CURRICULUM FOR THREE YEAR(SIX SEMESTER) DIPLOMA COURSE

IN

PAINT TECHNOLOGY

UNDER DEVELOPMENT

SEMESTER SYSTEM

Prepared By

CURRICULUM DEVELOPMENT CELL

INSTITUTE OF RESEARCH, DEVELOPMENT TRAINING,U.P., KANPUR-208002

Approved By B.T.E. held on dated 04.05.2017

Corrected and Approved By BTE 04.05.2017

STUDY AND EVALUATION SCHEME FOR

THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN PAINT TECHNOLOGY

(Effective From Session)

I SEMESTER

Curriculum							Scheme of Examination								
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total		
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Sess. Marks	Total Marks			
4	-	-	-	-	4	1.1 Foundational Communicaton	2.5	50	20	70	-	--	--	--	70
3	1	-	-	-	4	1.2 Applied Mathematics-I(A)	2.5	50	20	70	-	-	-	-	70
3	1	-	-	-	4	1.3 Applied Physics-I	2.5	50	20	70	-	--	--	--	70
4	2		4	--	10	1.4 Introduction To Paint and Polymer Technology	2.5	50	20	70	3	60	30	90	160
4	2		--	--	6	1.5 Measuring Instrument and Measurements	2.5	50	20	70	--	--	--	--	70
-	-	-	-	14	14	1.6 Workshop Practice	--	--	--	--	4	60	30	90	90
18	6	-	4	14	42	<---------TOTAL---------->	--	250	100	350	--	120	60	180	530
						Games/NCC/Social and Cultural Activity + Discipline (15 + 10)									25
						Aggregate									555

II SEMESTER

3	1	-	-	-	4	2.1 Applied Mathematics-I(B)	2.5	50	20	70	-	-	-	-	70
3	1	-	4	-	8	2.2 Applied Physics-II	2.5	50	20	70	3	40	20	60	130
5	1		2	-	8	2.3 Applied Mechanics	2.5	50	20	70	3	40	20	60	130
6	-	-	4	-	10	2.4 Applied Chemistry	2.5	50	20	70	3	40	20	60	130
4	-	10	-	-	14	2.5 Engineering Drawing	3.0	50	20	70	-	-	-	-	70
21	3	10	10	-	44	<---------TOTAL---------->	--	250	100	350	--	120	60	180	530
						Games/NCC/Social and Cultural Activity + Discipline (15 + 10)									25
						Aggregate									555

NOTE:- (1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 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.

Corrected and Approved By BTE 04.05.2017

STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN IN PAINT TECHNOLOGY
(Effective From Session)

III SEMESTER

Curriculum						SUBJECT	Scheme of Examination								
Periods Per Week							Theory				Practical				Grand
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Total
5	2	--	--	7		3.1 Applied Mathematics-II	2.5	50	20	70	--	--	--	--	70
5	2	--	--	7		3.2 Pigments & Extenders	2.5	50	20	70	--	--	--	--	70
5	2	--	6		13	3.3 Drying Oils & Paint Media	2.5	50	20	70	4	60	30	90	160
5	2	--	4		11	3.4 Elect.Tech. & Electronics.	2.5	50	20	70	3	40	20	60	130
2	--	--	5		7	3.5 Introduction To Computer	---	--	--	--	3	60	30	90	90
22	8	--	15	--	45	<---------TOTAL----------->	--	200	80	280	--	160	80	240	520
						Games/NCC/Social and Cultural Activity + Discipline (15 + 10)									25
														Aggregate	545

IV SEMESTER

4	--	--	--	--	4	4.1 FunctionalCommunicaton	2.5	50	20	70	--	--	--	--	70
5	2	--	--		7	4.2 Natural & Synthetic Resins	2.5	50	20	70	--	--	--	--	70
5	2	--	--		7	4.3 Conventional & Nonconventional source of energy	2.5	50	20	70	--	--	--	--	70
6	2	--	8		16	4.4 Fluid Mechanics and Solid Handling	2.5	50	20	70	3	100	50	150	220
4	2	--	--		6	4.5 Process Plant Utilities	2.5	50	20	70	--	--	--	--	70
3	--	--	2		5	4.6 Energy Conservation	2.5	50	20	70	3	20	10	30	100
27	8	--	10	--	40	<---------TOTAL----------->	--	300	120	420	--	120	60	180	600
						Games/NCC/Social and Culturl Activity + Discipline (15 + 10)									25
														Aggregate	625

NOTE:- (1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilised for revision etc.

Corrected and Approved By BTE 04.05.2017

STUDY AND EVALUATION SCHEME FOR
THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN IN PAINT TECHNOLOGY
(Effective From Session)

V SEMESTER

Curriculum							Scheme of Examination								
Periods Per Week						S U B J E C T	Theory			Practical				Grand Total	
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	
-	-	-	4	-	4	5.1 IntegrativeCommunicaton	2.5	--	--	--	3	40	20	60	60
6	2		--		8	5.2 Industrial Management and Enterprenurship Development	2.5	50	20	70	--	--	--	--	70
4	2	-	4	--	10	5.3 Heat & Mass Transfer	2.5	50	20	70	4	60	30	90	160
3	2	-	4	--	9	5.4 Coating Properties, Evaluation,Quality Control	2.5	50	20	70	3	60	30	90	160
4	1		--		5	5.5 Pollution Control & Industrial Safety	2.5	70	30	100	--	--	--	--	100
3	2		4		9	5.6 Formulation&Manufacturingof Paint	2.5	50	20	70	3	60	30	90	160
20	9	-	16	--	45	<---------TOTAL---------->	--	270	110	380	--	220	110	330	710
						Games/NCC/Social and Culturl Activity + Discipline (15 + 10)									25
													Aggregate		735

VI SEMESTER

5	1		--		6	6.1 Chemical Reaction Engineering	2.5	70	30	100	--	--	--	--	100
6	2		6		14	6.2 Automatic Process Control	2.5	70	30	100	4	100	50	150	250
5	2		-		7	6.3 Surface Preparation & Paint Application	2.5	50	20	70	-	--	--	--	70
5	2		-		7	6.4 Printing & Packaging Tech.	2.5	50	20	70	-	--	--	--	70
				10	10	6.5 Project									
						A- Project Problem	-	-	-	-	-	70	30	100	
						B- Field Exposure	-	-	-	-	-	40	20	60	160
21	7	--	6	10	44	<---------TOTAL---------->	--	240	100	340	--	210	100	310	650
						Games/NCC/Social and Cultural Activity + Discipline (15 + 10)									25
													Aggregate		675
										30% of I & II Semester					333
										70% of III & IV Semester					819
										100% of V & VI Semester					1410
													Grand Total		2562

NOTE:-
(1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) Field visit and extension lectures at institute level as per need be organised.

Corrected and Approved By BTE 04.05.2017

C O N T E N T S

Corrected and Approved By BTE 04.05.2017

MAIN FEATURES OF THE CURRICULUM

1. Title of the Course : Diploma in Paint Technology
2. Duration of the Course : Three Years Duration(Six Semester)
3. Type of the Course : Full Time Institutional
4. Pattern of the Course : Semester System
5. Intake : 60
6. Entry Qualification : Passed High School with 35% High School
7. Admission Criteria : State Joint Entrance Examination

Corrected and Approved By BTE 04.05.2017

LIST OF EXPERTS

List of experts whose deliberation helped the development of curriculum in Semester System for three year(Six Semester) diploma course in Paint Technology at I.R.D.T. U.P., Kanpur on 1.04.15 are honourably named below -

1.	Sri F. R. Khan	Principal	G.P., Kanpur
2.	Shri D. D. Singh	H.O.D. (Chem. Engg.)	Govt. Polytechnic Badaun
3.	Shri A. K. Agarwal	Head Chem. Engg. Deptt.	Govt. Polytechnic Sutavali(J.P.Nagar)
4.	Shri R. K. Gangwar	Head	Govt. Polytechnic Mankeda(Agra)
5.	Shri A. K. Mishra	Head	Govt. Polytechnic, Kanpur
6.	Shri Anjani Kumar Sharma	Head	Sanjay Gandhi Poly Jagdishpur(Amathi)
7.	Sri Durgesh Chandra	Lecturer	Govt. Poly.,Firojhabad
8.	Shri Lal Ji Patel	T.B.O.	I. R. D. T., Kanpur

List of experts whose deliberation helped the revision of curriculum for three year diploma course in Paint Technology at I.R.D.T. U.P., Kanpur on 28.01.2016 are honourably named below -

1.	Dr. S.Chandra	Retd.Professor	H.B.T.I., Kanpur
2.	Dr. Pramod Kumar	Professor & Head Deptt.of Oil & Paint Technology	H.B.T.I., Kanpur.
3.	Dr. Arun Mathani	Professor Oil&Paint Technology Deptt.	H.B.T.I., Kanpur.
4.	Shri S. C. Prajapati	Asstt. Manager	Kansai Nerolac Paint. Ltd. Kanpur Dehat
5.	Shri Rakesh Kumar	HOD(Chemical Engg.)	G.P.,Mankeda,Agra
6.	Shri Durgesh Chandra	Lecturer(Chemical Engg.)	G.P. Firozabad
7.	Shri Lal Ji Patel	T.B.O.	I.R.D.T.,U.P., Kanpur

List of experts whose deliberation helped the review and revision of curriculum for three year diploma course in Paint Technology at I.R.D.T. U.P., Kanpur on 06.09.2016 are honourably named below -

1.	Dr. Pramod Kumar	Professor & Head Deptt.of Oil & Paint Technology	H.B.T.I., Kanpur.

Corrected and Approved By BTE 04.05.2017

2. Dr. Arun Mathani	Professor	H.B.T.I., Kanpur.
3. Shri D. D. Singh	Principal Oil&Paint Technology Deptt.	G. P., Badaun
4. Shri Rakesh Kumar	HOD(Chemical Engg.)	G.P.,Mankeda,Agra
5. Shri Durgesh Chandra	HOD(Chemical Engg.)	G.P. Firozabad
6. Shri Shivam Dixit	Quality Control Officer	Kansai NerolacPaint Pvt. Ltd., Jainpur, Kanpur Dehat
7. Shri Shubham Chawala	QA Executive	Maharani Inovative Paint Pvt. Ltd. Faridabad(Hariyana)
8. Shri Lal Ji Patel	T.B.O.	I.R.D.T.,U.P., Kanpur

LIST OF EXPERTS

A Curriculum Workshop for Development of Curriculum on the Subject " Energy Conservation" was held on 22nd January, 2018 at NITTTR, Chandigarh. The following participated in the workshop:-

S. No.	Name, Designation and Official address
From Field/Industries/Institutions of Higher Learning	
1.	Shri Jotinder Singh, Engineer-in-Chief(Retd.) Punjab State Power Corpn. Ltd.(PSPCL), Punjab
2.	Shri Punit Sharma, Asstt.General Manager, Electrical & Energy Management, Godrej Appliances Ltd. Mohali, Punjab
3.	Ms. Anu Singla, Associate Professor, Chitkara University, Rajpura, Punjab
4.	Shri Girish Kumar, UP New and Renewable Energy Development Authroity (UPNEDA), Lucknow, U.P.
5.	Sh. Lal Ji Patel, TBO/ CDC Officer, IRDT Kanpur, U.P.
6.	Shri Ravinder Kumar, Research Assistant, IRDT, Kanpur, U.P.
From NITTTR, Chandigarh	
7.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, **Coordinator**

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.

Paint is a substance composed of solid colouring matter suspending in a liquid medium and and applied as a protective or decorative coating to various surfaces, or to canvas or other materials. Various chemicals are combined together to make a paint. Each particular chemical substance makes a particular function in the final product.

Paint Technology is the discipline in which one studies about the various ingradients-resin,polymers,pigments,etc.-that are used in making a paint. Different substrate and surfaces,depending on there unique physical and chemical properties,require different kinds of paint or coating formulations to be applied on them. One studies about the different aspects of paint technology application in this discipline.

Paint Technology application is a combination of processes-metallic and non-metallic surfaces are chemically treated and then coatings of paint are applied on them for the purpose of protection or for decoration.

In the discipline of Paint Technology, one studies about the manufacturing of paints, the use of various kinds of paints and the techniques used for the application of paints. One studies about the various kinds of paints in the discipline of Paint Technology. One studies about paints used for houses and other architectural set-ups, paints used for automobiles, aircraft and marine vessels. One also studies about high performance, anti-corrosive paints used in factories an industries.

A Paint Technologist is required in different departments of the paint industries. Paint Technologists work in the research development department, production department, manufacturing department, technical services or marketing department and paint application department.

PROFILE DEVELOPMENT

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

Feed back was taken from experts through questionnaire, personal interviews and workshops was analyzed 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. Analyzing activities into knowledge and skill.
3. Deriving the course objectives.
4. Deriving subject areas from course objectives.
5. Planning horizontal and vertical organization 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.

Corrected and Approved By BTE 04.05.2017

JOB POTENTIAL/JOB OPPORTUNITIES

The employment potential in this industry is hues. Job prospects are many for the one who is professionally qualified in Paint Technology. One will find employment in large paint manufacturing companies like-

Asian Paints India Limited
Shalimar Paints
Jenson and Nicolson
BergerPaintsIndia Limited
Nerolac Paints Limited, etc.

One will be posted in different wings of the paint industry like production department, manufacturing department or marketing department. One may also be posted in the technical service department as a Technical Assistant or Technical Executive.

Besides, one will also find employment as a supervisor in the application unit of an auto industry. There is huge demand for Paint Technologists in companies which are into the manufacture of home furnishing like almirah, refrigerators, etc. One will be able to find employment in such home furnishing industries. One will also be able to find employment in industries which are into the manufacturing of raw materials used in the manufacture of paints, and other allied industries like pigment or extender manufactures, resin suppliers, polymer suppliers or additive suppliers.

The Indian economy today is one of the fastest growing economics of the world. The paint industry, which is dependent on several industries like the housing industry, the automobile industry and the original equipment manufacturing industry, is growing by leaps and bound, due to the growth in these related industries. This has spread out a wide and prospective field for trained professionals in paint technology. Though India"s per capita consumption of paints is lower as compared to the developed countries, there is study increase in consumption of paints due to the boom in the economy. Thus, growth in the paint industry is ensured in the near future with promises of employment for trained Paint Technologists.

