamic system, properties and state of a substance, processes and cycle, equality of temp. the Zeroth law of thermodynamics; the pure substance; phases of a pure substance; Phase Rule Independent properties of a pure substance; equation of state for vapor phase (Van der Waals Equation).

2. FIRST LAW:

Various forms of energy; Heat work, Internal energy, Enthalpy comparison of heat and work, calculation of U, KE, PE, Q & W first law of thermodynamics for a closed system undergoing a cycle; for a change in state of a closed system; Joule Thomson coefficient J; Throttling process. Calculation of U, H, Q & W for Ideal gas undergoing reversible isometric, Isothermal, Isobar and adiabatic processes.

3. SECOND LAW:

Kelvin, Planck and Classius statement, the reversible process, Factors that render process irreversible: the Carnot cycle, Two propositions regarding the efficiency of a Carnot cycle. Thermodynamic temperature scale and ideal gas temperature scale. thermal thermodynamic equation-Maxwell relation.

4. ENTROPY :

Inequality of classius, entropy- a property of a system, Entropy change in reversible process; Entropy change for an open system; principle of increase of entropy; efficiency, irreversibility and availability; simple numerical problem for calculation of entropy change; thermodynamic relations.

5. REFRIGERATIONS & LIQUEFACTION :

The Cornot refrigeration cycle, the air refrigeration cycle, vapor compression cycle, Absorption refrigeration-flow diagram and their descriptions; coefficient of performance (C.O.P).liqefaction process. Latest refrigerant and their qualities and application.

6. VAPOUR LIQUID EQUALIIBRIA :

Concept of chemical potential, Roul't's Law, Henery's Law, Fugacity, Fugacity coefficient activity coefficient.

NOTE:- At least one Question should be asked from each topic (1 To 5).

2.9 COMPUTER APPLICATION FOR ENGINEERING LAB

[Common with Civil Engg., Civil (Spl. With Rural), Mechanical Engg.,(Specialisation in Production, Automobile, Refrigeration and Air conditioning), Electronics Engg., Instrumentation and Control Engg., Dairy Engg., Leather Technology, Footwear and Leather Goods Tech., Ceramics, Chemical Engg.(Four year Sandwich), Chemical Tech. (Rubber & Plastic), Chemical Tech. (Fertilizer)]

L T P
1 - 3

Rationale:

Computers are being used for design and information processing in all branches of engineering. An exposure to fundamentals of computer programming is very essential for all diploma holders. This subject has been included to introduce students in the use and application of computers in engineering.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction to Computer	5	-	-
2.	Introduction To Operating System MS DOS/Windows	3	-	-
3.	Ms-Word	4	-	-
4.	Ms-Excel	3	-	-
5.	Ms-Power Point	3	-	-
6.	Ms-Access	3	-	-
7.	Introduction to Internet	2	-	-
8.	Concept of Programming	2	-	-
		25	-	75

DETAILED CONTENTS

1. Introduction to Computer:

Block Diagram of Computer, Types Of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devices and memories. Visual Display Unit, Keyboard, Floppy disk drive, Hard disk drive, CD-ROM Drive, Magnetic & Tape Drive

Number system(Conversion) Binary, Octal, Hexa decimal number system, Conversion from Decimal to Other System and vice-versa Bit, Byte and Word.

2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:)

What is operating system, its significance, Commands of DOS, Features/Application of window.

3. MS WORD:

File : Open, Close, Save, Save as, Search, Send to, Print Preview, Print and Page Setup

Edit : Cut, Copy, Paste, Office Clipboard, Select All, Find, replace, Goto, etc.

View : Normal/Web Layout/Print Layout; Tool Bars; Header/Footer; Zoom, etc.

Insert: Break, Page Number, Date & Time, Symbol, Comment, Reference, etc.

Format: Font, Paragraph, Bullets & Numbering, Borders & Shading, Column, Change case, Back ground, etc.

Tools : Spelling & Grammer, Language, Word Count, Letters & Mailing, Options, Customize, etc.

Table : Draw, Insert, Delete, Select, Auto Format, AutoFit, Convert, Sort, Formula, etc.

4. MS EXCEL:

Introduction, Use of Tools/Icons for preparing simple applications.

5. MS POWER POINT :

Introduction, Use of Tools/Icons for preparing simple presentation on Power Point.

6. MS ACCESS :

Introduction, Use of Tools/Icons for preparing simple applications.

7. Introduction to Internet:

What is Network, How to send & receive messages, Use of Search Engines, Surfing different web sites. Creating Mail ID, Use of Briefcase, Sending./replying emails.

8. Concept of Programming :

Flowcharting, Algorithm techniques, etc.

COMPUTER APPLICATION FOR ENGINEERING LAB

List Of Practicals

1. Practice on utility commands in DOS.
2. Composing, Correcting, Formatting and Article (Letter/Essay/Report) on MS Word and taking its print out.
3. Creating, editing, modifying tables in MS ACCESS.
4. Creating labels, report, generation of simple forms in MS ACCESS.
5. Creating simple spread sheet, using in built functions in MS EXCELL.
6. Creating simple presentation on Power Point.
7. Creating mail ID, Checking mail box, sending/replying e-mails.
8. Surfing web sites, using search engines.

3.1 HEAT TRANSFER OPERATIONS

L T P
3 1 2

Rationale:

The subject already dealt as mechanical operations & Solid handling fluid mechanics in first and second year was the fundamentals. To further study the subject Heat transfer Operations is included to get the knowledge of modes of Heat transfer like conduction, convection and radiation. Different heat exchangers, condensers, evaporators, crystallisers, insulators used in chemical plant. Different types of simple numerical will be dealt to get the chemical engineering students aware of the problems generally occurring in the industries.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Modes of Heat transfer	6	2	--
2.	Conduction.	8	3	--
3.	Convection.	8	3	--
4.	Radiation.	8	2	--
5.	Heat Exchanger	10	4	--
6.	Condenser.	8	3	--
7.	Evaporators.	10	2	--
8.	Crystallisers.	8	3	--
9.	Insulation.	9	3	--
Total		75	25	50

DETAILED CONTENTS

1. MODES OF HEAT TRANSFER:

Conduction, convection & radiation.

2. CONDUCTION:

Fourier's law, Thermal conductivity, Conductance, flat Wall, Multilayer flat wall, Hollow cylinder, Multilayer cylinder log mean area, geometric mean area & Arithmetic mean area, Simple numerical problems in S.I. Units.

3. CONVECTION:

Natural and forced convection, Physical significance of dimensionless number. Reynold No,

Prandtl No., Nusselt No., Stanton No., Peclet No., Grashoff No., Dittus Boelter's equation-simple numerical problems using Dittus Boelter equation. Fouling factor. Individual heat transfer coefficient and overall heat transfer coefficient.

4. RADIATION:

Reflection, absorption and transmission of radiation, Kirchoff law, Emissive power, Wein's displacement law, the Stefan Boltzman law, Heat transferred by radiation exchange of energy between two parallel planes of different emissivity, Radiant Heat transfer coefficient, Solar radiation, gray surfaces or gray body.

5. HEAT EXCHANGERS:

Log.-Mean-temp.-Difference (L.M.T.D.) for parallel or cocurrent - flow, counter-current-flow, cross - flow, construction and description of

1. Double pipe heat exchangers.
2. Shell & Tube heat exchanger.
3. Finned tube heat exchangers.
Scale formation and cleaning devices, Wilson's plot (Simple Numerical Problems).
4. Plate type heat exchangers.

6. CONDENSER:

Film-wise and Drop-wise condensation. Construction & description of contact condenser and surface condenser.

7. EVAPORATORS:

Construction and description of

1. Horizontal tube types.
2. Standard vertical type or calandria type.
 - (a) Natural and forced circulation type.
 - (b) Entrainment and foam formation.
 - (c) Method of feeding evaporators-Forward, Backward & cross, mixed multi effect evaporation.
 - (d) BOILING : Nucleate boiling, film boiling, Transition boiling, Maximum flux and critical temperature drop, construction & description of Kettle type boilers. Boiling point rise (B.P.R) and effect, steam economy for single effective evaporator (Simple Numerical Problem).

8. CRYSTALLIZERS:

Classification of crystallizers; construction and description of

1. Swenson walker.

2. Vacuum crystalizer.

9. INSULATION:

Purpose of insulation common insulators, critical thickness of insulation for cylinder and spheres, optimum thickness of insulation, Heat loss from a pipe.