Corrected and Approved By BTE 04.05.2017

I Semester

1.1 FOUNDATIONAL COMMUNICATION
SECTION "A" (ENGLISH)

L	T	P
4	-	-

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time	L	T	P
Section A English					
1.	PARTS OF SPEECH	12	-	-	
2.	VOCABULARY BUILDING	05	-	-	
3.	Grammar	15	-	-	
4.	DEVELOPMENT OF EXPRESSION (Composition)	12	-	-	
Section B Hindi					
5.	Topic 5	2	-	-	
6.	Topic 6	5	-	-	
7.	Topic 7	5	-	-	
		56	-	-	

DETAILED CONTENTS

1. **PARTS OF SPEECH :**

   a. Noun
   b. The pronoun : Kinds and Usage
   c. The adjective : Kinds and Degree
   d. Determiner : Articles
   e. The verb : Kinds
   f. The Adverb : Kinds, Degree and Usage
   g. Prepositions
   h. Conjunctions
   i. The Interjections
   j. Subject: Verb Agreement (Concord)

2. **VOCABULARY BUILDING :**

a. Antonyms and Synonyms
b. Homophones
c. One word substitutions
d. Idioms and Phrases
e. Abbreviations

3. **Grammar**

a. Sentence & its types
a. Tenses
b. Punctuations
c. Active and Passive voice
d. Transformation of Sentences
e Synthesis of Sentences
f. Direct and Indirect Narrations

4. **DEVELOPMENT OF EXPRESSION (Composition) :**

a. Paragraph Writing
b. Essay Writing
c. Proposal Writing
d. Letter Writing (Formal,Informal,Business,official etc.)
f. Report Writing
g. Note Making
h. News Making
i. Application Writing
j. Minute Writing
k. Invitation Letter Writing

SECTION "B" (Hindi)

5– संज्ञा, सर्वनाम, विशेषण, क्रिया विशेषण, वर्ण समास, संधि, अलंकार, रस, उपसर्ग प्रत्यय।

6– पत्र लेखन, निविदा संविदा, दर आमंत्रण (कोटेशन) अपील, स्वतन्त्र अभिव्यक्ति, प्रतिवेदन लेखन, प्रेस विज्ञप्ति।

7– वाक्य/वाक्यांश के लिए शब्द, पर्यायवाची या समानार्थी शब्द, विलोम शब्द, अनेकार्थी शब्द, शब्दयुग्म या समुच्चारित शब्द समूह, वाक्य शुद्धि (शुद्ध अशुद्ध वाक्य), मुहावरे एवं लोकोक्तियॉं।

1.2 APPLIED MATHEMATICS I(A)

[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	8	3	-
2.	Algebra- II	8	3	-
3.	Trignometry	6	2	-
4.	Differential Calculus-I	10	3	-
5.	Differential Calculus-II	10	3	-
		42	14	-

DETAILED CONTENTS:

1. ALGEBRA-I : (10 Marks)

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.

Corrected and Approved By BTE 04.05.2017

1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule

2. ALGEBRA-II:(10 Marks)

2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.

2.2 Complex number.

Complex numbers, Representation, Modulus and amplitud Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. TRIGONOMETRY :(8 Marks)

3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.

3.2 Inverse circular functions : Simple case only

4. DIFFERENTIAL CALCULUS - I : (12 Marks)

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, Logaritimic differentiation, Differentiation of implicit functions.

5. DIFFERENTIAL CALCULUS -II :(10 Marks)

5.1 Higher order derivatives, Leibnitz theorem.

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

5.3 Application - Finding Tangants, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.

Corrected and Approved By BTE 04.05.2017

1.3 APPLIED PHYSICS-I

[Common to All Engineering Courses]

L	T	P
3	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.	Units & Dimensions	3	1	-
2.	Errors in Measurement	3	1	-
3.	Circular Motion	4	1	-
4.	Motion of Planets	4	1	-
5.	Dynamics of rigid body (Rotational Motion)	5	1	-
6.	Fluid Mechanics and Friction	4	1	-
7.	Friction	4	1	-
8.	Harmonic Motion	5	2	-
9.	Heat & Thermodynamics	6	4	-
10.	Acoustics	4	1	-
		42	14	-

DETAILED CONTENTS:

1. Units and Dimensions (4 Marks)

Corrected and Approved By BTE 04.05.2017

S.I. Units & Dimensions of physical quantities, Dimensional formula and dimensional equation. Principle of homogenity of dimensions and applications of homogenity 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.

2. ERRORS AND MEASUREMENT (4 Marks)

Errors in measuremnts, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement(Combination of erros in addition, substraction, multipication and powers). Significant figures, and order of accuracy in respect to instruments,

3. Circular Motion (5 Marks)

Central forces. Uniform Circular motion (Horizental and Vertical cases),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.

4. MOTION OF PLANETS AND SATELLITES :(5 Marks)

Gravitational force, Acceleration due to gravity and its

variation w.r. to height and depth from earth, Kapler's Law, Escope and orbital velocity, Time period of satellite, Geo-stationary, Polar satellites (Concept Only)

5. Dynamics of Rigid Body (Rotational Motion) (6 Marks)

Rigid body,Rotational motion, Moment of inertia,Theorems(Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. of regular bodies (Lamina, Sphere, Disc, Cylindercal),Concept of Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling of sphere on the slant plane . Concept of Fly wheel.

6. Fluid Mechanics :(5 Marks)

Surface tension, Capillary action and determination of surface tension from capilary rise method, Equation of continuity (A1V1=A2V2), Bernoulli's theorem, and its application stream line and Turbulent flow, Reynold's number.

7. Friction :(4 Marks)

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Coefficients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.

8. Harmonic Motion (6 Marks)

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

9. Heat & Thermodynamics: (6 Marks)

Modes of heat transfer (Conduction, Convection and
Radiation), coefficient of thermal conductivity Isothermal
and adiabatic process. Zeroth First, Second Law of
Thermodynamics and Carnot cycle, Heat Engine (Concept Only).

10. Acoustics (5 Marks)
Definition of pitch, loudness, quality and intensity of
sound waves. Echo, reverberation and reverberation time.
Sabine's formula without Derivation. Control of
reverberation time (problems on reverberation time).
Accoustics of building defects and remedy.

1.4 INTRODUCTION TO PAINT & POLYMER TECHNOLOGY

L T P

4

2 4

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Basics of paints	12	6	-
2.	Introduction to drying,semi drying & non drying oils	12	6	-
3.	Fundamentals of Polymer	12	6	-
4.	Classification of polymer	10	5	-
5.	Polymerization techniques	10	5	-
	TOTAL	**56**	**28**	**56**

DETAILED CONTENTS:

1. BASICS OF PAINTS:
General Introduction of Paint industry, definition of Paints, varnishes and lacquers their constitutions and functions. General classification of surface coating, mechanism of film formation,

2. INTRODUCTION TO DRYING AND NON DRYING OILS:
Source and composition of oils, non –glyceride, component of oils, classification, extraction and refining of oils, Chemical reactions of oils, like oxidation, hydrolysis, glyceralysis, saponification etc, and their evaluation, characterization of oils.

3. FUNDAMENTALS OF POLYMERS:
Introduction & historical background of polymers, macro-molecular concept, monomers & polymers nomenclature of polymer, feature & characteristic of a polymer, definition of polymerization, rate of polymerization, average degree of polymerization , functionality and polymerization. Oligomer and high polymers . Scope of elastomeric, fiber forming and plastic materials.

4. CLASSIFICATION OF POLYMERS:
Types of polymerization, addition (chain) polymerization, condensation polymerization, comparison between addition and condensation polymerization.

5. POLYMERIZATION TECHNIQUES:

Bulk, Suspension, solution & emulsion polymerization.

INTRODUCTION TO PAINT & POLYMER TECHNOLOGY LAB

1. Physical testing of drying oils for colour,sp.gr, R.I, etc.
2. Physical testing of semidrying oils for colour, sp. gr., R.I. , etc.
3. Physical testing of nondrying oils for colour, sp. gr., R.I. , etc.
4. Determination of acid value of oils.
5. Determination of iodine value of oils.
6. Determination of saponification of oils.
7. Oil/fat splitting to recover fatty acids & glycerol
8. Preparation of Polystyrene by bulk polymerization.
9. Preparation of Polyacrylate by solution/ polymerization

1.5-MEASURING INSTRUMENTS AND MEASUREMENTS

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

L	T	P
4	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.	12	6	-
2.	Pressure and Vacuum gauges	12	6	-
3.	Thermometers and Pyrometers	12	6	-
4.	Mass & Weight Measurement	10	5	-
5.	Liquid level meters	10	5	-
		56	28	-

DETALLED CONTENTS

1. INTRODUCTION & CLASSIFICATION OF INSTRUMENTS:

Corrected and Approved By BTE 04.05.2017

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. MASS & WEIGHT MEASUREMENT :

Measurement equipment - Two pan balance and single pan mechanical balances, Single pan electronic balance.

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. Hydrostatic head density compensator level meter,

Hydrostep, Radar or microwave level indicator, Ultrasonic or
Sonic level indicator.

REFERENCE BOOKS

1. Industrial instrumentation by Donald, P. Ekman
2. Instrumentation by Krik and Ramboi.

1.6 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 Past time Mechanical Engg. (sp. in Production Engg.)]

L	T	P
-	-	14

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	-	-	20
2.	Painting & polishing shop	-	-	16
3.	Sheet metal and soldering shop	-	-	56
4.	Fitting shop, Plumbing & Fastening Shop	-	-	24
5	Foundry shop			20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
		-	-	196

Corrected and Approved By BTE 04.05.2017

DETAILED CONTENTS

1. Carpentry Shop :

EX-1 Introduction & demonstration of tools used in carpentry shop and different types of joints, types of wood, seasoning and preservation of wood

EX-2 Planing and sawing practice

EX-3 Making of lap joint

EX-4 Making of mortise and tenon joint

Ex-5 Making of any one utility article such as wooden-picture frame, hanger, peg, name plate, etc.

2. Painting and Polishing Shop:

EX-1 Introduction of paints, varnishes, Reason for surface preparation, Advantange of painting, other method of surface coating i.e. electroplating etc.

EX-2 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-3 To prepare metal surface for painting, apply primer and paint the same.

EX-4 To prepare a metal surface for spray painting,first spray primer and paint the same by spray painting gun and compressor system.

* The sequence of polishing will be as below:

i) Abrassive cutting by leather wheel.

ii) Pollishing with hard cotton wheel and with polishing material.

iii) Buffing with cotton wheel or buff wheel.

3. Sheet Metal and Soldering Shop :

EX-1 Introduction and Types of sheets, measuring of sheets

EX-2 Study and sketch of various types of stakes/anvil.

EX-3 Introduction & demonstration of tools used in Sheet metal working shop.

EX-4 Cutting, shearing and bending of sheet.

EX-5 To prepare a soap case by the metal sheet.

EX-6 To make a funnel with thin sheet and to solder the seam of the same.

EX-7 To make a cylinder and to solder the same.

EX-8 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired joints.

EX-9 To braze small tube/conduit joints.

4. Fitting Shop, Plumbing Shop & Fastening Shop:

EX-1 Study of materials, limits, fits and toterances.

EX-2 Introduction & demonstration of tools used in Fitting Shop.

EX-3 Hacksawing and chipping of M.S. flat. Filing and squaring of chipped M.S. job. Filing on square or rectangular M.S. piece.

EX-4 Making bolt & nut by tap and die set and make its joints

Ex-5 To drill a hole in M.S. Plate and taping the same to creat threads as per need.

EX-6 Utility article-to prepare double open mouth spanner for 18" hexagonal head of a bolt.

EX-7 Cutting and threading practice for using socket, elbow and tee etc. and to fit it on wooden practice board.

EX-8 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc.

EX-9 Practice of bolted joints

EX-10 To prepare a rivetted joint

EX-11 To make a pipe joint

EX-12 To make a threaded joint

EX-13 Practice of sleeve joint

5. Foundry Work

Ex-1 Study of metal and non metals
Ex-2 Study & sketch of the foundry tools.
Ex-3 Study & sketch of cupula & pit furnace.
Ex-4 To prepare the green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)
Ex-5 Casting of non ferous (lead or aluminium) as per exercise 3.

6. Smithy Shop :

EX-1 Study & Sketch of Tools used in smithy shop.
EX-2 To prepare square or rectangular piece by the M.S. rod.
EX-3 To make a ring with hook for wooden doors.
EX-4 Utility article-to preapre a ceiling fan hook.

7. Welding Shop :

EX-1 Introduction to welding, classinfication of welding, types of weld joints.
EX-2 Welding practice-gas and electric.
EX-3 Welding for lap joint after preparing the edge.
EX-4 Welding of Butt joint after preparation of the edge.
EX-5 'T' joint welding after preparation of edge.
EX-6 Spot welding, by spot welding machine.

8. Machine Shop

EX-1 Study & sketch of lathe machine.
EX-1 Study & sketch of grinders, milling M/c, Drilling M/c and CNC Machines
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.

Corrected and Approved By BTE 04.05.2017

II Semester

2.1 APPLIED MATHEMATICS I (B)

[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.	Integral Calculus-I	12	4	-
2.	Integral Calculus-II	12	4	-
3.	Coordinate Geometry (2 Dimensional)	10	3	-
4.	Coordinate Geometry (3 Dimensional)	8	3	-
		42	14	-

DETAILED CONTENTS:

1. INTEGRAL CALCULUS - I : (14 Marks)

Methods of Indefinite Integration :-

1.1 Integration by substitution.

1.2 Integration by rational function.

1.3 Integration by partial fraction.

1.4 Integration by parts.

2. INTEGRAL CALCULUS -II :(14 Marks)

2.1 Meaning and properties of definite integrals, Evaluation of definite integrals. Integration of special function.

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

2.3 Simposns 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases.

3. CO-ORDINATE GEOMETRY (2 DIMENSION):(14 Marks)

3.1 CIRCLE :

Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

3.2 Standard form and simple properties

Parabola x2=4ay, y2=4ax,

Corrected and Approved By BTE 04.05.2017

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

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

4. CO-ORDINATE GEOMETRY (3 DIMENSION):(8 Marks)

4.1 Straight lines and planes in space -

Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line and Plane (Different Forms),

4.2 Sphere $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz = d$ (Radius, Centre and General Equation)

2.2 APPLIED PHYSICS-II

[Common to All Engineering Courses]

L	T	P
3	2/2	4

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.	Optics	4	1	-
2.	Introduction To Fiber Optics	4	1	-
3.	Laser & its Application	4	1	-
4.	Electrostatics	4	1	-
5.	D.C. Circuits	4	1	-
6.	Magnetic Materials & Their Properties	4	1	-
7.	Semi Conductor Physics	4	1	-
8.	Introduction Diode & Transistors	4	2	-
9.	Introduction To Digital Electronics	4	2	-
10.	Non-conventional energy sources	6	3	-
		42	14	56

1. Optics (4 Marks)

Nature of light, Laws of Reflection and Refraction, Snell's

Law, Interference (Constructive and Deotructive), Diffraction and Polarization (Concept Only), Law of Mallus and Polaroids.

2. Introduction To Fibre Optics :(5 Marks)

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.