3.2-MASS TRANSFER OPERATIONS

L T P
3 1 2

Rationale:

It is the further step of Unit Operation deals with the gas absorption, distillation, boiling point diagrams, extraction operation, humidification and drying processes in chemical industry. The subject have experiments as well, to be aware of the facts involved in actual process.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Mass Transfer	10	3	-
2.	Packed Tower	15	4	-
3.	Distillation	20	6	-
4.	Extration	15	4	-
5.	Humidification	10	4	-
6.	Drying	5	4	-
Total		75	25	100

DETAILED CONTENTS

1. MASS TRANSFER:

Definition of diffusion, Rate of diffusion in Mass Transfer, Fick's law, diffusion in the gas phase-Equimolecular counter diffusion, diffusion through a stationary gas (Stefan's Law), Mass. Transfer Coefficient. Film theory and penetration theory of Mass Transfer, Diffusion in solids. Derivation of the following relations.

$$\begin{aligned}
 \text{I.} \quad & \frac{1}{\text{KG.a}} = \frac{1}{\text{kG.a}} + \frac{m}{\text{kL.a}} \\
 \text{II.} \quad & \frac{1}{\text{KL.a}} = \frac{1}{\text{kL.a}} + \frac{1}{\text{m.kG.a}}
 \end{aligned}$$

2. PACKED TOWER:

Properties of tower packing, types of packing, Channeling, Limiting flow rates- Loading and Flooding Capacity of packed tower, Material balance and design equation, operating line. Concept of transfer unit. Working of absorption column height of column based on conditions in gas film, based on condition in liquid film, height of column based on overall

coefficient, the operating line and graphical integration for height of column. Concept of transfer unit. H.E.T.P. for packed column of distillation, relation H.T.U. to H.E.T.P.

3. DISTILLATION:

Various distillation methods:-

1. Equilibrium or flash distillation .
2. Differential distillation
3. Batch distillation.
4. Vacuum and Steam distillation.
5. Azeotropic and Extractive distillation.

Types of distillation columns:-

1. Perforated plate or sieve plate column
2. Bubble cap plate column

Vapor liquid equilibrium diagram, Raoult's law; Relative volatility, constant boiling mixtures, equilibrium diagram and construction of equilibrium diagram, Fractionating column calculation- Heat & material balance, Reflux ratio, equilibrium plate, Location of feed plate. Sub cooled reflux; effect of reflux ratio, Total reflux, Minimum reflux ratio Entrainment; Mc-Cable Thiele diagram-section above and below feed plate; Intersection of operating line. Location of q-line, optimum reflux ratio, calculation of no. of equilibrium plate by Mc-Cable Thiele diagram. Overall plate efficiency.

4. EXTRACTION :

1. Applications of this operation.
2. Choice of solvent.
3. Steps of extraction operation
4. Solid Liquid extraction, construction and description of
 - A. Bed Basket type oil seed extractor or Bollman extractor.
 - B. Rotocel extractor.

Liquid extractor; description and construction of

- A. Mixer settler extraction system.
- B. Perforated plate and baffle towers.

5. HUMIDIFICATION:

Definition and calculation of

1. Humidity
2. Percentage humidity
3. Relative humidity
4. Humid volume.
5. Humid heat.
6. Enthalpy and its calculation.
7. Dry bulb and wet bulb-temp.
8. Adiabatic saturation temperature.
9. Use of humidity chart. Dew point, simple numerical problem using humidity chart, construction and description of cooling towers. (Natural and induced draft)

6. DRYING

General drying behaviour-Critical moisture content, equilibrium moisture content: Discription and construction of dryer.

1. Tray dryer.
2. Screen conveyer dryer.
3. Rotary dryer.

NOTE:- At Least One Question From Each Topic.

HEAT & MASS TRANSFER LAB.

LIST OF EXPERIMENT

(At Least 7 experiment to be Performed)

1. To determine over all heat transfer coefficient for an open pan evaporater in steady state conditions.
2. To determine over all heat transfer coefficient for an open pan evaporater in unsteady state conditions.
3. To determine 'U' for a double pipe heat exchanger in steady state conditions and also to determine efficiency of heat utilization.
4. To determine 'U' for a shell and tube heat exchanger in steady state conditions and also to determine efficiency of heat utilization.
5. To study a shieve plate distillation operation and to calculate over-all efficiency of the distillation column.
6. To determine steam economy of a single and double effect evaporator.
7. To study the rate of drying in a vacuum dryer.
8. To determine the pounds of volatile compounds distilled per unit pounds of steam distilled in a steam distillation operation.
9. To determine rate of setting of crystals in a crystaliser.
10. To study the rate of drying in Rotary dryer.
11. To determine drying rate for a wet material in a Tray Dryer.
12. To study packed tower in various industries.
13. To study various extractors in solvent extraction plant.
14. To study a spray pond in suger and other industries for cooling system.

3.3 CHEMICAL REACTION ENGINEERING (CRE)

L T P
3 1 -

Rationale:

Chemical reaction engineering is concerned with all those engineering activities which involves exploitation of chemical reactions on a commercial scale.

The subject involves homogeneous chemical reactions and their equilibrium, chemical kinetics and types of reactor heterogeneous reaction.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	5	2	-
2.	Homogenous Reactions	15	5	-
3.	Interprtation of constation volume batch reactor data	20	7	-
4.	Ideal Reactors	20	8	-
5.	Introduction to Heterogenous reacting systems	15	3	-
Total		75	25	-

DETAILED CONTENTS

1. INTRODUCTION :

Thermodynamics, chemical kinetics, classification of reactions variables affecting the rate of reaction;

2. HOMOGENEOUS REACTIONS :

Concentration dependent term of a rate equation, single and multiple reaction, series and parallel reactions. Elementary and Non-elementary reactions, Kinetic view for elementary reactions molecularity and order of reaction, Rate constant K. Representation of a reaction rate, Temperature dependant term of a rate equation, Temperature dependancy from - (Arrhenius law, Thermodynamics and collision theory).

Activation energy and Temperature dependency. Simple numerical problems.

3. INTERPRETATION OF CONSTANT VOLUME BATCH REACTOR DATA :

Constant volume batch reactor-Integral method of Analysis of data, Differential method of analysis of data temperature and Reaction rate.

The search for a rate equation.
Simple Numerical problems.

4. IDEAL REACTORS :

Classification of reactors and application & their comparison, Ideal batch reactor, space time and space velocity, steady-state mixed flow reactor, steady state plug flow reactor. Holding time and space time for flow systems. Simple numerical problems.

5. INTRODUCTION TO HETROGENEOUS REACTING SYSTEMS :

Rate Equation for Hetrogeneous Reactions. Contacting pattern for two phase system Simple Numerical problems.

3.4-AUTOMATIC PROCESS CONTROL

L T P
3 1 4

Rationale:

The subject automatic process control deals with the different types of controls in process in chemical industries including automatic control system. Process characteristics is of first order that is time constant element and second order that is oscillatory type element. Different modes of control action and closed loop in automatic control are well known. The student will be well conversant with these processes.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	10	3	-
2.	Elements of control system	15	7	-
3.	Process Characteristics	20	5	-
4.	Controller Characteristics	15	5	-
5.	Closed loop in Auto control	15	5	-
Total		75	25	100

DETAILED CONTENTS

1. INTRODUCTION:

What is Automatic control, Advantage of Automatic control, manual and automatic control, physical and block diagram.

2. ELEMENTS OF CONTROL SYSTEM:

Definition-Input means, controlling means, actuating means, measuring means, final control elements.

3. PROCESS CHARACTERISTICS:

Process variables, process degree of freedom, forcing function, step fn., ramp, impulse, sinusoidal function, laplace transformation.

Elements of process dynamics:- Proportional, Capacitance.

Time constant and oscillatory element, determination of system function or transfer function of the following:-
(Sketch physical diagram and block diagram)

- (a) 1st order system or time constant element:-
- (i) Naked bulb thermometer.
 - (ii) Stirred tank heater.
 - (iii) Mixing process.
 - (iv) R.C. Circuit.
 - (v) Liquid levels.
 - (vi) Two time constant type liquid vessel cascaded i.e. Non interacting and non cascaded, i.e. interacting
 - (vii) Continuous stirred tank chemical reactor with 1st order chemical reaction.

- (b) 2nd order system or oscillatory type element.

- (i) Bulb in thermowell.
 - (ii) Mechanical damper.
 - (iii) Fluid manometer or U tubes.
- Response of 1st order system to step, ramp, impulse and sinusoidal inputs, Response of 2nd order system to step change (Transient response).

4. CONTROLLER CHARACTERISTIC OR MODES OF CONTROL ACTION:

Elements of controller, proportional control, Integral control, proportional-integral control, proportional derivative control, proportional-integral-derivative control, Two positions control.

5. CLOSED LOOP IN AUTOMATIC CONTROL:

Standard block diagram symbol, overall transfer fn. for a single loop system, overall transfer function for change in set point and for change in load, overall transfer fn. multi loop control system, unit step response of the following.

- (i) Proportional control at stirred tank heater for set point change and for load change.
- (ii) P.I control of stirred tank heater for set point change and load change.

AUTOMATIC PROCESS CONTROL LAB

LIST OF EXPERIMENT

(At Least 8 experiment to be Performed)

1. To measure time constant of a single capacity thermal process (water bath & heater).
2. To find out viscosity of given sample by constant stress rotational viscometer & falling ball type viscometer.
3. Calibration of thermo couple.
4. To study the transient response of first order system (thermo couple) and find out time constant.
5. To find out the drying characteristics of given sample and draw drying rate curve by infrared moisture meter and rapid moisture meter.
6. To study the transient response of a simple R-C network and plot Bodey's diagram.
7. To study on of type water level control and to find out steady state voltage.
8. To study the frequency response of a second order electrical circuit equipment to a physical system (R-L-C network).
9. Calibration of pressure Gauge by Dead Weight tester.
10. To study, sketch and operation of strip chart recorder and Directing pen recorder.
11. Calibration of bimetallic thermometer.
12. To study the response of bimetallic thermo meter for a step input and find its time constant.
13. To calibrate the pneumatic control valve (Diaphragm type).
14. To calibrate the given manometer for level measurement.
15. To study the response of two tank non interacting liquid level system and two tank interacting liquid level system.
16. A study of automatic ON and cut of A.C. supply by a solid state (Built in relay and transformer) voltage stabilizer.
17. To find out the viscosity of given sample by red wood no-1 and red wood no-2 viscometer.
18. To find out viscosity of given sample by Ostwald viscometer.

3.5 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L T P
2 1 -

Rationale:

The knowledge of this subject is required for all engineering technicians, but it becomes more important for those technicians who wish to choose industry as their career. This course is designed to develop understanding of various functions of management, role of workers, and engineers, industrial safety, trade unions, wages and incentives, marketing, entrepreneurship, inventory control and industrial legislation.

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Principles of Management	10	5	-
2.	Human Resource Management	4	2	-
3.	Human and Industrial Relations	6	3	-
4.	Personnel Management	6	3	-
5.	Financial Management	6	3	-
6.	Material Management	6	3	-
7.	Labour, Industrial and Tax Laws	4	2	-
8.	Entrepreneurship Development	8	4	-
		50	25	-

DETAILED CONTENTS

1. PRINCIPLES OF MANAGEMENT :

Definition of management, Administration organisation, Functions management, Planning, Organizing, Co-ordination and control, Structure and function of industrial organisations, Leadership- Need for leadership, Factors to be considered for accomplishing effective leadership, Communication -Importance, Processes, Barriers to communication, Making communication, Effective, formal and informal communication, Motivation - Factors determining motivation, Positive and negative motivation, Methods for improving motivation, Incentives, Pay promotion and rewards, Controlling - Just in time, Total quality management, Quality circle, Zero defect concept. Concept of Stress Management

2. HUMAN RESOURCE DEVELOPMENT :

Introduction, Staff development and career development, Training strategies and methods.

3. HUMAN AND INDUSTRIAL RELATIONS :

Human relations and performance in organisation, Understand self and others for effective behaviour, Industrial relations and disputes, Characteristics of group behaviour and Trade

unionism, Mob psychology, Labour welfare, Workers participation in management.

4. PERSONNEL MANAGEMENT :

Responsibilities of human resource management - Policies and functions, Selection - Mode of selection - Procedure - training of workers, Job evaluation and Merit rating - Objectives and importance wage and salary administration - Classification of wage, Payment schemes, Components of wage, Wage fixation.

5. FINANCIAL MANAGEMENT :

Fixed and working capital - resource of capital, Shares, types preference and equity shares, Debenture types, Public deposits, Factory costing, Direct cost, Indirect cost, Factory over head, Fixation of selling price of product, Depreciation- Causes, Methods.

6. MATERIAL MANAGEMENT :

Objective of a good stock control system - ABC analysis of inventory, Procurement and consumption cycle, Reorder level, Lead time, Economic order quantity, Purchasing procedure, Stock keeping, Bin card.

7. LABOUR, INDUSTRIAL AND TAX LAWS :

Importance and necessity of industrial legislation, Types of labour laws and dispute, Factory Act 1948, Payment of Wages Act 1947, Employee State Insurance Act 1948, Various types of taxes - Production Tax, Local Tax, Trade tax, Excise duty, Income Tax.

8. ENTREPRENEURSHIP DEVELOPMENT :

Concept of entrepreneurship, need of entrepreneurship in context of prevailing employment conditions of the country. Successful entrepreneurship and training for entrepreneurship development. Idea of project report preparation.

NOTE : Entrepreneurship Awareness camp to be organised at a stretch for Two or Three days. Lectures will be delivered on Entrepreneurship by industries experts at institute level.

3.6 PROCESS EQUIPMENT DESIGN

L T P
3 1 -

Rationale:

The topics included in the subject process equipment design are design of machine elements, storage vessels, pressure vessels with the consideration of stress involved in materials and their protective coatings. The student are expected to solve the elementary problems of different equipments used in process industry.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Basic Considerations	10	1	-
2.	Design Considerations	10	2	-
3.	Power Requirement of Pumps	10	4	-
4.	Pressure Vessels	10	5	-
5.	Distillation Column	15	5	-
6.	Heat Exchangers & Condensers	10	5	-
7.	Evaporators	10	3	-
Total		75	25	-

DETAILED CONTENTS

1. BASIC CONSIDERATIONS IN PROCESS EQUIPMENT DESIGN

Introduction, General Design Procedures, Fabrication Techniques, Equipment Classification, Power for rotational motion.

2. DESIGN CONSIDERATIONS

Introduction, Materials Selections, Corrosion Prevention, Stresses Created due to Static & Dynamic Loads, Elastic Instability, Combined Stresses and Theories of Failure, Fatigue, Brittle, Fracture, Creep, Temperature Effect, Radiation Effects, Effects of Fabrication Methods, Economic Consideration.

3. POWER REQUIREMENT OF PUMPS:

Problems relating calculations of horse power (H.P.), N.P.S.H., for flow of incompressible fluid.

4. PRESSURE VESSELS:

Selection of type of vessels, causes of failure of vessels, methods of fabrication, types of formed heads, stress in

thin shells subjected to internal pressure, Longitudinal and circumferential stress, joint efficiency and corrosion allowance, Crown and Knuckle radius, Problems relating calculation of shell thickness of cylindrical and spherical shells, Thickness of Torispherical heads subjected to internal pressure as per I.S. code.

5. DISTILLATION COLUMN:

Preparation of equilibrium diagram, Problems relating calculation of theoretical plates at a given reflux ratio and total reflux, minimum reflux ratio, Feed plate location, by McCabe-thiele methods for separation of ideal binary mixtures, Derivation of q-line equation.

6. HEAT EXCHANGER AND CONDENSERS:

Problems relating calculation of L.M.T.D., individual and overall heat-transfer coefficients, Number of tubes, Number of passes, Heat-transfer coefficient for condensing vapors by Wilson's plot.

7. EVAPORATORS:

Problems relating calculation of heating area, Steam requirement, Steam economy for single and double effect evaporators. Methods of feeding evaporators and effect of Boiling Point Rise (B.P.R) and Hydrostatic Head.

3.7-POLLUTION CONTROL & INDUSTRIAL SAFETY

L T P
3 1 -

Rationale:

A chemical engineering technician must have the knowledge of different types of pollution caused due to industrialisation so that he may help in balancing the eco-system and control the pollution by means of control devices. The technician must know various types of accidents which occur in chemical plants and how to safe guard them to avoid injury to men and material. The content of the subject have been developed to cater the above needs.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	5	1	-
2.	Air Pollution	8	2	-
3.	Water Pollution	12	5	-
4.	Environment Protection	12	5	-
5.	Radioactive Pollution	10	2	-
6.	Pollution Acts	10	4	-
7.	Safety in Chemical Industry	12	4	-
8.	Solid Waste Management	4	1	-
9.	Disaster Management	2	1	-
Total		75	25	-

DETAILED CONTENTS

1. INTRODUCTION:

What is environment ? What is Pollution? Classification of pollution e.g. Land, Water, Air, Noise. Impact assesment of development projects. Character and origin of industrial wastes.

2. AIR POLLUTION:

- (i) Definition of air pollution, Types of Air pollutants and their sources like SPM, SOX, NOX, NH₃, F, Cl, CFC, Co₂ etc.
- (ii) Air pollution control equipment in industries.
 - (a) Settling chambers
 - (b) Cyclones
 - (c) Scrubbers (dry & wet)
 - (d) Multiclones
 - (e) Electro Static Precipitations (ESPS)
 - (f) Bug Filters
- (iii) Ambient air quality measurement & their standards.
- (iv) Vehicular Pollution and its control
- (v) Noise Pollution and its control mechanism.