3. Lasers and its Applications (4 Marks)

Absorbtion and Emission of energy by atom, Spontaneous and Stimulated Emission, Poluation inversion, Main component of laser and types of laser- Ruby Laser, He-Ne laser and their applications. Introduction to MASER.

4. Electrostatics :(4 Marks)

Coutomb's Law, Electric field, Electric potential, Potential energy, Capacator, Energy of a charged capacitor, Effect of dielectric on capacators.

5. D.C. Circuits (5 Marks)

Ohm's Law, Kirchoff's Law and their simple application, Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); Carey Foster's bridge, potentiometer.

6. Magnetic Materials and Their Properties: (5 Marks)

Corrected and Approved By BTE 04.05.2017

Dia, Para and Ferro-magnetism, Ferrites, Magnatic Hysteresis Curve and its utility. Basic idea of super conductivity, Meissner's effect.

7. Semiconductor Physics (4 Marks)

Concept of Energy bands in soldis, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semi conductors, Electrons and holes as charge carriers in semiconductors, P-type and N-type semiconductors.

8. Junction Diode and Transister : (6 Marks)

Majority and Minority charge carriers,P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor-action, Base, emitter and collector currents and their relationship LED's.

9. Introduction To Digital Electronics : (6 Marks)

Concept of binary numbers, Interconversion from binary to decimal and decimal to binary. Concepts of Gates (AND, NOT, OR).

10. Non-conventional energy sources: (7 Marks)

(a) Wind energy : Introduction, scope and significance, measurement of wind velocty by anemometer, general principle of wind mill.

(b) Solar energy: Solar radiation and potentiality of solar radiation in India, uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector.

PHYSICS LAB

Note: Any 4 experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.

2. Determination of 'g' by plotting a graph T2 verses l and using the formula g=4n2/Slope of the graph line

3. Determine the force connstant of combinationof springs incase of 1. Series 2. Parallel.

4. To verify the series and parallel combination of Resistances with the help of meter bridge.

5. To determine the velocity of sound with the help of resonance tube.

6. Determination of viscosity coefficient of a lubricant by Stoke's law.

7. Determination of E1/E2 of cells by potentio meter.

8. Determination of specific resistance by Carry Foster bridge.

9. Determination of resitivity by P.O.Box.

10. Verification of Kirchoff's Law.

11. To draw Characteristics of p-n Junction diode.

12. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.

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.

2.3 APPLIED MECHANICS

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

[Also Common to Mechanical Engineering (Spacialization In Production Engineering]

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

L	T	P
5	1	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	4	1	
2.	System of Forces & General Condition of Equilibrium	18	4	
3.	Moment and Couple	8	1	
4.	Friction	8	1	

Corrected and Approved By BTE 04.05.2017

5.	Machines	8	1	
6.	Center of Gravity	8	2	
7.	Moment of Inertia	8	2	
8.	Beam & Trusses	8	2	
	Total	70	14	28

DETAILED CONTENTS

1. Introduction:

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

2.A. 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 praticle,conditions of equilibrium of coplaner concurrent force system.

B. 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.

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. Friction:

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

5. Machines:

Definition of a machine. Mechancial 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.

6. Centre of Gravity:

Concept, definition of centroid of plain figures and center of gravity of symmetrical solid bodies. Determination of centroid of plain and composite lamina using moment method only, Centroid of bodies with removed portion. Determination of center of 'gravity' of solid bodies - cone, cylinder, hemisphare and sphere, composite bodies and bodies with portion removed.

7. Moment of Inertia:

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical section : rectangle, triangle, circle (without derivations). Second moment of area for L, T, I and channel section, section of modulus.

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)

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).

9. To find out center of gravity of regular lamina.

10. To find out center of gravity of irregular lamina.

Corrected and Approved By BTE 04.05.2017

2.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L	T	P
6	-	4

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	4	-	-
4.	Electro Chemistry-I	7	-	-

Corrected and Approved By BTE 04.05.2017

5.	Electro Chemistry-II	8	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	4	-	-
8.	Solid State	4	-	-
9.	Fuels	4	-	-
10.	Water Treatment	6	-	-
11.	Colloidal State	4	-	-
12.	Lubricants	4	-	-
13.	Hydrocarbons	7	-	-
14.	Organic Reactions & Mechanism	8	-	-
15	Polymers	4	-	-
16	Synethetic Materials	6	-	-
		84	-	56

DETAILED CONTENTS:

1. ATOMIC STRUCTURE :(3 MARKS)

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

2. CHEMICAL BONDING :(4 MARKS)

Covalent bond, Ionic & Co-ordinate, Hydrogen bonding,
Valence bond theory, Hybridisation, VSEPR theory, Molecular
orbital theory.

3. CLASSIFICATION OF ELEMENTS :(3 MARKS)

Modern classification of elements (s,p,d and f blcok
elements), Periodic properties : Ionisation potential
electro negativity, Electron affinity.

4. ELECTRO CHEMISTRY-I:(3 MARKS)

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 numericals. Buffer solutions,
Indicators, Solubility product, Common ion effect with their
application,

5. ELECTRO CHEMISTRY-II:(3 MARKS)

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. Chemical and
Electrochemical theory of corrosion, Galvenic Series.
Prevention of corrosion by various method.

6. CHEMICAL KINETICS :(3 MARKS)

Law of mass action, order and molecularity of rection.
Activation energy, rate constants, Ist order reactions and
2nd order reactions.

7. CATALYSIS :(2 MARKS)

Definition Characteristics of catalytic reactions, Catalytic
promotors and poison , Autocatalysis and Negative catalysis,
Theory of catalysis, Application.

8. SOLID STATE :(2 MARKS)

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. FUELS :(3 MARKS)

Definition, its classification, high & low Calorific value.Determination of calorific value of solid and liquid fuels by Bomb calorimeter.

Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Disel and Petrol), Benzol and Power alchol. Knocking, Anti-knocking agents, Octane number and Cetane number.

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

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

Numerical Problems based on topics

10. WATER TREATMENT :(3 MARKS)

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, scale and sludge formation, Corrosion, Caustic embritlement, primming and foarming in biolers.

Disinfecting of Water By Chloramine-T, Ozone and Chlorine.

Advantage and disadvantage of chlorinational, Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Numerical Problems based on topics.

11. COLLOIDAL STATE OF MATTER :(3 MARKS)

Concept of collidal and its types, Different system of colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electrodialysis. 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.

12. LUBRICANTS :(3 MARKS)

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.

13. HYDROCARBONS:(4 MARKS)

A. Classification and IUPAC nomeuclature of organic compounds

hamologous series (Functional Group)

B. Preparation, properties and uses of Ethane, Ethene, Ethyne
(Acetylene), Benzene and Toluene.

14. ORGANIC REACTIONS & MECHANISM:(4 MARKS)

1. Fundamental auspects -

A. Electrophiles and nucleophiles, Reaction Intermediates,
Free radical, Carbocation, Carbanion
B. Inductive effect, Mesomeric effect, Electromeric effect.

2.A. Mechanism of addition reaction (Markonicove's Rule,
Cyanohydrin and Peroxide effect),

B. Mechanism of Substitution reactions; (Nucleophillic)
hydrolysis of alkyle halide, electrophillic substitution
halogenation, Sulphonation, Niration and friedel-Craft
reaction.

C. Mechanism of Elimination reaction - Dehydration of primary
alcohol, Dehyrohalogenation of primary alkyl halide.

15. POLYMERS :(3 MARKS)

1. Polymers and their classification. Average degree of
polymerisation, Average molecular weight, Free radical
polymerisation (Mechanisms)

2. Thermosetting and Thermoplastic resen -

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. General concept of Bio polymers, Biodegradable polymers and
inorganic polymers(Silicon)

16. SYNETHETIC MATERIALS :(4 MARKS)

A. Introduction - Fats and Oils
B. Saponification of fats and oils , Manufacturing of soap.
C. Synthetic detergents, types of detergents and its
manufacturing.
3. EXPLOSIVES: TNT, RDX, Dynamite.
4. Paint and Varnish

LIST OF PRACTICALS

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 Eriochroma black-T indicator.

4. To determine the strength of given HCl solution by titration against NaOH solution using Phenolphthalium as indicator.

5. To determine the Chloride content in supplied water sample by using Mohr's methods.

6. Determination of temporary hard ness of water sample by O-Hener's method.

2.5 ENGINEERING DRAWING

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

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

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

L	T	P
4	-	10

Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, draftmen and craftmen 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 perosonnel 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, providedto 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 refered 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 deversified fields of engineering. It is expected that at the end of this session, the students acqures 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	5	-	4
2. A.	Lettering techniques	3	-	16
B.	Introduction to scales	2	-	8
3.	Conventional Presentation	5	-	8
4. A.	Principles of projections	3	-	12
B.	Point Line, Plane	2	-	28
5.	Orthographic projection of simple geometrical solids	5	-	12
6.	Section of Solids	5	-	20
7.	Isometric Projection	5	-	20
8.	Free Hand Sketching	5	-	8
9.	Development of surfaces	5	-	24
10.	Orthographics Projection of Machine Parts	5	-	12
11.	Practice on Auto Cad	6	-	24
		56	-	140

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 Sheet

1.1 Introduction to various drawing, instruments. 1

1.2 Correct use and care of Instruments.

1.3 Sizes of drawing sheets and their layouts.

2. (a) Lettering Techniques 2 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 2 Sheet

Necesssity and use, R F

Types of scales used in general engineering drawing.

Plane, diagonal and chord scales.

3. Conventional Presentaion : 1 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 2 Sheet Geometrical Solids

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 referance planes.

(b) Orthographic views of simple composite solids from their isometric views.

(c) Exercises on missing surfaces and views

6. Section of Solids 2 Sheet

Concept of sectioning

Cases involving cutting plane parallel to one of the reference planes and prependicular to the others.

Cases involving cutting plane perpendicular to one of the reference planes and inclind 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 2 Sheet

Parallel line and radial line methods of developments.

Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).

10. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet

Nut and Bolt, Locking device, Wall bracket

11. PRACTICE ON AUTO CAD : 2 Sheet

Concept of AutoCAD, Tool bars in AutoCAD, Coordinate System, Snap, Grid and Ortho mode.Drawing Command - Point, Line, Arc, Circle, Ellipse. Editing Commands - Scale, Erase, Copy, Stretch, Lengthen and Explode. Dimensioning and Placing text in drawing area. Sectioning and hatching. Inquiry for different parameters of drawing.

NOTE :

A. The drawiang should include dimension with tolerence whereever 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

B. Practice on AutoCAD latest software is to be done in AutoCAD
lab of Mechanical Engineering Department of the Institute.

III SEMESTER

3.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L	T	P
5	2	-

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	16	6	-
2.	Differential Calculus	15	6	-
2.	Differential Equations	15	6	-
4.	Integral Calculus	12	5	-
5.	Probability & Statistics	12	5	-
		70	28	-

DETAILED CONTENTS

1. MATRICES :(12 Marks)

1.1 Algebra of Matrices, Inverse :

Corrected and Approved By BTE 04.05.2017

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.

Definition and Computation of inverse of a matrix.

1.2 Elementry 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 Eigen Pairs, Cayley-Hamilton Theorem :

Definition and evaluation of eign values and eign 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. DIFFERENTIAL CALCULUS :(10 Marks)

2.1 Function of two variables, identification of surfaces in space, conicoids

2.2 Partial Differentiation :

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

2.3 Vector Calculus :

Vector function, Introduction to double and triple integral, differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives.

3. DIFFERENTIAL EQUATION :(10 Marks)

3.1 Formation, Order, Degree, Types, Solution :

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

3.2 First Order Equations :

Variable seperable, equations reducible to seperable forms, Homogeneous equtions, equtions reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.

3.3 Higher Order Linear Equation :

Property of solution, Linear differential equation with constant coefficients (PI for X=eax, Sin ax, Cos ax, Xn, eaxV, XV.

3.4 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

4. INTEGRAL CALCULUS - II: (12 Marks)

4.1 Beta and Gamma Functions :

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

4.2 Fourier Series :

Fourier series of f(x),-n<x<n, Odd and even function,Half range series.

4.3 Laplace Transform :

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

5. PROBABILITY AND STATISTICS :(6 Marks)

5.1 Probability :

Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution :

Discrete and continuous distribution, Bionimal Distribution,

Poisson Distribution, Normal Distribution..

3.2 PIGMENTS AND EXTENDERS

L	T	P
5	2	0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	**UNITS**	**COVERAGE TIME**		
		L	**T**	**P**
1.	Introduction	10	5	-
2.	Inorganic Pigments	20	10	-
3.	Extenders	15	5	-
4.	Organic pigments	15	5	-
5.	Miscellaneous pigment	10	3	-
	TOTAL	**70**	**28**	**-**

DETAILED CONTENTS

1. INTRODUCTION:

Concept of colour phenomenom, classification of pigments, testing of pigments,oil absorption value, bulking value, sp. Gravity, refractive index, mass tone, reducing power, tinting strength, resistance to heat. Definition of pigment Dyes, dyes stuffs, toners and lake pigment etc.

2. INORGANIC PIGMENTS:
(A)- White pigment such as titanium di-oxides, zinc oxide, Zinc Sulphate, Lithopone etc.
(B)- Color pigments natural and synthetic iron oxide, lead chromate , silico chromatees and molybdates, chromegreen, chromium oxide, cadmium pigments, Prussian and ultramarine blue,black, mercuric sulphide, synthetic inorganic complexes etc.
(C)- Metallic pigments such as aluminium, Zinc, copper alloys, stainless steel etc., anti corrosive pigments such red lead, silicon chromate, zinc and strontium chromate white molybdates, calcium plumbate etc. Functional and miscellaneous pigments such as cuprous and mercuric oxides, barium meta borate, nacreous luminescent, etc.

3. EXTENDERS:
Sources, manufacture, properties and uses of extenders pigments such as carbonates, silicates, sulphates, oxides, aluminates etc. Lead carbonate, sulphate, silicate etc, antimony oxides, zirconium oxide and silicate, potassium titanate etc.

4. ORGANIC PIGMENTS:
Natural organic pigments, comparison of organic pigments and inorganic pigments General method of preparation and classification of synthetic organic pigment. Basic and acid dye pigment.

5. MISCELLANEOUS PIGMENTS:
Phthalocyanine blue and green, honsa yellows rubine, tonnrs, para reds.toludine, metallic, phosphorocent, flouroescent pearl pigments, treated pigments.Testing and identification of organic pigments.

3.3 DRYING OILS & PAINT MEDIA

L	T	P
5	2	6

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	10	5	-
2.	Driers	15	6	-
3.	Solvents	15	6	-
4.	Plasticizers	15	6	-
5.	Additives	15	5	-
	TOTAL	**70**	**28**	**84**

DETAILED CONTENTS

1. INTRODUCTION:

Properties and uses of some commonly used drying, semi drying & non drying oils, yellowing of oils modified oils like heat treated oils, maleinised oils, co polymerized oils, dehydrated castor oils, isomerized oils, reconstituted oils etc.