3. WATER POLLUTION:

Water pollution, standards for drinking water, domestic waste water and industrial waste water. Methods of measurement of various parameter like BOD, SS, pH, COD, TDS etc. Methods of treatment of industrial waste water like

- (a) Chemical treatment
- (b) Physio-Chemical treatment
- (c) Bio-chemical treatment
- (d) Any other advance treatment

4. ENVIORNMENT PROTECTION :

Enviornmental protection from hazardeous Chemicals & Waste :-

Terminology relating to chemical hazards and air pollution, classification of chemical hazards and hazardous chemicals, codes of safety for operational hazards in laboratories, industries etc. (Reference should be made of I.S. Codes)

5. RADIO ACTIVE POLLUTION:

Sources and effect on human, animal, plant and material. Measurement, means to control, preventive measures.

6. POLLUTION ACTS:

A water pollution prevention control Act 1974, Air pollution Act 1981, Environment protection Act 1986, Hazardous chemical manufacturing, Storage and impact rules 1989 and hazardous waste and management and handling rules 1989, Noise Pollution Act.

7. SAFETY IN CHEMICAL INDUSTRY:

Receiving and storing chemicals-Transporting and moving chemicals- Safety in chemical reactions, Pipe-lines in chemical factories. Precautions in the case of processes in operations involving explosive or inflammable dusts, gases, vapours etc. Maintenance of chemical plants-corrosion health hazards in common chemical processes, Fire hazards and their Prevention. Codes of practice and specification for safety equipment (Reference should be made from I.S. Codes).

8. SOLID WASTE MANAGEMENT:

Municipal solid waste, Biomedical waste, Plastic waste and Its Management.

9. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of

various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

3.8 FERTILIZER TECHNOLOGY-I

L T P
2 1 2

Rationale:

The students are supposed to be familiar with various types of Fertilizers i.e. Nitrogenous, Phosphatic and Potassic and their manufacturing processes. Use of catalysts in manufacturing processes will strengthen their knowledge and will be useful in the world of work.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	5	1	-
2.	Nitrogenous Fertilizer	15	8	-
3.	Potassic Fertilizer	15	8	-
4.	Catalyst	15	8	-
Total		50	25	50

DETAILED CONTENTS

1. INTRODUCTION :

Origin, Development and use of commercial fertilizers, types of chemical fertilizers with special reference to availability in Indian conditions. Role of fertilizers in plant growth and their application.

2. NITROGENEOUS FERTILIZERS:

(a) Feed stock for production of Ammonia-Natural gas, Associated gas, Coke oven gas, Napha Petroleum heavy stock, Coal, Lignite, Coke, Electricity.

(b) Nitrogenous Fertilizers :

Ammonium Sulfate, Urea, Ammonium Nitrate and Calcium Ammonium Nitrate, Ammonium Chloride - their methods of production, Characteristics and specifications. Storage and handling problems, operational problems in the plants.

3. POTASSIC FERTILIZERS:

Production of Potassium Chloride, Potassium Sulfate, their specifications and characteristics.

4. CATALYST:

Catalyst used in fertilizer industry - Reforming catalyst (Primary and Secondary), High Temperature, Low Temperature, Shift Reaction Catalyst, Ammonia Synthesis Catalyst, Methanation Catalyst etc.

3.9 FERTILIZER TECHNOLOGY-II

L T P
2 1 -

Rationale:

Besides Nitrogenous, Phosphatic and Potassic fertilizers, mixed and NPK fertilizers are also important and their manufacturing technology is of great importance in the industry. The students are supposed to have knowledge about these fertilizers also.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Agrochemical Industries	5	2	-
2.	Phosphatic Fertilizer	15	8	-
3.	Complex and NPK Fertilizer	10	5	-
4.	Mixed Fertilizer	10	5	-
5.	Bio-Fertilizers	10	5	-
Total		70	25	50

DETAILED CONTENTS

1. AGROCHEMICAL INDUSTRIES:

Insecticides, Fungicides, Herbicides Plant nutrients, Manufacture of B.H.C. & D.D.T..

2. PHOSPHATIC FERTILIZERS:

(a) RAW MATERIALS:

Phosphate rock, Pyrites etc.

(b) Processes for manufacture of Sulfuric and phosphoric acid.

(c) PHOSPHATIC FERTILIZERS:

Ground rock phosphate bone meal raw and steamed, single and triple super phosphates, thermal phosphates - their methods of production, characteristics and specification. Operational details of plants.

3. COMPLEX AND NPK FERTILIZERS:

Methods of production of Ammonium Phosphate Sulfate, Diammonium Phosphates, Nitrophosphate, Urea Ammonium Phosphates.

4. MIXED FERTILIZER:

Their advantage and disadvantages. Materials used in mixed fertilizers, Manufacture of granulated NPK mixed fertilizer. Granulation techniques. Approved mixed fertilizer grades.

5. BIO-FERTILIZER (Nitrogenfixing)

Introduction to Bio-Fertilizer (Nitrogen fixing).

FERTILIZER TECHNOLOGY I & II AND POLLUTION CONTROL LAB

LIST OF EXPERIMENTS

1. Analysis of fertilizers.
2. Estimation of water soluble phosphate and total phosphates.
3. Estimation of total nitrogen, ammonical nitrogen and nitrate.
4. Estimation of potassium as per Chlorate.
5. Estimation of free acid in ammonium sulphate in time.
6. Analysis of blue gases, fuel gas and processed gases.
7. Analysis of feed stock (Naphtha, Fuel Oil, Fertilizer Feed Stock).
8. Estimation of Zn.
9. Determination of pH-value.
10. Determination of Turbidity.
11. Determination of Total Dissolved Solid (TDS).
12. Determination of Dissolved Oxygen (DO).
13. Determination of Chemical Oxygen Demand (COD).
14. Determination of Biochemical Oxygen Demand(BOD).

PROJECT

3.10 Equipment design project

L T P
1 - 4

Rationale:

Every diploma holder have to do a project work before going into the world of work so that he may have sufficient knowledge to face the various problems involved in solving the project. Chemical engineering technician must be well aware of these too. So the project on the design of pressure vessel, storage tanks, heat exchanger, distillation column and evaporator are included in the subject.

Every Students is supposed to design one of the following problems allotted by Head of Deptt. and prepare the complete Project Report. The viva - voce will be conducted by the external examiner appointed by the board of Technical Education for the purpose.

The Students should be acquainted with the various codes and standards and the requirements of inspection and safety.

Problem -I.

Design of Pressure Vessel

- (a) Shell
- (b) Head or Cover
- (c) Nozzle
- (d) Flanged Joint
- (e) Support

Problem-II.

Design of Storage Tanks

- (a) Material
- (b) Bottom Design
- (c) Shell Design
- (d) Wind graders for open - Top Tanks
- (e) Roof - Curb Angles
- (f) Self - Supporting Roof Design
- (g) Column Supported Roofs
- (h) Nozzles and Mountings

Problem - III.

Design of Heat Exchanger (Shell & Tube)

- (a) Shell Design
- (b) Shell Cover

- (c) Tubes
- (d) Tube Sheet
- (f) Tie Rods and Spacers
- (g) Baffles
- (h) Channel
- (i) Channel Cover

Problem - IV.

Design of Distillation Column

- (a) Shell Thickness
- (b) Stresses in Column Shell
- (c) Column Internal Details
- (d) Head
- (e) Support
- (f) Tray

Problem - v

Design of Evaporator

- (a) Shell design
- (b) Shell cover
- (c) Tubes
- (d) Steam Economy & Heating area
- (e) Vacuum creating device
- (f) Impingement Baffles

INDUSTRIAL TRAINING/FIELD EXPOSURE

Students have to go for an industrial training of 4 weeks in a chemical industry under the guidance of their H.O.D.. The student will submit an industrial training report which will be scrutinized and examined by the external examiner appointed by the B.T.E.. There will be viva voce of 100 marks and sessional marks 50.

TRAINING SCHEDULE

04 weeks structured supervised branch specific, task oriented Industrial Training to be organized during summer vacation after IInd year examination. The student during the industrial training must undertake training in at least any one of the following and submit the training report in the format given at Annexure-I & II.

1. OPERATION OF CHEMICAL PLANT:

Operation of chemical plant, Process control, Management of labour, Material and utility, Safety of workers and equipments.

2. CHEMICAL ANALYSIS:

Analysis of sample, Interpretation of results of analysis.

3. ERECTION & COMMISSIONING OF CHEMICAL PLANT:

Reading and interpreting the sketches, drawings, layout, planning etc. Erection of chemical plants, Commissioning of chemical plants.

4. INSPECTION & TESTING OF CHEMICAL EQUIPMENT:

Inspection, testing and performance of individual equipment, Fault finding or trouble shooting and its rectification.

STAFF STRUCTURE

THREE YEAR DIPLOMA IN CHEMICAL ENGINEERING(FERTILIZER)

Intake of the Course 60
 Pattern of the Course Annual Pattern

Sl. No.	Name of Post	No.
1.	Principal	1
2.	H.O.D.	1
3.	Lecturer Chemical Engineering	2
4.	Lecturer in Mech. Engg.	1
5.	Lecturer in Maths	1
6.	Lecturer in Chemistry	1
7.	Lecturer in Physics	1
8.	Lecturer in Comm. Tech.	1
9.	Lecturer in Elect. Engg.	1
10.	Computer Programmer	1
11.	Steno Typist	1
12.	Accountant / Cashier	1
13.	Student / Library Clerk	1
14.	Store Keeper	1
15.	Class IV	6
16.	Sweeper	Part time as per requirement
17.	Chaukidar & Mali	as per justification

Note :

1. Services of other discipline staff of the Institute may be utilized if possible
2. Qualifications of Staff : as per service rule
3. The post of "Computer Programmer" is not needed in the institutions where diploma in "Electronics Engineering" is running.

SPACE STRUCTURE

[A] ADMINISTRATIVE BLOCK

Sl. No.	Details of Space	Floor Area Sq. metres	Remark
1.	Principal's Room	30	
2.	Confidential Room	10	
3.	Steno's Room	6	
4.(a)	Office including Drawing Office	80	
(b)	Record Room	20	
5.	Staff Room		
	(a) Head 1	15	
	(b) Lecturer 10 sq.m./ Lect. for 8 Lecturers	80	
6.	Library and Reading room	150	
7.	Store	100	
8.	Students Common room	80	
9.	Model Room	90	

[B] Academic Block

Sl.No.	Detail of Space	No.	@ Sq.m	Floor Area Sq.m.
1.	Class Room	2	60	120
2.	Drawing Hall	1	90	90
3.	Physics Lab			75
4.	Chemistry Lab			120
5.	App. Mechanics Lab.			60
6.	Electrical Engg. Lab.			120
7.	Unit Operation-I,II			120
	Over Head Tank 2000 Litre Cap;			
	Under Ground Tank 600 Litre Cap;			
8.	Unit Operation-III,IV			120
9.	Automatic Process Control Lab.			75
10.	Fertilizer Technology/Petroleum & Petro Chemical Lab.			120
11	Computer Lab (Air Cond.Glass Partition and Special type pvc flooring and false ceiling)			60

[C] Work shop

I	Workshop Supdt. Room	12
II	Store	20
III	Shops	
(a)	Carpentry Shop	50
(b)	Smithy Shop	70
(c)	Fitting Shop	50
(d)	Welding Shop	50
(e)	Painting Shop	50
(f)	Sheet Metal ,Soldering & Brazing shop	50
(g)	Plumbing shop	50
(h)	Machine Shop	150
(i)	Foundry	75

[D] Student's Amenities

1.	Hostel	40	%	of Strength of Students
2.	Cycle Stand	50	%	of Strength of Students
3.	Canteen and Tuck shop	50		
4.	N.C.C. Room	70		
5.	Dispensary	40		
6.	Guest Room(Attached Bath) including kitchen & store	45		

[E] STAFF RESIDENCES

1.	Principal	1	100	100
2.	Head of Department	1	100	100
3.	Lecturer	4	80	320
4.	Non teaching & Supporting staff	8	60	480
5.	Class IV	6	30	180

Priority to be given in following order

(1)

- a. Administrative Building
- b. Labs
- c. Workshop
- d. Over head Tank
- e. Boundary Wall
- f. Principal Residence
- g. Fourth Class Quarters (2/3)

(2)

- a. Hostel
- b. Students Amenities

(3)

- Residences of employee

LIST OF EQUIPMENTS

Only those of the equipments given below which are essentially required for the conduction of practicals mentioned in the curriculum are to be procured by the institutions.

"Machine/Equipments/Instruments of old BTE list which are not included below are to be retained in the Lab/Shop for Demonstration purpose but not to be demanded fresh for purchase."

NOTE : Equipment for different shop and lab of latest version should be purchased.

I. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Brass ball with hook 2 cm. dia	2	20	40
2.	Stop clock least count 0.1 Sec	2	500	1000
3.	Wall bracket with clamping arrangement	2	50	100
4.	Meter scale	5	20	100
5.	Convex lenses of focal length 10 cm., 20 cm., 50 cm. and 100 cm. 2 nos. of each	8	10	80
6.	Optical bench steel with pin and lens holders	2	500	1000
7.	Astronomical telescope	1	500	500
8.	Searl's conductivity apparatus with copper & steel rods 25 X 4 cm. diameter with all accessories	1 set	1000	1000
9.	Lee's conductivity app. complete with all accessories	1 set	1000	1000
10.	Constant water flow arrangement	2	400	800
11.	Boiler made of copper 2 lt. cap.	4	200	800
12.	Platinum resistance thermometer	2	800	1600
13.	Potentiometer - 10 wires with jockey	1	500	500
14.	Meter bridge complete	1	250	250
15.	Lead accumulator 2.2 V. and 20 amp. hour capacity	2	250	500
16.	Moving coil galvanometer	3	200	600
17.	Moving coil ammeter 0-1 amp., 0-5 amp., 0-10 amp., 1 no of each	3	250	750
18.	Moving coil voltmeter 0-1 V. 0-5 V., 0-10 V. 1 No of each	3	250	750
19.	Leclanchi cell complete	3	100	300
20.	Resonance col. of steel tube with tuning forks and other accessories	1	500	500
21.	Tuning forks set of different frequencies	1 set	1000	1000

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
22.	App. for determining coefficient of friction on a horizontal plane	1 set	1000	1000
23.	Appratus for determining characteristics of P-N junction diode complete with all accessories	1 set	1500	1500
24.	Post office box dial type	1	1200	1200
25.	Resistance box 0-10 ohm., 0-100 ohm. 2 nos. each	4	400	1600
26.	Rheostat of different ohm.capacity	8	250	2000
27.	Physical balance with weight box	2	800	1600
28.	Set of fractional weights	10	20	200
29.	Fortin's barometer with mercury	1	2500	2500
30.	Battery eleminator 6 V. & 3 amp.	1	250	250
31.	Lab tables	3	8000	24000
32.	Lab stools	10	100	1000
33.	Anemometer cup type	1	1000	1000
34.	Anemometer hand held	1	1000	1000
35.	Suryamapi	1	1500	1500
36.	Insolation meter	1	1500	1500
	Misc.	LS		5000

II. APPLIED CHEMISTRY LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Test tube stand	15	10	150
2.	Funnel stand	15	10	150
3.	Burette stand	15	30	450
4.	Pipette stand	15	10	150
5.	Chemical balances with analytical weights 1gm -200gms	5	1500	7500
6.	Fractional weights set with rider	5sets	25	125
7.	Kipp's apparatus 1000 ml. polythen	2	500	1000
8.	Reagents bottles			
	250ml	120	10	1200
	500ml	5	15	75
	1000ml	5	25	125
9.	Wide mouth bottle 250 ml	15	15	225
10.	Winchester bottle 2.5 litre	15	30	450
11.	Test tubes 1/4" x 6"	75	1	75
12.	Boiling tube 1" x 6" hard glass	24	10	240
13.	Pestle and mortar 10 cms	2	30	60
14.	Watch glass 7.5 cms	15	5	75
15.	Beakers			
	100 ml.	10	15	150
	250 ml.	24	20	480
	400 ml.	12	25	300
	1000 ml.	5	30	150
16.	Weighing bottle 10 ml with lid	15	10	150
17.	Wash bottles	15	15	225
18.	Conical flask 250 ml.	15	30	450
19.	Flat bottom flask 500 ml.	6	40	240
20.	Flat bottom flask 250 ml.	15	25	375
21.	Burette 50 ml.	15	60	900
22.	Pipette 25 ml.	15	20	300
23.	Measuring flask 250 ml. with stopper	15	50	750
24.	Measring cylinder of various sizes (250 ml, 500 ml, 1000 ml) 3 no. of each	9	LS	250
25.	Bunsen's burner of brass	15	50	750
26.	Gas plant petrol 10 to 20 burners automatic	1	5000	5000
27.	Spirit lamp	15	30	450
28.	Tripod stand	15	10	150
29.	Wire gauge 15 X 15 cm. with asbestos	15	15	225
30.	Test tube holder	15	10	150
31.	Porcelain plates	15	20	300
32.	Funnel 15 cm.	15	16	240
33.	Blow pipe & work tools with electric blower for glass blowing	1 set	10000	10000
34.	Cork borers with sharpn	2 set	100	200
35.	Cork pressure	1 set	250	250
36.	Glass cutting knife	1	75	75
37.	Spatula hard & nickel/steel	2 each	50	100