2. DRIERS:

Definition of driers, types of driers like primary, secondary and auxillary. Function of metals as well as, acid part of driers, driers mechanisms, manufacture of driers, their evaluation and recommendation for water based and solvent based coatings, combination and dosage of driers, properties of different metal as well as organic radical of driers.

3. SOLVENTS:

Types of volatile solvents, general properties of solvents like solvent power, toxicity rate of evaporation, boiling point-aromatic content, etc classification like true solvents, latent solvents and diluents, effect of solvent on film properties,

classes of solvents with their sources, properties, evaluation of solvents, solubility parameters.

4. PLASTICIZERS:

Definition, importance, mechanism of plasticization, types of plasticizers with their properties, evaluation of plasticizers.

5. ADDITIVES:

Function of additives, additives for solvent-thinned coating like wetting, and dispersing agents, anti settling and bodying agents, anti skinning agents, anti flooding agents etc, additives for latex paints like surface – active agents, antifoam agents, emulsifier, thickening agents, preservatives coalescing agents etc.

DRYING OILS & PAINT MEDIA LAB

1. Testing of pigments and extenders such as oil absorption value, bulkins value, tinting strength, reducing power, mass tone, etc.
2. Preparation and testing of rosin modification such as ester gum, maleic resins, etc.
3. Preparation and testing of synthetic resins such as alkyds, etc.
4. Preparation & testing of stand oils.
5. Preparation & testing of dehydrated castor oils (DCO).
6. Testing of volatile solvent for Distillation Range.
7. Testing of volatile solvent for Flash Point.

3.4 ELECTRICAL TECHNOLOGY & ELECTRONICS

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

L	T	P
5	2	4

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 introuce 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	3	1	-
2.	A. C. Theory	5	3	-
3.	Three Phase Circuits	5	3	-
4.	Measurement & Measuring Instruments	12	4	
5.	Electronics	12	4	-
6.	D. C. Machines	8	3	-
7.	Transformers	5	2	-
8.	Synchronous Machines	5	2	-
9.	Induction Motors	6	2	-
10.	Electro Heating	6	3	-
11.	Electro Plating	3	1	-
		70	28	56

DETAILED CONTENTS

Corrected and Approved By BTE 04.05.2017

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, Instantneous, Average, R.M.S. maximum values of sinosoidal wave. Form factor, peak factor.

Representation of a sinosoidal 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. Engery Meter.

(iii) Measurement of power in a single phase and three phase circuits by wattmeter, Use fo 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 at an amplifier (Brief description only). Prniciple

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, Elementry 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 equipement 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 od Silicon Controled Rectifier (SCR).
15. Testing of electrical devices - Zenor, Diode, Transistor, FET, UJT, SCR.

16. Use of operational amplifier as adder, substractor, comparator, differentiator and integrators.

3.5 INTRODUCTION TO COMPUTER

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

L	T	P
2	-	5

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

Corrected and Approved By BTE 04.05.2017

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	4	-	-
2.	Introduction To Operating System (MS DOS/Windows)	3	-	-
3.	Word Processing	4	-	-
4.	Worksheet	4	-	-
5.	Presentation	4	-	-
6.	Data Base Operation	3	-	-
7.	Introduction to Internet	2	-	-
8.	Introduction to advance tools	4	-	-
		28	-	70

DETAILED CONTENTS

1. Introduction to Computer:

   A. Block Diagram of Computer.
   B. Types Of Computer
   C. Types of Input and Output devices
   D. Memories Devices (Its Types and Basic).

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

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

3. WORD PROCESSING:

Corrected and Approved By BTE 04.05.2017

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.
Mail Merge

4. WORKSHEET:

Introduction, Use of Tools/Icons for preparing simple
Mini Project.

5. PRESENTATION :

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

6. DATABASE OPERATION :

Create database using MS Access, Create Table and Creating Reports.

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. INTRODUCTION TO ADVANCE TOOLS :

I. Steps requires to solving problems.
A. Flow Chart
B. Algroithm
C. Programming

II. Use of advance Tools such as Skype, Teamviewer, Installation of Modem, use of WiFi, Etc.

INTRODUCTION TO COMPUTER LAB

List Of Practicals

1. Practice on utility commands in DOS.

2. Composing, Correcting, Formatting and Article (Letter/Essay/ Report) on Word Processing tool Word and taking its print out.

3. Creating, editing, modifying tables in Database tool.

4. Creating labels, report, generation of simple forms in Database tool.

5. Creating simple spread sheet, using in built functions in Worksheet tool..

Corrected and Approved By BTE 04.05.2017

6. Creating simple presentation.

7. Creating mail ID, Checking mail box, sending/replying e-mails.

8. Surfing web sites, using search engines.

Note : In the final year, related students have to use the concept of MS Word/MS Excel/MS Access/ MS Power Point in their respective branch's project work such as creating project report through MS Word/Creation of statistical data in MS Excel/Creation of database in MS Excel/ Demonstration of project through Power Point Presentation.

IV Semester

4.1 Functional Communication

L	T	P
4	-	-

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Time	Coverage L	T	P
Section A English					
1.	On Communication		04	-	-
2.	Exploring Space	04	-	-	
3.	Sir C.V. Raman		04	-	-
4.	Professional Development		04	-	-
5.	Buying a Second Hand Bicycle		04	-	-
6.	Leadership and Supervision		04	-	-
7.	First Aid	03	-	-	
8.	The Romanance of Reading		03	-	-
9.	No Escape from Computers		03	-	-
10.	Bureau of Indian Standards		03	-	-
Section B Hindi					
1.	Topic 1		02	-	-
2.	Topic 2		02	-	-
3.	Topic 3		02	-	-
4.	Topic 4		02	-	-
5.	Topic 5		02	-	-
6.	Topic 6		02	-	-
7.	Topic 7		02	-	-
8.	Topic 8		01	-	-
9.	Topic 9		02	-	-
10.	Topic 10		02	-	-
11.	Topic 11		01	-	-
		56	-	-	

Section “A” (English)

Corrected and Approved By BTE 04.05.2017

Text Lessons

Unit I.	On Communication
Unit.II	Exploring Space
Unit.III	Sir C.V. Raman
Unit.IV	Professional Development of Technicians
Unit.V	Buying a Second Hand Bicycle
Unit.VI	Leadership and Supervision
Unit.VII	First Aid
Unit.VIII	The Romanance of Reading
Unit.IX	No Escape from Computers
Unit.X	Bureau of Indian Standards

Section "B" Hindi

1– स्वरोजगार
2– भारतीय वैज्ञानिकों एवं तकनीकियों का भारत के विकास में योगदान
3– ग्राम्य विकास
4– परिवार नियोजन
5– सामाजिक संस्थायें
6– नियोजन और जन कल्याण
7– भारत में प्रौद्यौगिकी के विकास का इतिहास
8– हरित कांन्ति
9– पर्यावरण एवं मानव प्रदूषण
10–श्रमिक कल्याण
11–भारत में श्रमिक आन्दोलन

Corrected and Approved By BTE 04.05.2017

4.2 NATURAL & SYNTHETIC RESINS

L T P

5 2 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction to natural resins	6	3	-
2.	Shellac	6	2	-
3.	Cellulosic and Bitumens	6	2	-
4.	Fundamental of Synthetic film formers	7	3	-
5.	Alkyd & Phenolic Resins	12	5	-
6.	Amino resins and epoxy resins	12	5	-
7.	Polyurethane & Silicon Resins	12	5	-
8.	Vinyl and acrylic resins	9	3	-
	TOTAL	**70**	**28**	**-**

DETAILED CONTENTS

1.INTRODUCTION TO NATURAL RESINS :

Classification and properties of natural resins etc, Resins sources, oleoresin and its composition, properties and deficiencies of rosin film, modification of rosin, calcium rosinate and maleoprimaric acid from rosin etc, Identification of rosin.

2. SHELLAC:

Shellac: orgin, extraction of lac, different kinds of lac and their properties, composition of lac, chemical modification of shellac for use in coatings , French polish, leather finishes, Oleoresinous varnishes etc, from shellac.

3. CELLULOSIC AND BITUMENS:

Cellulose source, properties, modification of cellulose for use in surface coatings like cellulose esters, ethers. Bitumen, pitches, gums and glues, natural bitumens like gilosonite and petroleum pitches general properties and uses of gums and glues.

4. FUNDAMENTAL OF SYNTHETIC FILM FORMERS:

Fundamental of film formers, chemical structures of monomers, functionality and its determination, polymerization and molecular weight, convertible, non- convertible film formers, linear, branched and cross linked film formers and co polymers.

5. ALKYD RESIN AND PHENOLIC RESINS
:

Alkyd resin, raw material, chemistry and formulation of various alkyds, manufacturing process classification, properties and application of various types alkyds, modification of alkyd such as co-polymerized alkyds, natural & synthetic resins modified alkyds, water soluble alkyds, polyester resin, saturated polyesters, components and formulation of unsaturated polyester resin, curing mechanism, properties and application of polyester resin, water soluble polyesters,.
Phenolic resins, classification, types of phenols used, reaction of phenol and formaldehyde, novolac and resoles, resin production, properties and application of various phenolics, water souble phenolics.

6. AMINO RESINS AND EPOXY RESINS:

Amino resin : urea formaldehyde and melamine formaldehyde resins, formulation of methylol products, alkylation and curing reaction, properties and application in surface coatings & water soluble and other amino resins. chemistry of epoxy resins,

epoxy resin manufacture, formulation of two pack system like solvent based coatings solvent less, high solids coating, single pack epoxies like epoxy ester thermoplastic epoxy etc, various epoxy modified resin and their application water soluble epoxies, polyamide resins, poly amines and acids used, dimerised fatty acids, properties and application of various polyamides.

7. POLYURETHANE AND SILICONE RESINS:

Poly urethanes: various isocynates used, reaction of the isocynate group and their hazards, classification of poly urethanes, properties and application of various single and two pack systems; silicone resin; synthesis of silicone resin's, structure and properties relationship, modified silicone, properties and application of silicone resins.

8. VINYL AND ACRYLIC RESINS:

A. Vinyl and acrylic : vinyl and acrylic monomers type of vinyl resin used in surface coating . Vinyl co polymer and their properties, thermo plastic and thermo settling acrylics, water soluble acrylics.
B. Other Resins - Hydro carbon resin , coumarone and indene resins, resins from petroleum products, terpene resins, miscellaneous resins : fluoro polymers, ketone resins, poly carbonate etc.

4.3-CONVENTIONAL AND NON CONVENTIONAL SOURCE OF ENERGY

L	T	P
5	2	-

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. The student will enhance their knowledge in the field of fuel technologies related to chemical industries.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
PART-A	: CONVENTIONAL ENERGY SOURCE			
1.	Introduction	4	2	-
2.	Solid Fuels	10	3	-
3.	Liquid Fuels	10	3	-
4.	Gaseous Fuels	8	2	-
5.	Combustion Calculation	8	2	-
PART-B	: NON CONVENTIONAL ENERGY SOURCE			
1.	Solar Energy	5	2	-
2.	Wind Energy	5	2	-
3.	Bio Energy	5	3	-
4.	Hydro Energy	5	3	-
5.	Geothremal Energy	5	3	-
6.	Wave and Tidal Energy	5	3	-
	Total	70	28	-

Corrected and Approved By BTE 04.05.2017

DETAILED CONTENTS

PART-A : CONVENTIONAL ENERGY SOURCE

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, Biogas, Biomass, GNG, PNG.

(ii) Properties (Sp. gravity, 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 : NON CONVENTIONAL ENERGY SOURCE

1. SOLAR ENERGY:

Energy from the Sun, Application of solar technology : Solar thermal, Electricity production, Fuel production, Energy storage methods.

2. WIND ENERGY :

Source of wind energy, Wind power : Types of wind power, Wind power industry : Wind forms, wind turbine.

3. BIO ENERGY:

Resource of Bio energy, Solid biobass, Electricity generation from biomass, Bio energy product.

4. HYDRO ENERGY:

Types of Hydropower, Advantage and disadvantages of hydroenergy

5. GEOTHERMAL ENERGY:

Types of Geothermal energy, Resources, Production, Renewability and sutainability.

6. WAVE AND TIDAL ENERGY:
Generation of Tidal energy and wave energy. Generating methods, Difference between wave and tidal energy.

REFERENCE BOOKS

1. Nonconventional Energy Resources by D. S. Chauhan

2. Thermal Engineering by R. K. Rajpoot

3. Fundamental of Renewable Energy System by D. Muknergy

4.4-FLUID MECHANICS & SOLID HANDLING

L	T	P
6	2	8

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. 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, filteration & mixing equipments. 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
A-				
1.	Fluids	6	1	-
2.	Flow of incompressible fluids	12	3	-
3.	Measurement of flowing fluids	12	3	-
4.	Transportation of fluids	12	4	-
B-				
1.	Introduction	5	3	-
2.	Characterisation of Solid Particles	5	2	-
3.	Size Reduction	6	2	-
4.	Handling of Solids	8	3	-
5.	Mechanical Separation	6	3	-
6.	Mixing Equipments	12	4	-

Total	84	28	112

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 Newtonion fluid.

(ii) Reynold No.Elementry knowledge of laminar and turbulent flow, Reynold experiment.

(iii) Continuity equations, Bernaulli'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 mumerical problems, Definition:- Cofficient of contraction, Coefficient of velocity, coefficient of discharge (Simple numerical problems).

4. TRANSPORTATION OF FLUIDS:

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

PART - B

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, Grizzles, trommels.

3. SIZE REDUCTION:

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

4. HANDLING OF SOLIDS:

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

5. MECHANICAL SEPARATIONS:

(i) Types of filtration equipement, 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.

FLUID MECHANICS & SOLID HANDLING 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 (Cv), coefficient of discharge (Cd),coefficient of contraction (Cc) 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.

12. To study and draw a sketch of Chemical Engineering lab.
13. To analyse the given sample on a set of screens and report the analysis.
14. To determine the critical speed of a ball mill.

15. To determine the efficiency of disintegrator.
16. To determine filteration constant by a plate and frame filter press.
17. To determine the rate of settling of slurries of various concentration draw a height VS time curve.
18. To determine the efficiency of Jaw crusher.
19. To study and sketch a Rotary filter.