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
38.	Water tapes with gooseneek	6	200	1200
39.	Gas taps two way	10	150	1500
40.	Pinch cock & screw	15	20	300
41.	Distilled water units (electrical)	1	5000	5000
42.	Distilled water units (solar)	1	5000	5000
43.	Open balance 1000 gms./10 mg.	1	600	600
44.	Platinum wire	5	25	125
45.	Brush for cleaning various type	40	10	400
46.	Jars 20 Lit. for keeping destilled water	5	100	500
47.	Lab table 2 m. x 1.2 m. x 1 m. hight with central sink and cup boards (Teak wood) with drawers and two built in almirah on each side with reagent racks, better tile top	4	8000	32000
48.	Exhaust fans 18"	4	2000	8000
49.	Side racks and selves for bench reagents made of teak wood for 24 bottels each set	4	2000	8000
50.	Digital balance electronic	1	10000	10000
51.	Hot plates 7-1/2", 3" dia controled 2000 watts	1	1000	1000
52.	Hot air oven thermostatically controled with selves and rotary switches 350 x 350 x 25 high	1	8000	8000
53.	pH Meter	1	1000	1000
54.	Glass Electrode	2		
55.	Reference Electro	2		
	Miscellaneous	LS		10000

APPLIED MECHANICS LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Polygon of Forces Apparatus	1	700	700
2.	Universal Force Table	1	1500	1500
3.	Principle of Moment Apparatus			
	Bell Crank lever	1	500	500
4.	Combined Inclined plane & Friction apparatus	1	900	900
5.	Simple wheel and axle	1	800	800
6.	Differential wheel and axle	1	1200	1200
7.	Double sleeve Pulley Block	1	400	400
8.	Simple Screw Jack	1	200	200
9.	System of pulleys (Any I,II,III)	1	1200	1200
10.	Worm & Worm wheel	1	1200	1200
11.	Apparatus for Reaction at support	1	1000	1000
12.	Jib Crane	1	500	500
13.	Jointed Roof Truss Apparatus	1	500	500
	Misc.	Lum Sum		2000

III. WORKSHOP PRACTICE

CARPENTRY SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	60 cm.rule	10	15	150
2.	Flexible steel rule 2 metre	2	20	40
3.	T square 23 cm. steel	10	20	200
4.	Bevel square 23 cm. steel	2	30	60
5.	Marking knife 25 cm. steel	10	30	300
6.	Marking gauge wooden & brass 25 cm.	10	30	300
7.	Mortise gauge wooden & brass 25 cm.	10	50	500
8.	Caliper inside, steel 20 cm.	2	50	100
9.	Caliper outside , steel 20 cm.	2	50	100
10.	Compass steel 20cm.	2	40	80
11.	Devicer steel 20 cm.	2	40	80
12.	Plumb	2	20	40
13.	Wooden bench vice steel 20 cm.	10	200	2000
14.	Bench hold fast steel 30 cm.	10	40	400
15.	Bar clamp 2 m.	2	300	600
16.	G clamp of flat spring steel 20x30 cm.	4	60	240
17.	Rip saw 40-45 cm.	10	80	800
18.	Cross cut saw 40-45 cm.	2	80	160
19.	Tennon saw 30-35 cm.	10	50	500
20.	Dovetail saw 30-35 cm.	2	60	120
21.	Compass saw 35 cm.	4	60	240
22.	Key hole saw or pad saw 30-35 cm.	2	25	50
23.	Bow saw	2	25	50
24.	Frame saw	2	25	50
25.	Chisel fish brand 1" to 1/8" firmer	3 set	100	300
	Dovetail	3 set	100	300
	Mortise	3 set	100	300
26.	Gauge or Golchi 1" to 1/8"	3 set	150	450
27.	Wooden jack plane complete	10	100	1000
28.	Wooden smoothing plane	10	80	800
29.	Iron jack plane complete	10	200	2000
30.	Iron rebate plane complete	3	80	240
31.	Iron grooving plane complete	3	120	360
32.	Iron compass plane complete	3	200	600
33.	Wooden moulding plane complete	3	200	600
34.	Bradawl	3	150	450
35.	Gimlet drills set	1 set	150	150
36.	Center bit	2	120	240
37.	Twist bit	2	80	160
38.	Auger bit	2	40	80
39.	Dovetail bit	2	15	30
40.	Counter shank bit	2	20	40
41.	Ratchet brace machine	2	175	350
42.	Grand drill machine 1/4"	2	200	400
43.	Wooden hand drill burmi	5	200	1000
44.	Wooden mallet	10	25	250
45.	Claw hammer	3	30	90
46.	Carpenters hammer	10	30	300

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
47.	Cutting tool for Universal wood working machine	3 set	800	2400
48.	Screw driver 18" & 15"	6	50	300
49.	Adze 500 gm.	10	50	500
50.	Pincer 175 mm.	6	75	750
51.	Plier 150 mm.	4	90	360
52.	Oil stone 8"	4	75	300
53.	Rasp file 12"	4	100	400
54.	Half round file 12"	4	80	320
55.	Round file 12"	4	80	320
56.	Triangular file 5", 4"	8	60	480
57.	Water stone	4	20	80
58.	Carpentry work benches	4	2000	8000
59.	Band saw machine complete	1	30000	30000
60.	Circular saw machine	1	15000	15000
61.	Double Ended Electric Bench grinder	1	6000	6000
62.	Universal wood working machine misc. for foundation of machines	1 LS	15000	15000 10000
SMITHY SHOP				
1.	Anvil 150 Kg. with stand	5	2500	12500
2.	Swage block 50x30x8cm.&45x45x10cm.	2	1250	2500
3.	Hammers			
	Ball peen 0.8 Kg. (Approx.)	10	150	1500
	Cross peen 0.8 Kg. (Approx.)	10	150	1500
4.	Beak iron 25 Kg.	1	500	500
5.	Swages different types	6	40	240
6.	Fullers different types	6	30	180
7.	Leg vice 15 cms. opening	1	150	150
8.	Electric blower with motor	1	5000	5000
9.	Furnace chmney with exhaust pipe	5	5000	25000
10.	Sledge hammer - 5 Kg.	2	200	400
	Misc. tools		LS	2500
SHEET METAL, SOLDERING & BRAZING				
1.	Dividers - 15cm.	5	60	300
2.	Trammel 1 m.	1		
3.	Angle protector	5	60	300
4.	Try square 30 cm.	5	40	200
5.	Centre punch	5	20	100
6.	Steel rule 30 cm. , 60 cm.,	5	25	125
7.	Sheet metal gauge	1	120	120
8.	Straight snips 30 cm.	2	250	500
9.	Curved snips 30 cm.	2	300	600
10.	Bench shear cutter 40 cm.	1	5000	5000
11.	Chisel 10 cm.	5	100	500
12.	Hammer	5	150	750
13.	Bench vice 13 cm.	5	1000	5000
14.	Plier	5	50	250
15.	Nose plier	5	60	300
16.	Sheet metal anvil/stakes	5	2000	10000

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
17.	Shearing machine 120 cm.	1	2500	2500
18.	Solder electric	2	500	1000
19.	Solder furnace type	2	250	500
20.	Brazing equipments and accessories	1	5000	5000
21.	Blow lamp	2	250	500
22.	Sheet bending machine	1	10000	10000
	Misc.		LS	5000

FITTING SHOP

1.	Bench vice jaw 10 cm.	10	300	3600
2.	Surface plate 45x45 cm.	2	2000	4000
3.	V. Block 10x7x4 cm.	5	350	1650
4.	Try square	10	40	400
5.	Bevel protractor 30 cm.	1	2100	2100
6.	Combination set	1	2500	2500
7.	Divider	5	60	300
8.	Centre punch	5	20	100
9.	Calipers (Different sizes)	12	20	240
10.	Vernier calipers 30 cm.	2	600	1200
11.	Micrometer 0-25, 25-50 m.m.	4	500	2000
12.	Vernier depth gauge	1	350	350
13.	Feeler gauge--15 blades	1	30	30
14.	Radius gauge	1	100	100
15.	Angle gauge	1	100	100
16.	Thread gauge	1	100	100
17.	Bench drilling machine 13 mm.	1	5000	5000
18.	Double ended electric grinder	1	4000	4000
19.	Drill set	1set	1000	1000
20.	Reamer set	1set	2000	2000
21.	Tap set	1set	2000	2000
22.	Adjustable wrenches (15 cm., 20cm. 30 cm.)	1set	500	500
23.	Allen key set	1set	350	350
24.	Spanners	6	60	360
25.	Work benches	6	2000	12000
26.	Power hacksaw	1	4000	4000
	Misc. Files, Dieset, Hexa frames etc.		LS	10000