Corrected and Approved By BTE 04.05.2017

4.5-PROCESS PLANT UTILITIES

L	T	P
4	2	-

Air, water and steam are principal plant utilities in any chemical process. Detailed knowledge concerning these utilities will enable the superviser 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	6	3	--
2.	Types of fuels used in boilers	2	1	--
3.	Steam Generator.	6	3	--
4.	Steam Distribution	6	3	--
5.	Pressure & Vaccum system	6	3	--
6.	Water	6	3	--
7.	Water Treatment Technique	8	4	--
8.	Demmiralization	8	4	--
9.	Cooling Water	8	4	--
	Total	56	28	--

DETAILED CONTENTS

1. GENERATION, PROCESS & STEAM PROPERTIES :

Generations of steam at constant pressure, phases of

Corrected and Approved By BTE 04.05.2017

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:

Types of process furnaces and its classification,Method of firing,
Types of Burners, 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, Trouble shooting of problems (No numerical question).

4. STEAM DISTRIBUTION:

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

5. PRESSURE & VACCUM SYSTEM:

COnstruction 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, filteration, 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.

REFERENCE BOOKS

1. Engineering Chemistry by P. C. Jain
2. Unit Operation of Chemical Engg. by Macabe and Smith
3. Thermal Environmental Engineering by J . K. Thiked

4.6 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

DETAILED CONTENTS

1. **Basics of Energy**

   1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
   1.2 Global fuel reserve
   1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
   1.4 Impact of energy usage on climate

2. **Energy Conservation and EC Act 2001**

   2.1 Introduction to energy management, energy conservation, energy efficiency and its need
   2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
   2.3 Standards and Labeling
      2.3.1 Concept of star rating and its importance
      2.3.2 Types of product available for star rating

3. **Electrical Supply System and Motors**

   3.1 Types of electrical supply system
   3.2 Single line diagram

Corrected and Approved By BTE 04.05.2017

3.3 Losses in electrical power distribution system

3.4 Understanding Electricity Bill

3.4.1 Transformers Tariff structure

3.4.2 Components of power (kW, kVA and kVAR) and power factor, improvement of power factor

3.4.3 Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)

3.5 Transformers

3.5.1 Introduction

3.5.2 Losses in transformer

3.5.3 Transformer Loading

3.5.4 Tips for energy savings in transformers

3.6 Electric Motors

3.6.1 Types of motors

3.6.2 Losses in induction motors

3.6.3 Features and characteristics of energy efficient motors

3.6.4 Estimation of motor loading

3.6.5 Variation in efficiency and power factor with loading

3.6.6 Tips for energy savings in motors

4. Energy Efficiency in Electrical Utilities

4.1 Pumps

4.1.1 Introduction to pump and its applications

4.1.2 Efficient pumping system operation

4.1.3 Energy efficiency in agriculture pumps

4.1.4 Tips for energy saving in pumps

4.2 Compressed Air System

4.2.1 Types of air compressor and its applications

4.2.2 Leakage test

4.2.3 Energy saving opportunities in compressors.

4.3 Energy Conservation in HVAC and Refrigeration System

4.3.1 Introduction

4.3.2 Concept of Energy Efficiency Ratio (EER)

4.3.3 Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5 Lighting and DG Systems

5.1 Lighting Systems

5.1.1 Basic definitions- Lux, lumen and efficacy
5.1.2 Types of different lamps and their features
5.1.3 Energy efficient practices in lighting

5.2 DG Systems
5.2.1 Introduction
5.2.2 Energy efficiency opportunities in DG systems
5.2.3 Loading estimation

6 Energy Efficiency in Thermal Utilities

6.1 Thermal Basics
6.1.1 Types of fuels
6.1.2 Thermal energy
6.1.3 Energy content in fuels
6.1.4 Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

6.2 Energy Conservation in boilers and furnaces
6.2.1 Introduction and types of boilers
6.2.2 Energy performance assessment of boilers
6.2.3 Concept of stoichiometric air and excess air for combustion
6.2.4 Energy conservation in boilers and furnaces
6.2.5 Do's and Don'ts for efficient use of boilers and furnaces

6.3 Cooling Towers
6.3.1 Basic concept of cooling towers
6.3.2 Tips for energy savings in cooling towers

6.4 Efficient Steam Utilization

7 Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features
7.2 Tips for energy savings in buildings
7.2.1 New Buildings
7.2.2 Existing Buildings

8 Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery
8.2 Concept and types of co-generation system

9 General Energy Saving Tips

Energy saving tips in:

9.1 Lighting
9.2 Room Air Conditioner
9.3 Refrigerator
9.4 Water Heater
9.5 Computer
9.6 Fan, Heater, Blower and Washing Machine
9.7 Colour Television
9.8 Water Pump
9.9 Cooking
9.10 Transport

10 Energy Audit

10.1 Types and methodology
10.2 Energy audit instruments
10.3 Energy auditing reporting format

PRACTICAL EXERCISES

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

V SEMESTER

5.1 INTEGRATIVE COMMUNICATION

L	T	P
-	-	4

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction to Personality Development	-	-	02
2.	Factors Influencing / Shaping Personality	-	-	02
3.	Self Awareness – 1	-	-	03
4.	Self Awareness – 2	-	-	02
5.	Self Awareness – 3	-	-	02
6.	Change Your Mind Set	-	-	02
7.	Interpersonal Relationship and Communication	-	-	03
8.	Non-Verbal communication Communication Skills	-	-	02
9 .	Communication Skills ACTIVITIES	-	-	06
10.	Body Language skills	-	-	03
11.	Leadership Traits & Skills	-	-	03
12.	Attitude	-	-	03
13.	Analyzing & Solving a Problem skills	-	-	02
14.	Time Management skills	-	-	03
15.	Stress Management Skills	-	-	02
16.	Interview Skills	-	-	04
17.	Conflict Motives	-	-	02
18.	Negotiation / Influencing Skills	-	-	02
19.	Sociability	-	-	03
20.	Importance of Group	-	-	03
21.	Values / Code of Ethics	-	-	02

Corrected and Approved By BTE 04.05.2017

PERSONALITY DEVELOPMENT

1 Introduction to Personality Development

AIM, Skills, Types of Skills, LIFE SKILLS VS OTHER SKILLS, Concept of Life Skills. Ten core Life Skills identified by WHO

2. **Factors Influencing / Shaping Personality :**

Introduction, Physical and Social Factors Influencing / Shaping Personality (Hereditary, Self-Development, Environment, Education, Life-situations) Psychological AND Philosophical Factors Influencing / Shaping Personality (Past Experiences, Dreams and Ambitions, Self-Image, Values)

3. **Self Awareness – 1**

DIMENSIONS OF SELF AWARENESS (Self Realization, Self Knowledge or Self Exploration, Self Confidence, Self Talk, Self Motivation, Self Esteem, Self Image, Self Control, Self Purpose, Individuality and Uniqueness, Personality, Values, Attitude, Character), SELF REALIZATION AND SELF EXPLORATION THROUGH SWOT ANALYSIS AND JOHARI WINDOW,

4. **Self Awareness – 2**

SYMPATHY VS EMPATHY AND ALTRUISM, Importance ofEmpathizing with Others,

5. **Self Awareness – 3**

Self-Awareness through Activity, Body Image (What is Body Image, What Decides our Body Image, What is Poor Body Image, What are the Harmful Effects of Poor Body Image), Tackling Poor Body Image(Enhance Self-Esteem, Build Up Critical Thinking, Build up Positive Qualities, Understand Cultural Variation, Dispel Myths, Utilize Life Skills)

6. **Change Your Mind Set**

What is Mindset, HOW TO CHANGE YOUR MINDSET (Get the Best Information Only, Make the best people your Role Model, Examine Your Current Beliefs, Shape Your Mindset with Vision

and Goals, Find Your Voice, Protect Your Mindset, Let Go of Comparisons, Put An End To Perfectionism, Look At The Evidence, Redefine What Failure Means, Stop Worrying About What "People" Think)

INTERPERSONAL SKILLS

7. **Interpersonal Relationship and Communication**

INTERPERSONAL RELATIONSHIP , Forms of Interpersonal Relationship, Must Have in an Interpersonal Relationship, Interpersonal Relationship between a Man and a Woman (Passion, Intimacy, Commitment), Relationship Between Friends, ROLE OF COMMUNICATION IN INTERPERSONAL RELATIONSHIP (Take Care Of Your Tone And Pitch, Choice of Words is Important in Relationships, Interact Regularly, Be Polite, Try To Understand The Other Person's Point Of View As Well, Individuals Can Also Communicate Through Emails,

8. **NON-VERBAL COMMUNICATION Communication Skills**

Non-Verbal Communication, We Communicate with Our Eyes, Communication with Facial Expression, A Good Gesture, Appearance, Posture and Gait, Proximity and Touch), IMPORTANCE OF LISTENING, Characteristics of Good and Effective Listener(Is Attentive, Do Not Assume, Listen for Feelings and Facts, Concentrate on the Other Speakers Kindly and Generously, Opportunities)

9. **Communication Skills ACTIVITIES –**

Activities in Making Collages, Making Advertisements, PPT Preparation & Presentation, Speaking -Seminars, Group Discussions, Debates, Extempore Speeches, Listening to an audio clip and telling its gist, Answering a telephone call, Making enquiries, General tips- Pronunciation, Tone, Pitch, Pace, Volume, relevance, brief, simple Reading Newspaper, Magazines (Current Affairs, Economic magazines, Technical magazines), How to read a report, article, Writing- Resume Writing, Writing joining report, Notice writing, Report making, Proposal writing, Advertisement, Notice for tender, Minutes writing, E-Mail writing,

Listening News, Listening to audio clips.(Lecture, poetry, speech, songs),

10. Body Language skills

Introduction, What is Body Language , Body Language Parts, Personal Space Distances (Intimate Distance, Personal Distance, Social Distance, Public Distance), IMPORTANT BODY LANGUAGE SIGNS AND THEIR MEANING

UNDERSTANDING OTHERS

11. **Leadership Traits & Skills :**

Introduction, Important Leadership Traits (Alertness, Bearing, Courage, Decisiveness, Dependability, Endurance, Enthusiasm, Initiative, Integrity, Judgment, Justice, Knowledge, Loyalty, Sense of Humour), Other Useful traits (Truthfulness, Esprit-de-corps, Unselfishness, Humility and sympathy, Tact without loss of moral courage, Patience and a sense of urgency as appropriate, Selfconfidence, Maturity, Mental including emotional stability)

12. **Attitude**

Types of Attitude, Components of Attitudes (Cognitive Component, Affective Component, Behavioral Component), Types of Attitudes (Positive Attitude, Negative Attitude, Neutral Attitude, Rebellious Attitude, Rational and Irrational Attitudes, Individual and Social Attitudes), Kinds of Attitude, ASSERTIVENESS, How to Develop Assertiveness (Experiment and Try New Things, Extend Your Social Circle, Learn to Make Decisions for Yourself, Indulge in Knowledge, Admire Yourself & Others), Negotiation (Be Sensitive to The Needs Others, Be Willing To Compromise, Develop Your Problem-Solving Skills, Learn to Welcome Conflict, Practice Patience, Increase Your Tolerance For Stress, Improve Your Listening Skills, Learn To Identify Bottom-Line Issues Quickly, Be Assertive, Not Aggressive)

PROBLEM SOLVING

13. **Analyzing & Solving a Problem skills**

Critical Thinking, Creative Thinking, Decision Making, Goal Setting & Planning, Problem Solving

14. **Time Management skills**

Need of Time Management, TIME WASTERS (Telephone, Visitors , Paper work, Lack of Planning & Fire Fighting , Socializing , Indecision , TV , Procrastination), PRINCIPLES OF TIME MANAGEMENT - Develop a Personal Sense of Time (Time Log , value of other people's time), Identify Long-Term Goals , Concentrate on High Return Activities , Weekly & Daily Planning (The Mechanics of Weekly Planning , Daily Planning), Make the Best Use of Your Best Time , Organize Office Work (Controlling Interruptions , Organizing Paper Work), Manage Meetings, Delegate Effectively, Make Use of Committed Time, Manage Your Health,

15. **Stress Management Skills**

INTRODUCTION, Understanding Stress and its Impact, Expected Responses (Physical, Emotional, Behavioral), stress signals(thoughts, feelings, behaviors and physical), STRESS MANAGEMENT TECHNIQUES (Take Deep Breath, Talk It Out, Take A Break, Create a Quite Place in Your Mind, Pay Attention to Physical Comfort, Move, Take Care of Your Body, Laugh, Mange Your Time, Know Your Limits, Do You Have To Be Right Always, Have A Good Cry, Look for the Good Things Around You, Talk Less, Listen More), UNDERSTANDING EMOTIONS AND FEELINGS-through Activity

16. **Interview Skills (2 sessions from Industry Expert is Compulsory)**

Curriculum Vitae (When Should a CV be Used, What Information Should a CV Include, personal profile, Covering Letter, What Makes a Good CV, How Long Should a CV Be, Tips on Presentation), Different Types of CV (Chronological, Skills-Based), BEFORE THE INTERVIEW , CONDUCTING

YOURSELF DURING THE INTERVIEW , FOLLOWING THROUGH AFTER THE INTERVIEW , Interview Questions To Think About , MOCK INTERVIEW – Activity (MOCK INTERVIEW EVALUATION - NON-VERBAL BEHAVIORS, VERBAL BEHAVIORS, General Etiquettes to face the Board , Telephonic interview

17. **Conflict Motives –Resolution**

Motives of Conflict(Competition for Limited Resources, The Generation Gap and Personality Clashes, Aggressive Personalities, Culturally Diverse Teams, Competing Work and Family Demands, Gender Based Harassment), Merits and Demerits of Conflict , Levels of Conflict (Interpersonal Conflict, Role Conflict, Inter-group Conflict, Multi-Party Conflict, International Conflict), Methods of Conflict Resolution (The Win-Lose Approach, The Lose-Lose Strategy, The Win-Win Approach), Techniques for Resolving Conflicts (Confrontation and Problem Solving Leading to Win-Win, Disarm the Opposition, Cognitive Restructuring, Appeal to Third Party, The Grievance Procedure)

18. **Negotiation / Influencing Skills**

Why Influencing, What Is Influencing, TYPES OF INFLUENCING SKILLS (Probing And Listening, Building Rapport, Sign Posting, Pacing, Selling, Assertiveness), LAWS AND PRINCIPLES OF INFLUENCE, The Six Laws of Influence (The Law of Scarcity, The Law of Reciprocity, The Law of Authority, The Law of Liking, The Law of Social Proof, The Law of Commitment and Consistency), Influencing Principles (Making a Start, Buy Yourself Thinking Time, Dealing With Disagreement, Difficult And Sensitive Situations)

19. **Sociability : Etiquettes And Mannerism & Social Skills**

Need for Etiquette , Types of Etiquettes (Social Etiquette, Bathroom Etiquette, Corporate Etiquette, Wedding Etiquette, Meeting Etiquette, Telephone Etiquette, Eating Etiquette, Business Etiquette, E-Mail Etiquettes,), MANNERISMS, HOW TO IMPROVE YOUR SOCIAL SKILLS (Be Yourself, Be

Responsible, Be Open & Approachable, Be Attentive, Be Polite,
Be Aware, Be Cautious)

20. Importance of Group / Cross Cultural Teams / Team Work skills **I**ntroduction, Types and Characteristics of Groups (Definition of a
Group, Classification / Types of Groups, Friendship Group, Task
Group, Formal Groups, Informal Group, Effective Group), Importance of a Group, Characteristics of a Mature Group, TYPES AND CHARACTERISTICS OF A TEAM (Definition of a Team, Types of Teams, Functional Teams, Problem Solving Teams, Cross - Functional Teams, Self - Managed Teams), Importance of a Team, Characteristics of a Team

21. VALUES / CODE OF ETHICS
Meaning, A FEW IMPORTANT VALUES (Honesty, Integrity, Purity, Discipline, Selflessness, Loyalty, Fairness, Equality, Trust,
Support, Respect, etc)

Note : One Orientation module for the faculty is must.
Involvement of Industry Experts is necessary for Interview Skills

5.2 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
6	**2**	**-**

RATIONALE

The knowledge of this subject is required for all engineers/technicians who wish to choose industry/field as their career. This course is designed to develop understanding of various functions of management, role of workers and engineers and providing knowledge about industrial and tax laws.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Principles of Management	8	-	-
2.	Human Resource Development	10	-	-
3.	Wages and Incentives	4	-	-
4.	Human and Industrial Relations	6	-	-
5.	Professional Ethics	2	-	-
6.	Sales and Marketing management	10	-	-
7.	Labour Legislation Act	10	-	-
8.	Material Management	8	-	-
9.	Financial Management	8	-	-
10.	Entrepreneurship Development	8	-	-
11.	Fundamental of Economics	5	-	-
12.	Accidents and Safety	5	-	-
		84	-	-

DETAILED CONTENTS

1. **Principles of Management**

Corrected and Approved By BTE 04.05.2017

1.1 Management, Different Functions: Planning, Organising, Leading, Controlling.
1.2 Organizational Structure, Types, Functions of different departments.
1.3 Motivation: Factors, characteristics, methods of improving motivation, incentives, pay, promotion, rewards, job satisfaction, job enrichment.
1.4 Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader, promoting team work.

2. **Human Resource Development**

2.1 Introduction, objectives and functions of human resource development (HRD) department.
2.2 Recruitment, methods of selection, training strategies and career development.
2.3 Responsibilities of human resource management – policies and functions, selection – Mode of selection – Procedure – training of workers, Job evaluation and Merit rating.

3. **Wages and Incentives**

3.1 Definition and factors affecting wages, methods of wage payment.
3.2 Wage incentive – type of incentive, difference in wage, incentive and bonus; incentives of supervisor.
3.3 Job evaluation and merit rating.

4. **Human and Industrial Relations**

4.1 Industrial relations and disputes.
4.2 Relations with subordinates, peers and superiors.
4.3 Characteristics of group behaviour and trade unionism.
4.4 Mob psychology.
4.5 Grievance, Handling of grievances.
4.6 Agitations, strikes, Lockouts, Picketing and Gherao.
4.7 Labour welfare schemes.
4.8 Workers' participation in management.

5. **Professional Ethics**

5.1 Concept of professional ethics.
5.2 Need for code of professional ethics.
5.3 Professional bodies and their role.

6. **Sales and Marketing management**

6.1 Functions and duties of sales department.
6.2 Sales forecasting, sales promotion, advertisement and after sale services.
6.3 Concept of marketing.
6.4 Problems of marketing.

Corrected and Approved By BTE 04.05.2017

6.5 Pricing policy, break even analysis.
6.6 Distribution channels and methods of marketing.

7. **Labour Legislation Act (as amended on date)**
7.1 Factory Act 1948.
7.2 Workmen's Compensation Act 1923.
7.3 Apprentices Act 1961.
7.4 PF Act, ESI Act.
7.5 Industrial Dispute Act 1947.
7.6 Employers State Insurance Act 1948.
7.7 Payment of Wages Act, 1936.
7.8 Intellectual Property Rights Act

8. **Material Management**
8.1 Inventory control models.
8.2 ABC Analysis, Safety stock, Economic ordering quantity.
8.3 Stores equipment, Stores records, purchasing procedures, Bin card, Cardex.
8.4 Material handling techniques.

9. **Financial Management**
9.1 Importance of ledger and cash book.
9.2 Profit and loss Account, Balance sheet.
9.3 Interpretation of Statements, Project financing, Project appraisal, return on investments.

10. **Entrepreneurship Development**
10.1 Concept of entrepreneur and need of entrepreneurship in the context of prevailing employment conditions.
10.2 Distinction between an entrepreneur and a manager.
10.3 Project identification and selection.
10.4 Project formulation.
10.5 Project appraisal.
10.6 Facilities and incentives to an entrepreneur.

11. **Fundamental of Economics**
11.1 Micro economics.
11.2 Macro economics.

12. **Accidents and Safety**
12.1 Classification of accidents based on nature of injuries, event and place.
12.2 Causes and effects of accidents.
12.3 Accident-prone workers.
12.4 Action to be taken in case of accidents with machines, electric shock, fires and erection and construction accidents.
12.5 Safety consciousness and publicity.
12.6 Safety procedures.
12.7 Safety measures – Do's and Don'ts and god housing keeping.

Corrected and Approved By BTE 04.05.2017

5.3 HEAT AND MASS TRANSFER

L	T	P
4	2	4

The purpose of this paper is to aquaint the students with the tools needed in Unit Operation like Modes of heat transfer, Coduction, Convection, Radiation, Heat exchanger and Evaporator, to meet the challenges of industrial atmosphere

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
	PART 'A'			
1.	Mode of Heat transfer	4	2	-
2.	Conduction	4	2	-
3.	Convection	4	2	-
4.	Radiation	6	3	-
5.	Heat Exchangers	6	3	-
6.	Evaporators	6	3	-
	PART B			
7.	Gas Absorption	4	2	-
8.	Distillation	4	2	-
9.	Extraction	6	3	-
10.	Humidification	6	3	-
12.	Drying	6	3	-
	Total	56	28	56

DETAILED CONTENTS

Corrected and Approved By BTE 04.05.2017

PART-'A'

1. MODE OF HEAT TRANSFER:

Conduction, Convection and Rediation.

2. CONDUCTION:

Fourier's Law, Thermal conductivity, Conductance wall, Multilayer flat wall, Hollow cylinder, Multilayer cylinder, Logmean Area, Geometric mean area and Arithmetic mean area. Simple Numerical Problems in S. I. Units.

3. CONVECTION:

Natural and Forced convection, dimensional analysis, Pi theorem, Physical significance of dimension less number, Reynold number, Pranatle number, Nusselt number, Stanten number, Peclit number, Grashaff number, Ditlus Baltier's equation - Simple Numerical Problems using Ditlus Baltiers equation. Individual heat transfer coefficients and overall heat transfer coefficients.

4. RADIATION:

Reflection, absorption and transmission of radiation, Kirchoff's law, Emmisive power, Wein's displacement law. The Stefen's Boltzman law, Heat transfer by radiation, Exchange of energy between two parallel planes of different emissivity, Radiant heat transfer coefficient, Solar radiation gray surface or gray body.

5. HEAT EXCHANGERS:

Log mean temperature difference (L.M.T.D.) for parallel or Cocurrent flow, Counter current flow, Cross flow, Construction and discription of (i) Double pipe heat exchangers, (ii) shell and tube heat exchangers. Wilson plat calculation of individual and over all heat transfer coefficients.

6. EVAPORATORS:

Construction and Description of (1) Basket type (2) Horizontal tube types (3) Vertical tube or Long tube type. Boiling point rise (B.P.R.) and its effect, Steam economy for single effect evaporator.

PART 'B'

7. GAS ABSORPTION:

Properties of tower packing. Types of tower packing and Stone ware tower construction.

8. 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 capplate column (3) Packed column.
Fractional column accessories.

Boiling point diagrams, Roult's law, Henery's law, Relative volatility, Constant boiling mixture, Equlibrium diagram and constant of equilibrium diagram. Fractionating calumn calculations - Heat and material balance Reflux ratio equilibrium plate, Enthalpy composition diagram, Graphic solution - Selection of column above and below feed plate, Location of feed plate, Subcooled reflex effect on reflux ratio, entrainment M/c cabe thiele diagram - Section above and below feed plate. Intersection of operation line, Location of 'q' line Optimim reflux ratio, Calculation of number of equilibrium plate by M/c cabe thiele diagram, over all plate efficiency. The merphy plate efficiency. The murphy point efficiency.

9. EXTRACTION:

(1) Choice of Solvent (2) Steps of Extraction operation (3) Solid liquid Extraction construction and description of (a) stationery solid bed extractor, moving bed-basket type oil seed extractor or Bollman extractor (c) Rotocel extractor (d) liquid extraction.

10. HUMIDIFICATION:

Determination of (1) Humidity (2) Percentage himidity (3) Relative humidity (4) Humid volume (5) Humid heat (6) Dry

bulb and wet bulb temperature (7) Adiabalic saturation
temperature (8) Use of Humidity chart (9) Dew point
temperature. Simple numerical problems using humidity chart
construction and description of cooling towers.

11. DRYING:

General drying behaviour - Critical moisture content
equilibrium moisture content, Description and construction
of dryers.

1. Tray Dryer
2. Rotary Dryer
3. Screw Conveyor.

HEAT AND MASS TRANSFER LAB

List of Practicals

1. To determine over all heat transfer coefficient for an open pan evaporator in steady state condition.

2. To determine over all heat transfer coffienents for an open pan evaporator in a unsteady state cindition.

3. To determine 'U' for a double pipe heat exchanger in steady state condition and also to determine efficiency of heat utilization.

4. To determine shell and tube heat exchanger in steady state conditions and also to determine efficiency of heat utilization.

5. To study a sieve plate distillation column operation and to calculate over all effiency of the distillation column.

6. To determine steam economy of a open pan evoperator.

7. To study the construction and working of various chemical equipments.

8. To study the rate of drying in vacuum dryer.

9. To determine the pounds of volatile compound distilled per unitpounds of steam distilled in a steam distillation operation.

10. To determine rate of settling.

5.4 Coating Properties, Evaluation and Quality Control

L T P

3 2 6

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	COATING PROPERTIES	9	7	-
2.	TESTING OF LIQUID FILMS	9	7	-
3.	TESTING OF DRY PAINT FILMS	8	6	-
4.	ANALYSIS OF PAINTS & VARNISHES	8	3	-
5.	DURABILITY TESTS	8	5	-
	TOTAL	**42**	**28**	**84**

DETAILED CONTENT

1. COATING PROPERTIES:

General properties of oil paints, enamels varnishes and lacquers, their comparative merits, classification of paints, and adhesive and cohesion properties, factors affecting adhesion wetting power, optical properties , color,L,a,b, and E values, gloss, hiding etc, physical, chemical and mechanical properties of paint films factors affecting coating properties, rheological properties, Newtonian and non Newtonian liquids, thixo-tropy, factor affecting viscosity influence of the rheological behavour.

2. TESTING OF LIQUID FILMS:

Objective of paint testing, quality control procedures, standard specifications and test methods, classifications of paint test and evaluation tests, test on liquid paints density, dispersion, viscosity and consistency , wet Opacity and dry hiding, spreading capacity and spreading rate, wet & dry film thickness, drying time etc.

3. TESTING OF DRY PAINT FILMS:

Test of dried coatings, color and color fastness, light fastness, gloss, flexibility, adhesion impact test, hardness, mar resistance, abrasion, resistance, water and moisture resistance, Protection against corrosion (PAC) ,and salt spray test, resistance to chemical , resistance to lubricating oils and solvents, resistance to heat and fire, air permeability etc, evaluation of water based paints, biological effects on paint films.

4. ANALYSIS OF PAINTS & VARNISHES:

Analysis of paints and varnishes, volatile and non volatile matter, pigment content , binder or solid vehicle content, water content, ash content, pigment, binder and solvent analysis.

5. DURABILITY TESTS:

Ageing properties of coatings, weatherometery, natural and outdoor durability test, accelerated out door weathering, artificial weathering test in a weatherometer, defects observed in paint film on exposure, concept of quality circles, introduction to ISO.

TESTING & QUALITY CONTROL LAB

LIST OF EXPERIMENT

1. Determination of the physical properties of liquid paints, varnishes & lacquers such as color, weight per liter, fineness of grind, viscosity, non volatile content, spreading capacity.
2. Determination of the physical properties of dry films of paints, varnishes & lacquers such as Drying time, D.F.T.
3. Determination of mechanical properties of dry film paints, varnishes & lacquers such as scratch hardness, flexibility and adhesion, pencil hardness, impact resistance .
4. Determination of optical properties of dry films of paints, varnishes & lacquers such as wet capacity, hiding, gloss, shade.
5. Determination of chemical resistance properties of dry films of paints, varnishes & lacquers such as water resistance, acid resistance, alkali resistance and solvent resistance..
6. Determination of corrosion resistance properties of dry films of paint, varnishes and lacquers such as salt spray test and humidity chamber test (PAC : Protection against corrosion)

.

. 5.4-POLLUTION CONTROL & INDUSTRIAL SAFETY

L	T	P
6	2	-

Rationale:

A chemical engineering technician must have the knowledge of different types of pollution caused due to industrialsation 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 occour in chemical plants and how to safe gaurd 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	6	1	-
2.	Air Pollution	9	2	-
3.	Water Pollution	12	5	-
4.	Environment Protection	12	5	-
5.	Radioactive Pollution	12	2	-
6.	Solid Waste Management	6	2	-
7.	Pollution Acts	12	5	-
8.	Safety in Chemical Industry	12	5	-
9.	Disaster Management	3	1	-
	Total	84	28	-

DETAILED CONTENTS

1. INTRODUCTION:

Corrected and Approved By BTE 04.05.2017

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. SOLID WASTE MANAGEMENT:

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

7. 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.

8. 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 inflammble 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).

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 benifit 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.

REFERENCE BOOKS

1. Safety in Process Plant Design by Wells
2. Safety and Accident Prevention in Chemical Operation by H. H. Tawcatte and W S Wood
3. Engineering Chemistry by P. C Jain

5.5 FORMULATION & MANUFACTURING OF PAINTS

L T P

3 2 6

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNIT	COVERAGE TIME		
		L	T	P
1.	INTRODUCTION	8	5	-
2.	STEPS IN PAINT MANUFACTURING	8	5	-
3.	MACHINERY USED IN PAINT MANUFACTURING	9	6	-
4.	GENERAL HAZARDS	8	5	-
5.	SAFETY MEASURES & FACTORY LAYOUT	9	7	-
	TOTAL	**42**	**28**	**84**

DETAILED CONTENTS

1. INTRODUCTION:

Principles of paint formulation, formulation elements, mathematics & steps involved in paint : Pigment Volume Concentration (PVC), Pigment To Binder (P/B) ratio, etc, Typical

formulation of primers, under coats, base coats and finish coats industrial and site applied coating for steel work for mild, moderate and severe conditions.