WELDING SHOP

1.	Ellectric welding set oil cooled	1	10000	10000
2.	Industrial regulator type oil cooled arc welder	1	12000	12000
3.	Air cooled spot welder 7.5 KVA	1	15000	15000
4.	General accssories for air cooled spot welder of 7.5 KVA			8000
5.	Gas welding set with gas cutting torch and complete with all accessories	1	15000	15000
6.	Misc. work benches		LS	20000

PAINTING & POLISHING SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
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1.	Air compressor complete with 2 HP motor	1set	12000	12000
2.	Spray gun with hose pipe	1	1000	1000
3.	Stoving oven	1	3000	3000
4.	Buffing machine with leather and cotton wheels	1	4000	4000
5.	Electroplating Equipment for cromium Nikle plating.	1	10000	10000
	Misc.		LS	2000

PLUMBING SHOP

1.	Pipe vice 5 cm.	4	250	1000
2.	Chain wrenches	5	250	1250
3.	Ring spanner Set	5	125	625
4.	Wheel pipe cutter	2	300	600
5.	Water pump plier	4	50	200
6.	Pipe die set 2" set	2 set	600	1200
7.	Pipe bending device	1	5000	5000
8.	Work benches	4	4000	16000
9.	Set of various types of plumbing fittings e.g. Bib cock, Cistern, Stop cock, Wheel volve, Gat volve etc.		LS	2000
10.	Misc. Hacksaw frame and others		LS	2000

FOUNDRY SHOP

1.	Moulding boxes	25		6000
2.	Laddles	5		1000
3.	Tool kits	10 sets		2500
4.	Quenching tanks water or oil	2		1000
5.	Permiability tester	1		1000
6.	Mould hardness tester	1		6000
7.	Sand tensile testing equipment	1		7500
8.	Portable grinders	1		3000
9.	Temperature recorders/controllers	LS		5000
10.	Pit furnace with Blower	1		5000

MACHINE SHOP

1.	Lathe machine 4.5 feet "V" bed. Height of centres 8.5 inch. Dog chuck 8 inch complete 1 H.P. motor 440v, push button starter with coolent pump, tray and with standand accessories.	2	25000	50000
2.	Shaper machine 12 inch stroke with 2 H.P. motor 440 volts push button starter with vice 6 inch (Swivel base)	1	20000	200000

NOTE:-

The institutes running mechanical engg. course need not purchase these two items sepreately because they will have one complete machine shop for the course

UNIT OPERATION LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Apparatus to verify Bernoulli's Thorem	1 set	12000	12000
2.	Apparatus for conducting experiments on venturimeter with collecting and supplying tank	1 set	12000	12000
3.	Reynold's apparatus with storage tank and flow steadying arrangement with 1/2 HP pump and accessories	1 set	8000	8000
4.	Apparatus for determining Cc, Cv and Cd	1 set	12000	12000
5.	Apparatus for determining various head losses in pipes	1 set	8000	8000
6.	Notch apparatus with set of notches	1 set	9000	9000
7.	Model of Reciprocating pump	1	2000	2000
8.	Model of Centrifugal pump	1	2000	2000
9.	Pressure gauge Borden's type	1	2000	2000
10.	In place of item no. 1,2,4,5 & 8 Hydraulic bench may be purchased with all accessories or such institution if already have above items may purchase one unit, Otherwise 6 units			
	One Unit cost			15000
	Six units cost			90000
11.	Misc. for tools, Manometer Pitot's tube, Differential manometer and minor equipments			10000
12.	Orifice Meter	1	500	500
13.	Rota Meter	1	5000	5000
14.	Stop Watch	3	500	1500
15.	Centrifugal Pump with Motor	1	8000	8000
16.	Plate & Frame filter Press	1		10000
17.	Sieve Shaker with Motor & Time Switch	1		7000
18.	Test Sieve	1 Set		3000
19.	Sieve Plate(S.S.) Distillation Column	1		45000
20.	U Tube Double Pipe Heat Exchanger	1		6000
21.	Stainless Steel Spherical Jackted Open Pan Evaporator.	1		25000
22.	Stainless Steel Crystalizer	1		25000
23.	Rotatory Dryer	1		50000
24.	M.S. Thickner	1		25000
25.	S.S. Spherical Jackted Open Pan Evaporator With Stirrer.	1		30000
26.	Shell & Tube Heat Exchanger	1		25000
27.	Tray Dryer	1		35000
28.	Rotary Vacuum Filter	1		35000
29.	Boiler	1		50000
30.	Disintegrator Alongwith Wattmeter and voltmeter (1 Horse Power)	1		25000
31.	Jaw Crusher alongwith Wattmeter and voltmeter (1 Horse Power)	1		25000

AUTOMATIC PROCESS CONTROL LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Electronic Microprocessors Based Balance 300 Gr.	1		25000
2.	Strip Chart Recorder	1		25000
3.	Automatic Rapid Moisture Tester.	1		24000
4.	Air Compressor (Single Stage)	1		6000
5.	Constant Steam Rational Viscometer	1		2000
6.	Infra Red Moisture Meter	1		8000
7.	Viscometer Falling Type	1		200
8.	Aircompressor With Automatic Control Switch.	1		4000
9.	Bimetallic Thermometer	1		1000
10.	Stop Watch	2		1000
11.	Platinum Resistance Thermometer	1		800
12.	Thermo Couple With Indicator and Control Recorder	1		10000
13.	Recording Type Gas/Vapour Filled Thermometer (Single Pen)	1		6000
14.	Pressure Transducer With Indicator	1		10000
15.	Rate Meter Cap. 40 to 400 Lt.	2		6000
16.	Pneumatic Control Valve (Diaphragm Type)	1		5000
17.	Float & Tape Type Liquid Level Measuring Depth.	1		800
18.	Flap or Nozzle Arrangement For Demonstration.	1		500
19.	Pressure Regulator with Air Filter Niddle.	1		1500
20.	M.S. Tanks 1.5x1x0.7 M.	3		10500
21.	M.S. Tank Cylindrical With Inlet & Outlet type.	6		9000
22.	Bourdan Pressure Gauge	3		1800
23.	Tullo Pump of Minium Capacity	3		13500
24.	Auto Transformer	3		3000
25.	Voltage Stabilizer	2		1000
26.	Millivoltmeter Milliammeter Micrometer	3		15000
27.	Hot Plate Heater/Water Heater	2		2000
28.	Red Wood Viscometer (Complete Set)	1		10000
29.	Ostwald Viscometer with Water Bath	1		30000

COMPUTER APPLICATION FOR ENGINEERING (Common to all Trades)

COMPUTER CENTRE

S.No.	DESCRIPTION	QTY.	APPROX. COST (in Rs.)
1	PENTIUM-IV 2.4 Ghz or latest RAM-256 MB or latest HDD-80 GB latest MONITOR COLOUR 17" AGP 16 MB 52X MM KIT(52x CD Drive, Speaker, sound card) FDD - 1.44 MB Key Board - 107 Keys Multimedia Mouse - Optical Fibre Mouse 32 Bit PCI ETHERNET CARD(10/100) Mbps Pre loaded Windows XP OR WINDOWS 2000 Pre loaded Norton Anti Virus with licence media and manual	16 (15+1Server)	8,000,00=00

OR

Computer of latest Specification

Software :

i.	Noval Netware/NT Latest Version	01	55000
ii.	WINDOWS - XP/WINDOWS 2000 /Windows NT	01	6000
iii.	MS OFFICE XP	01	17000
iv.	Dos latest version.	01	5,000
v.	FoxPro 2.5 or Latest Version	01	
vi.*	Mechanical DeskTop Power Pack (*->Only For Mechanical Engg.)	01	70000

3. Hardware

i.	Internal Modem 56 kbps		
ii.	Hubs-16 port, all accessories related to Networking.		
iii.	Scanner- A4	01	10,000
4.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life	01	15,000
5.	Laser Jet	01	20,000
6.	5 KVA on line UPS with minimum 30 minute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries with network connectivity.	01	1,75000
7.	Window Air Conditioner 1.5 tones capctity with ISI mark alongwith electronic voltage stablizer with over viltage and time delay circuit	04	30,000(EACH)
8.	Room preparation and furniture		LS

FERTILIZER TECHNOLOGY & POLLUTION CONTROL LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Carbon dioxide generator	1		
2.	Combustion assembly	1		
3.	Shift Niteometer	1		
4.	K-ieldahl flask (300 C.C.)	6		
5.	Electric Oven	2		
6.	Electronics Balance	1		
7.	Reflux Condenser	1		600
8.	COD Heater	1		38000
9.	Rubber Tube	10 Meter		500
10.	Condenser	1		450
11.	Round Bottom Flask with Joint B-24, 500 ml	1		300
12.	BOD Incubator	1		112000
13.	BOD Bottle 300ml	1		400
14.	Refrigerator	1		25000
15.	Laboratory Oven	1		28000
16.	Laboratory Incubator	1		26000
17.	Turbidity Meter	1		45000
18.	TDS Portable Meter	1		21000
19.	pH Meter	1		14000