2. STEPS IN PAINT MANUFACTURING:

,Rheology and rheological considerations (Pseudoplasticity, dilatatncy and thixotropy). Steps in paint manufacture- mixing, grinding, letdown, thinning, tinting (shade matching), straining, phenomenon of wetting, grinding and dispersion, important considerations in pigment dispersion

3. MACHINERY USED IN PAINT MANUFACTURING:

Heavy duty mixtures; double blade mixture W& P blending, sigma kneaders pug mills, dough mixers, change can mixter planetary Z blade, cavitation mixers, edge runner roller mills , different variants, material balance, power inputs and mill base composition for three roll mill, Ball, pebble and bead mills, cascading & factors affecting effectiveness of milling, such as size & shape of grinding medium, mill base , attritors and vibration mill, sand mill : type of grinding media, sand grinding process efficiency of mill, horizontal sand mills like dyno mill , pearl mills etc, miscellaneous mills, colloid mills, high speed and impingment mill, kady mills etc.

4. GENERAL HAZARDS:

let down vehicles and let down of non aqueous and latex paints, fire and health hazards, general industrial hazards, prime cause for fire and explosion electro-static charges precautionary measures.

5. SAFETY MEASURES AND FACTORY LAYOUTS:

Safety measure protection, factory layout principles and general considerations, typical flow diagram, single & multi storied building , sections of paint factory and their location.

Corrected and Approved By BTE 04.05.2017

PAINT MAKING LAB

LIST OF EXPERIMENT

1. Preparation of dry and oil bound distempers
2. Preparation of acrylic emulsion paints (exterior and interior)
3. Preparation of cement paints
4. Preparation of oleoresionous varnishes
5. Preparation of primers (solvent based and water based)
6. Preparation of glossy paints

Corrected and Approved By BTE 04.05.2017

VI SEMESTER

6.1 CHEMICAL REACTION ENGINEERING (CRE)

L	T	P
5	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 hetrogenous reaction.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction	5	1	-
2.	Homogenous Reactions	15	3	-
3.	Interprtation of constation volume batch reactor data	15	3	-
4.	Ideal Reactors	15	3	-
5.	Introduction to Heterogenous reacting systems	15	2	-
6.	Introduction of Various Types of Industrial reactor	10	2	-

Corrected and Approved By BTE 04.05.2017

Total	70	14	-

DETAILED CONTENTS

1. INTRODUCTION :

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 comparision, 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.

6. INTRODUCTION OF VARIOUS TYPES OF INDUSTRIAL REACTORS :

CSTR, Tricle, Sheray, Packed bed, Fludizer bed.

REFERENCE BOOKS

1. Chemical Engineering Kinetics by J. M. Smith
2. Chemical Reaction Engineering by Octave Levenspal
3. Reaction Engineering by Walas
4. Chemical Reaction Engineering I & II by K. A. Gawhane

6.2-AUTOMATIC PROCESS CONTROL

L	T	P
6	2	6

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 oscillatroy type element. Different modes of control action and closed loop in automatic control are well known. The student will be well conversent 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	10	3	-
3.	Process Characterstics	16	5	-
4.	Controller Characteristics	12	3	-
5.	Closed loop in Auto control	12	4	-
6.	Programmable Logic Controller	12	4	-
7.	Distributed Control System	12	4	-
	Total	84	28	84

DETAILED CONTENTS

1. INTRODUCTION:

Corrected and Approved By BTE 04.05.2017

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 CHARCTERISTICS:

Process variables, process degree of freedom, forcing
function, step fn., ramp, impulse, sinusiodal 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) Ist 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) Contionuous stirred tank chemical reactor with Ist order chemical reaction.

Corrected and Approved By BTE 04.05.2017

(b) IInd order system or oscillatory type element.

(i) Bulb in thermowell.
(ii) Mechanical damper.
(iii) Fluid manometer or U tubes.

Response of Ist order system to step, ramp, impulse and sinusoidal inputs, Response of IInd order systsm to step change (Transient response).

4. CONTROLLER CHARACTERISTEIC 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.

6. PROGRAMMABLE LOGIC CONTROLER (PLC):

Introduction, Principle of operation, Architecture of programmable controller, Programming the programmable controler, Application of programmable control.

7. DISTRIBUTED CONTROL SYSTEM (DCS) :

Real time computer control system - concept, functional requirements of distributed process control system, configuration some popular DCS.

REFERENCE BOOKS

1. Process System Analysis and Control by Coughnowr and Koppel

2. Chemical Process Control by George Stephanopalous

3. Computer Control of Industrial Process by S. Savas, Emenule

4. Industrial Instrumentation by D. P. Eckman

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. Caliberation of thermo couple.

3. To study the transient response of first order system (thermo couple) and find out time constant.

4. To study the transient resposne of a simple R-C network and plot Bodey's diagram.

5. To study on of type water level control and to find out steady state voltage.

6. To study the frequency response of a second order electrical circuit equipment to a physical system (R-L-C network).

7. Caliberation of pressure Gauge by Dead Weight tester.

8. To study, sketch and operation of strip chart recorder and Directing pen recorder.

9. Claiberation of bimetallic thermometer.

10. To study the response of bimetallic thermo meter for a step input and find its time constant.

11. To calibrate the pneumatic control valve (Diaphram type).

12. To calibrate the given manometer for level measurement.

Corrected and Approved By BTE 04.05.2017

13. To study the response of two tank non interacting liquid
level system and two tank interacting liquid level system.

14. A study of automatic ON and cut of A.C. supply by a solid
state (Built in relay and transformer) voltage stablizer.

6.3 SURFACE PREPARATION AND PAINT APPLICATION

L T P

5 2 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	SURFACE PREPARATION	20	7	-
2.	PRE-TREATMENT	15	6	-
3.	PAINT APPLICATION INVOLVING ATOMIZATION	10	5	-
4.	PAINT APPLICATION NOT INVOLVING ATOMIZATION	10	5	-
5.	DRYING, CURING AND PAINT DEFECTS	15	5	-
	TOTAL	**75**	**28**	**-**

DETAILED CONTENTS

1. SURFACE PREPARATION:

Importance of surface preparation, types of substrate : Substrate, Degreasing, rust & oxide removal, blast cleaning, degreasing mild steel and preparation of samples of wood by a sequence of staining, filling and sealing.

2. PRE-TREATMENT:

Steps of surface pre treatment process – activation, phosphating, passivation, zinc, iron and tricationic system, coating weight.

3. PAINT APPLICATION INVOLVING ATOMIZATION:

Selection criteria for application techniques, Paint application involving atomization air assisted spraying, airless spraying, electrostate spraying, compare hot and cold sprarying. Disc and bell application and robotics in spraying

4. PAINT APPLICATION NOT INVOLVING ATOMIZATION:

Paint application not involving atomization: Dipping, roller coating, coil & curtaing coating , other application methods- brushing, hand rolling trowelling , silk screeing tumbling , flow coating, electro deposition, anodic vs cathodic electro deposition – merit and demerits, throwing powder, CED plat..

5. DRYING, CURING AND PAINT DEFECTS:

Drying and curing process: air drying, forced drying and stoving, radiation curing (ultravailet and electron beam), hybrid curing, selection of curing techniques, ovens. Defects : settling, skinning, orange peals, pin holes, crater, etc.

Corrected and Approved By BTE 04.05.2017

6.4 PRINTING & PACKAGING TECHNOLOGY

L T P

5 2 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	MAJOR PRINTING SYSTEM	10	5	-
2.	TESTING&EVALUATION OF RAW MATERIAL	10	5	-
3.	PRINCIPLES OF INK FORMULATION	5	2	-
4.	TYPES OF INK	5	2	-
5.	PRINTING INK MANUFACTURE	8	3	-
6.	PACKAGING	8	3	-
7.	HAZARDS	8	3	-
8.	PACKAGING FORMS	8	3	-
9.	TYPES PACKAGING	8	2	
	TOTAL	**70**	**28**	**-**

DETAILED CONTENTS

1. MAJOR PRINTING SYSTEM:

Principle of printing, description and schematic diagram e;g; Typographic , Planographic , Gravur, flaxo and screen process, classification of printing inks , mechanism of ink drying, color matching and process printing.

2. TESTING & EVALUATION OF RAW MATERIAL:

Testing and evaluation of raw materials for their use in ink manufacturing .

3. PRINCIPLES OF INK FORMULATION:

Principles of ink formulations and characteristics of various types of process ink e.g. letter press, offset, lithographic, gravurs, flexographic and screen inks for various substracts e.g. paper, plastic, febric, leathers, glass and metal.

4. TYPES OF INK:

Inks for newspapers, publication work, posters, labels and packaging materials, heat set and quick set inks for multi color printing , metal decoding inks , over print varnishes and lacquers, magnetic inks, ceramic inks, inks for printed circuit boards, and other miscellaneous inks, water based inks.

5. PRINTING INK MANUFACTURE:

Different methods and machinery used laboratory equipments and ink testing, factory layout, hazard and pre caution , various ink troubles and remedial measures.

Corrected and Approved By BTE 04.05.2017

6. PACKAGING:

Concept of packaging, packaging values, scope of packaging: Toys, general consumables, cosmetics food pharmaceuticals, engineering material and other utilities.

7. HAZARDS:

Biotic and abiotic hazards associated with packages.

8. PACKAGING FORMS:

Packaging forms: wood containers, glaces wares, metal containers, paper & paper boards, folded cartons and setup boxes.

9. TYPES PACKAGING:

Corrugated fibre board , fibre tubes, cans and drums, plastics: films and foils.

6.5 PROJECT

a. Project Problem

The Students will be required to search literature pertaining to design of an equipment /processing paint /production of paint product, comprehend it and prepare a report for assessment.

b. Field Exposure (Four Weeks)

The students will be required to undertake training in the paint industry after IV Sem. for specified period and submit its report after completion for evaluation and oral examination in the in Six Semester

1.STAFF STRUCTURE

THREE YEAR(SIX SEMESTER) DIPLOMA IN PAINT TECHNOLOGY

Intake of the Course 60
Pattern of the Course Semester Pattern

Sl. No.	Name of Post	No.
1.	Principal	1
2.	H.O.D. Chemical Engg.	1
3.	Lecturer Paint Technology/Chemical Engg.	2/2
4.	Lecturer in Mech. Engg.	1 |
5.	Lecturer in Maths	1 |Parttime/
6.	Lecturer in Chemistry	1 |Common with other discip-
7.	Lecturer in Physics	1 |lines if the intake is more
8.	Lecturer in Comm. Tech.	1 |than 180
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" in not needed in the institutions where diploma in "Electronics Engineering" is running.

Corrected and Approved By BTE 04.05.2017

2. SPACE REQUIREMENT

[A] ADMINISTRATIVE BLOCK

Sl. No.	Details of Space	Floor Area in 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 Over Head Tank 2000 Litre Cap; Under Ground Tank 600 Litre Cap;		120	
8.	Unit Operation-III,IV		120	
9.	Automatic Process Control Lab.		75	
10	Computer Lab (Air Cond.Glass Partition and Special type pvc flooring and false ceiling)	2	60	120
11.	LRC		100	
12.	Seminar Room	1	75	

Corrected and Approved By BTE 04.05.2017

[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 AMINITIES

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) incuding 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

Priorty 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 Aminities

(3)
Residences of employee

3. 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 verson should be purchased.

I. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
1.	Brass ball with hook dia 1.8 Cm to 2 Cm diameter	2	50	100
2.	Stop watch least count Least Count 0.1 Sec.(non-megnetic) 0.01 sec to 0.001 sec (Electronic Desirable)	4	750	3000
3.	Wall bracket with clamping arrangement 8" to 10" length	2	50	100
4.	Meter scale Least count 0.1cm,wooden 1meter	5	40	200
5.	Meter scale Least count 0.1cm,wooden 50 Cm	5	40	200
6.	Searl's conductivity apparatus with copper & steel rods 25 cm length 4 cm.diameter with all accessaries	2 set	1500	3000
7.	Constant Level Water Flow Container of one liter capacity vertical stand & rubber tubing	2	250	500
8.	Thermometer 0-110oC(Least count 0.1oC desirable)	4	100	400
9.	Potentiometer - 10 wires (1 meter length of each wire) with jockey, sunmoical top	4	750	3000
10.	Moving coil galvenometer 30-0-30 with moving mounting	5	300	1500
11.	Rheostat 50 ohm.,100 Ohm.,150 Ohm.16 capacity		300	4800
12.	Lead Accumulator 2V,6V (1 No.Each)	2	250	500
13.	Meterbridge 1 meter length, sunmica top copper strips fitted with scale	2	300	600
14.	Resistance Coil (Standard) 1 ohm. to 10 ohm.	10	50	500

Corrected and Approved By BTE 04.05.2017

S.No.	Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
15.	Moving coil ammeter 0-1 amp., 0-2 amp., 0-5 amp. with mounting	8	250	2000
16.	Moving coil voltmeter 0-1 V.,0-2V 0-5 V., 0-10 V. with mounting	8	250	2000
17.	Denial cell with complete accessories	2	250	500
18.	Leclaunche Cell with complete accessories	2	250	500
19.	Standard Cadmium Cell with complete accessories	2	250	500
20.	Battery Charger with complete accessories	1set	1800	1800
21.	Battery Eliminator Multi range	2set	750	1500
22.	Multimeter(Digital)	1set	800	800
23.	Carey Foster Bridge (With all accessories)	2set	4500	9000
24.	Resistance Box (2 No. Each) 0-1 Ohm, 0-100 Ohm.	4	850	3400
25.	Fractional Resistance Box 0-1 Ohm.	2	1200	2400
26.	Post office box Key type	2	1200	2400
27.	Post office box Dial type	2	1200	2400
28.	Resistance Wire(100 Gm.) (Constanton/Maganin)	1 lacchi	100	100
29.	Connecting Wire Copper(1/2 Kg.) (Cotton Insulated)	1 lacchi	700	700
30.	Screw gauge L.c 1/100 mm	5set	150	750
31.	Vernier Callipers L.c. 1/10 mm	5set	100	500
32.	Appratus for determining character-stics of P-N junction diode complete with all accessaries	2 set	1500	3000
33.	Resonance Column of steel One Meter length and 3-4 Cm diameter fitted with scale & water level arrangement	2	1600	3200
34.	App. for determining coefficient of friction on a horrizontal plane (Complete with all accessories)	2 set	700	1400
35.	Tuning Fork's Sets Set of different frequency (with rubber pad)	3set	350	1050
36.	Physical balance with weight box Complete with Fractional weight	2	800	1600
37.	Anemometer with counter cup type	1	1000	1000
38.	Spring Force Constant Apparatus with graduated mirror & pointer, weight set with hanger	2	1200	2400
39.	Viscosity Apparatus (Stock law) with steel balls and viscous liquid & timer	2set	1600	3200
40.	Thermometer of different range	10set	100	1000