PETROLEUM & PETRO-CHEMICAL LAB

1.	Red Wood Viscometer as per I.S. 1448 & I.P. 70 With	1		
	Stop Watch	1		
	Measuring Flasks (50 ML.)	1		
	Thermometers I.P.S.C.			
	Low Range Thermometer	1		
	Medium Range	1		
	High Range	1		
2.	Englier Viscometer As Per I.S. 434 & AS TM 490 with Stop watch & Measuring flasks (200 to 240 M.L.)	1		
	Thermometers ASTM 23oC			

- ASTM 24oC
ASTM 25oC
3. Saybalt viscometer ASTM 58 with 1
Stop watch and Measuring flask 60 M.L.
Thermometers ASTM 17oC
Saybalt ASTM 22oC
Saybalt ASTM 18oC
 4. Pensky Master Flask Point 1
Apparatus As Per I.P. 34
& 151448 closed cup types with
Thermometers I.P. 15oC Low range
I.P. 16oC High range
 5. Cleave Land Flask & Fire Point 1
Apparatus as per I.P.-36/67
& ASTM D-92 open cup types with
Thermometers I.P. 28oC
 6. Smoke Point Apparatus as per 1
I.P. 57 & I.C. 1448
 7. Analine Point Apparatus as per 1
I.P. 2 with
Thermometer I.P. 20oC to
I.P. 21 oC

Sl.No.	Name of Equipment	No.	Rate	Amount
8.	Cloud & Pore Point Apparatus As per I.P 15 & I.S. 1448 With Thermometer I.P. 1oC (cloud & pore point) I.P. 2oC	1		
9.	Renstometer as per I.P 49 & I.S.-1448 with Thermometer I.P.-38oC	1		
10.	Photo Electric calorimeter	1		
11.	Hydrometer I.P. 160	1		
12.	Carbon Residue (Rans Bottom) I.S. 1448 & 14/65	1		
13.	Carbon Residue(conradson) I.P.13/42	1		
14.	Distillation of Petroleum Product-I.P. 123/68	1		
15.	Colour by Lovibound Tinfometer	1		
CHEMICAL TECHNOLOGY LAB				
1.	Distillation Apparatus (Glass)	1		5000
2.	Heating Mental	1		1000

ELECTRICAL TECHNOLOGY & ELCETRONICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	D.C. Shunt Motor 3 Kw. 1500 RPM with 3 Point Starter.	2	10000	20000
2.	D.C. Compound Motor 3 Kw. 1500 RPM	2	10000	20000
3.	Single Phase Transformer 1 KVA 50 Hz. Primary Voltage 230 with tapping at 50%, 86.6 % Facility	2	6000	12000
4.	3 Phase Induction Motor 415 V., 50 Hz, 440 RPM, 3 KVA Star/Delta/Autotransformer Starter.	2	5000	10000
5.	Loading Drum Spring Balance & Belt Arrangement.	2 Set		
6.	Tachometer (Analog/Digital)	1	2000	2000
7.	3 Phase Inductive Loading of Variable Nature	1	8000	8000
8.	Single Phase Inductive Loading Variable 0-10 Amp., 50 Hz.	1	8000	8000
9.	Moving Coil Ammeter 0-10 Amp.	8	1000	1000
10.	Moving Coil Voltmeter 0-300 V.	8	1000	8000
11.	Moving Iron Ammeter 0-10 Amp.	8	1000	8000
12.	Moving Iron Voltmeter 0-300 V.	8	1000	8000
13.	Wattmeter Single Phase Dynamo Type 75/300/600 V. 2.5/5 Amp.	4	2500	10000
14.	Three Phase Variable Inductive Loading.	1	8000	8000
15.	Single Phase Variable Inductive Loading with Rheostat.	1	8000	8000
16.	Megger 0-20 Mega Ohm, 500 RPM .			
17.	Flouroscant Tube With Choke.	1	100	100
18.	SCR Bread Board	1	1000	1000

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
19.	Power Supply 230 V.	1	1000	1000
20.	Moving Coil Ammeter 0-500 M.A.	1	1000	1000
21.	Moving Coil Voltmeter 0-250 V.	1	1000	1000
22.	Energy Meter Single Phase 230 V., 5 Amp	1	2000	2000
	Misc.		L.S.	1500

7. LEARNING RESOURCE MATERIALS

1.	Overhead Projector with screen	1	--	20000
2.	35 m.m. Slide cum Film Projector	1	--	50000
3.	Audio Cassette Recorder	1	--	15000
4.	V.C.R. with Monitor & Accessories	1	--	35000
5.	Photography Camera for Production of slide and film strips, 35 mm still camera dark room equipment.	1		100000
6.	Mathematical Typewriter	1	--	50000
7.	Cutting, Binding & Stitching equipment.	1	--	30000

ANNEXURE - I

FORMAT FOR FIELD EXPOSURE

1. Name & Address of the unit
2. Date of
 - i. Joining.
 - ii. Leaving.
3. Nature of Industry
 - i. Product.
 - ii. Services.
 - iii. Working Hrs.
4. Sections of the unit visited and activities there in.
5. Details of machines/Tools & instruments used in working in the section of the unit visited.
6. Work procedure in the section visited.
7. Specifications of the product of the section and materials used.
8. Work of repair and maintenance cell.
9. Details of the shops (welding, Foundary, Machine shop etc) related to repair and maintenance work.
10. Name of checking and Inspecting Instruments and their details.
Quality controls measures taken.
11. Details of hadraulics/pneumatic/thermal units or appliances used if any.
12. Discription of any breakdown and its restoring.
13. Use of computer - if any.
14. Visit of units store, Manner of keeping store items, Their receiving & distribution.
15. Safety measures on work place & working conditions in general - comfortable, convenient & hygeinic.

ANNEXURE - II

TRAINEES ASSESSMENT

This Institution invites the comments on the training of its students (work & behaviour) from their immediate supervisors on the following points.

1. Name of the trainee
2. Date of
 - i. Joining.
 - ii. Leaving.
3.
 - i. Regularity & Punctuality
 - ii. Sense of responsibility
 - iii. Readiness to work/learn
 - iv. Obedience
 - v. Skill aquired
4. Name of the sections of the unit he attended during his stay.
His activities/worth of being there.
5. Any thing specific

Sinnature of the Assessor

Date :-

Designation

ANNEXURE-III QUESTIONNAIRE

INSTITUTE OF RESEARCH, DEVELOPMENT AND TRAINING U.P. KANPUR -208024

SUBJECT: Questionnaire for ascertaining the job potential and activities of diploma holder in Chemical Engg. (Fertilizer)

PURPOSE: To design and develop Three Year diploma curriculum in Chemical Engg .

NOTE: 1. Please answer the questions to the points given in the questionnaire.
2. Any other point or suggestion not covered in this questionnaire may be written on a separate paper and enclosed with the questionnaire.

1. Name of the organisation: _____

2. Name & Designation of the officer _____
filling the questionnaire _____

3. Name of the department/section/ _____
shop _____

4. Important functions of the _____
department/section/shop _____

5. Number of diploma holder employees _____
under your charge in the area of _____
Chemical Engg. (Fertilizer)

6. Please give names of modern equipments/machines handled by a diploma holder in Chemical Engg. (Fertilizer)

1. 2. 3.

4. 5. 6.

7. What proficiencies are expected from a diploma holder in Chemical Engg. (Fertilizer)

1. 2. 3.

4. 5. 6.

8. Mention the approximate percentage of the following desired in Diploma teaching.

16. Job prospects for the diploma holder in Chemical Engg.(Fertilizer) the next ten years in the state / country.
17. In your opinion what should be the subjects to be taught to a diploma student in Chemical Engg.(Fertilizer)

Theory

Practical

18. Kindly mention particulars regarding topics/areas which should be given more emphasis in the curriculum .

Theory

Practical

19. Kindly state whether your organisation can contribute towards improvement of curriculum in above field. Yes/ No
If yes : Please give names of experts in your organisation to whom contact.
20. Kindly give your valuable suggestions for being considered at the time of finalisation of curriculum.
21. What changes in technologies are to be incorporated in the development of curriculum in Chemical Engg.(Fertilizer)

(Signature)

Kindly mail the above questionnaire duly filled to:-

Dr. Durgesh Chandra
Asstt. Professor
Institute of Research, Development & Training, U.P.
Govt. Polytechnic Campus
Kanpur-208024

(Please note that all information in this survey is confidential for the use of curriculum design only)