	Mercury thermometer 0-50oC to 0-110oC			
41.	Wall Thermometer Alcohal Filled 0-50oC	2set	20	40
42.	Sprit Level Technical Type	1set	60	60
43.	Drilling Machine Electric with different size bits	1set	800	800
44.	LPG Gas Burner with Cylinder	1set	800	800
45.	Tool Kit with different tools Complete	1set	800	800
46.	Lab stools	30		

S.No.	Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
47.	Lab tables	8		
48.	Plug Keys One Way	5	50	250
49.	Plug Keys Two Way	5	100	500
50	Helical Springs - Soft, 10 cm each	6	100	600

II. APPLIED CHEMISTRY LAB

S.No.	Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
1.	Test tube stand (Plastic/Tafflon)	30	20	600
2.	Funnel stand (Plastic/Tafflon)	30	20	600
3.	Burette stand Stainless Steel/Wooden/Iron	30	50	1500
4.	Pipette stand Stainless Steel/Wooden/Plastic	30	20	600
5.	Chemical balances with analytical weights 1gm -200gms	5	1500	7500
6.	Fractional weights set with rider 10 mg to 500 mg with rider	5sets	25	125
7.	Kipp's apparatus 1000 ml. Plastic/ Tafflon	2	500	1000
8.	Reagents bottles			
	250ml	120	20	2400
	500ml	25	25	625
	1000ml	5	30	150
9.	Wide mouth bottle 250 ml Glass	50	15	750
10.	Winchester bottle 2.5 litre Plastic/Tafflon	15	30	450
11.	Test tubes 1/4" x 6"			
	i. Corning or Borosil	200	9	1800
	ii. Glass	200	2	400
12.	Boiling tube 1" x 6"			
	i.Corning or Borosil	100	16	1600
	ii. Glass	100	5	500
13.	Pestle and morter Dia 10 cms 15 cms (Ceramics)	2	30	60
14.	Watch glass 5.0 cms,7.5 cms glass	15	5	75
15	Beakers (Glass/Brosil/Corning Plastic)			
	250 ml.	50	20	1000
	500 ml.	50	20	1000
16.	Weighing Tube 10 ml with lid (Plastic)	30	10	300
17.	Wash bottles (Plastic/Tafflon)	30	15	450
18.	Conical flask 250 ml. Glass (Brosil/Corning/Plastic) Transparnt	100	30	3000
19.	Flat bottom flask 500 ml.Glass	15	40	600
20.	Flat bottom flask 250 ml.Glass	15	25	375
21.	Burette 50 ml. (Plastic/Tafflon)	30	60	1800
22.	Pipette 25 ml. (Plastic/Tafflon)	30	20	600
23.	Measuring flask 250 ml. with stopper	30	50	1500
24.	Measring cylinder of various sizes (100 ml,250 ml,500 ml,1000 ml) 3 no. of each	12	30	360
25.	Bunsen's burner of brass	30	50	1500
26.	Gas plant petrol/LPG 10 to 20 burners automatic	1	5000	5000
27.	Spirit lamp (Brass)	30	30	900

S.No.	Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
28.	Tripod stand (Steel/Iron) Large/Medium	30	30	900
29.	Wire gauge 15 X 15 cm. with asbestos	30	15	450
30.	Test tube holder wodden	50	10	500
31.	Porcelain plates Ceramic	30	20	600
32.	Funnel 15 cm. Glass Borosil Corning/Plastic	60	16	960
33.	Spatula hard & nickel/steel	2 each	50	100
34.	Distilled water units (electrical)	1	10000	10000
35.	Distilled water units (solar)	1	5000	5000
36.	Open balance 1000 gms./10 mg.	1	600	600
37.	Brush for cleaning Hydro Fiber Acid & Alkali Resistant	100	10	1000
38.	Jars 20 Lit. for keeping destilled water	5	100	500
39.	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
40.	Exhaust fans 18" (GEC make/Crompton)	4	2000	8000
41.	Side racks and selves for bench reagents made of teak wood for 24 bottels each set	4	2000	8000
42.	Digital balance electronic Electronics upto 2 decimal places	1	10000	10000
43.	Hot plates 7-1/2", 3" dia controled 2000 watts	1	1000	1000
44.	Hot air oven thermostatically controled with selves and rotary switches 350 x 350 x 25 high	1	8000	8000
45	pH Meter (Digital)	1	1000	1000
46	Glass Electrode	2	850	1700
47.	Reference Electro	2	850	1700
48.	Weight Box 1gm,2gmX2, 5gm,10 gm 20gmX2, 50gm, 100gm with for cep			
	Miscellaneous	LS		15000

Corrected and Approved By BTE 04.05.2017

III. APPLIED MECHANICS LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Polygon of Forces Apparatus	4	1500	60000
2.	Universal Force Table	2	2500	5000
3.	Principle of Moment Appratus Bell Crank lever	4	1500	60000
4.	Combined Inclind plane & Friction apparatus	4	1500	60000
5.	Simple wheel and axle	2	2500	5000
6.	Differential wheel and axle	2	3500	7000
7.	Double sleave Pulley Block	1	800	800
8.	Simple Screw Jack	4	3000	12000
9.	System of pulleys (Any I,II,III)	2Set Each	4000	8000
10.	Worm & Worm wheel	2Set Each	5000	10000
11.	Simply Support Beam with different weights (2 Sets)	2	3000	6000
12.	Jib Crane	2	2500	5000
13.	Jointed Roof Truss Apparatus	2	2500	5000
	Misc.	Lum Sum		5000

Note :
1. S. No. 1,2 Acrylic/Wood material/Aluminium Cast
2. S.No. 3,4,5,8,9 working model of Acrylic/Aluminium/Cast
3. Above items are for 2 batches of 15 students each.

V. WORKSHOP PRACTICE

CARPENTRY SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	60 cm.rule	10	50	500
2.	Flexible steel rule 2 metre	2	75	150
3.	T square 23 cm. steel	10	50	500
4.	Bevel square 23 cm. steel	2	100	200
5.	Marking knife 25 cm. steel	10	100	1000
6.	Marking gauge wooden & brass 25 cm.	10	150	1500
7.	Mortise gauge wooden & brass 25 cm.	10	150	1500
8.	Caliper inside,steel 20 cm.	2	200	400
9.	Caliper outside , steel 20 cm.	2	200	400
10.	Compass steel 20cm.	2	100	200
11.	Devider steel 20 cm.	2	100	200
12.	Plumb	2	75	150
13.	Wooden bench vice steel 20 cm.	10	500	5000
14.	Bench hold fast steel 30 cm.	10	300	3000
15.	Bar clamp 2 m.	2	500	1000
16.	G clamp of flat spring steel 20x30 cm.	4	150	600
17.	Rip saw 40-45 cm.	10	200	2000
18.	Cross cut saw 40-45 cm.	2	200	400
19.	Tennon saw 30-35 cm.	10	200	2000
20.	Dovetail saw 30-35 cm.	2	150	300
21.	Compass saw 35 cm.	4	150	600
22.	Key hole saw or pad saw 30-35 cm.	2	150	300
23.	Bow saw	2	200	400
24.	Frame saw	2	200	400
25.	Chisel fish brand 1" to 1/8"			
	firmer	3 set	250	750
	Dovetail	3 set	250	750
	Mortise	3 set	250	750
26.	Gauge or Golchi 1" to 1/8"	3 set	300	900
27.	Wooden jack plane complete	10	100	1000
28.	Wooden smoothing plane	10	250	2500
29.	Iron jack plane complete	10	200	2000
30.	Iron rebate plane complete	3	200	600
31.	Iron grooving plane complete	3	300	900
32.	Iron compass plane complete	3	350	1050
33.	Wooden moulding plane complete	3	500	1500
34.	Bradawl	3	350	1050
35.	Gimlet drills set	1 set	300	300
36.	Center bit	2	250	500
37.	Twist bit	2	200	400
38.	Auger bit	2	200	400
39.	Dovetail bit	2	200	400
40.	Counter shank bit	2	200	400
41.	Ratchet brace machine	2	300	600
42.	Grand drill machine 1/4"	2	600	1200
43.	Wooden hand drill burmi	5	700	3500
44.	Wooden mallet	10	100	1000

45.	Claw hammer	3	100	300
46.	Carpenters hammer	10	100	1000
47.	Cutting tool for Universal wood working machine	3 set	1500	4500
48.	Screw driver 18" & 15"	6	100	600

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
49.	Adze 500 gm.	10	100	1000
50.	Pincer 175 mm.	6	250	1500
51.	Plier 150 mm.	4	200	800
52.	Oil stone 8"	4	180	720
53.	Rasp file 12"	4	200	800
54.	Half round file 12"	4	200	800
55.	Round file 12"	4	200	800
56.	Triangular file 5", 4"	8	200	1600
57.	Water stone	4	80	320
58.	Carpentry work benches	4	4000	16000
59.	Band saw machine complete	1	60000	60000
60.	Circular saw machine	1	35000	35000
61.	Double Ended Electric Bench grinder	1	15000	15000
62.	Universal wood working machine	1	30000	30000
	misc. for foundation of machines	LS		20000
	SMITHY SHOP			
1.	Anvil 150 Kg. with stand	5	5500	25500
2.	Swage block 50x30x8cm.&45x45x10cm.	2	3000	6000
3.	Hammers			
	Ball peen 0.8 Kg. (Approx.)	10	350	3500
	Cross peen 0.8 Kg. (Approx.)	10	350	3500
4.	Beak iron 25 Kg.	1	1000	1000
5.	Swages different types	6	100	600
6.	Fullers different types	6	100	600
7.	Leg vice 15 cms. opening	1	300	300
8.	Electric blower with motor	1	10000	10000
9.	Furnace chmney with exhaust pipe	5	10000	50000
10.	Sledge hammer - 5 Kg.	2	400	800
	Misc. tools		LS	5000
	SHEET METAL, SOLDERING & BRAZING			
1.	Dividers - 15cm.	5	100	500
2.	Trammel 1 m.	1	80	80
3.	Angle protector	5	100	500
4.	Try square 30 cm.	5	80	400
5.	Centre punch	5	50	250
6.	Steel rule 30 cm. , 60 cm.,	5	25	125
7.	Sheet metal gauge	1	250	250
8.	Straight snips 30 cm.	2	500	1000
9.	Curved snips 30 cm.	2	600	1200
10.	Bench shear cutter 40 cm.	1	10000	10000
11.	Chisel 10 cm.	5	200	1000

12.	Hammer	5	300	1500
13.	Bench vice 13 cm.	5	2000	10000
14.	Plier	5	100	500
15.	Nose plier	5	120	600
16.	Sheet metal anvil/stakes	5	3500	17500
17.	Shearing machine 120 cm.	1	5000	5000
18.	Solder electric	2	1000	2000
19.	Solder furnace type	2	500	1000
20.	Brazing equipments and accessories	1	10000	10000
21.	Blow lamp	2	400	800
22.	Sheet bending machine	1	20000	20000
	Misc.		LS	10000

FITTING SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Bench vice jaw 10 cm.	10	600	6000
2.	Surface plate 45x45 cm.	2	4500	9000
3.	V. Block 10x7x4 cm.	5	700	3500
4.	Try square	10	100	1000
5.	Bevel protractor 30 cm.	1	250	250
6.	Combination set	1	3000	3000
7.	Divider	5	100	500
8.	Centre punch	5	80	400
9.	Calipers (Different sizes)	12	100	1200
10.	Vernier calipers 30 cm.	2	1500	3000
11.	Micrometer 0-25, 25-50 m.m.	4	1500	6000
12.	Vernier depth gauge	1	700	700
13.	Feeler gauge--15 blades	1	100	100
14.	Radius gauge	1	200	200
15.	Angle gauge	1	200	200
16.	Thread gauge	1	200	200
17.	Bench drilling machine 13 mm.	1	10000	10000
18.	Double ended electric grinder	1	8000	8000
19.	Drill set	1set	2000	2000
20.	Reamer set	1set	3500	3500
21.	Tap set	1set	3500	3500
22.	Adjustable wrenches (15 cm.,20cm. 30 cm.)	1set	1200	1200
23.	Allen key set	1set	700	700
24.	Spanners	6	100	600
25.	Work benches	6	4500	27500
26.	Power hacksaw	1	8000	8000
	Misc. Files, Dieset, Hexa frames etc.		LS	20000

WELDING SHOP

1.	Ellectric welding set oil cooled	1	20000	20000
2.	Industrial regulator type oil cooled arc welder	1	25000	25000
3.	Air cooled spot welder 7.5 KVA	1	30000	30000
4.	General accssories for air cooled spot welder of 7.5 KVA			15000

5.	Gas welding set with gas cutting torch and complete with all accessories	1	30000	30000
6.	Misc. work benches		LS	35000

PAINTING & POLISHING SHOP

1.	Air compressor complete with 2 HP motor	1set	25000	25000
2.	Spray gun with hose pipe	1	1500	1500
3.	Stoving oven	1	6000	6000
4.	Buffing machine with leather and cotton wheels	1	8000	8000
5.	Electroplating Equipment for cromium Nikle plating.	1	20000	20000
	Misc.		LS	5000

PLUMBING SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Pipe vice 5 cm.	4	500	2000
2.	Chain wrenches	5	500	2500
3.	Ring spanner Set	5	250	1250
4.	Wheel pipe cutter	2	600	1200
5.	Water pump plier	4	100	400
6.	Pipe die set 2" set	2 set	1200	2400
7.	Pipe bending device	1	5000	5000
8.	Work benches	4	6500	26000
9.	Set of various types of plumbing fittings e.g. Bib cock Cistern, Stop cock, Wheel volve, Gat volve etc.		LS	4000
10.	Misc. Hacksaw frame and others		LS	4000

FOUNDRY SHOP

1.	Moulding boxes	25		12000
2.	Laddles	5		2000
3.	Tool kits	10	sets	5000
4.	Quenching tanks water or oil	2		2000
5.	Permiability tester	1		2000
6.	Mould hardness tester	1		12000
7.	Sand tensile testing equipment	1		15000
8.	Portable grinders	1		6000
9.	Temperature recorders/controllers	LS		10000
10.	Pit furnace with Blower	1		10000

MACHINE SHOP

1.	Lathe machine 4.5 feet	4		50000

"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 standard accessories.

2. Shaper machine 12 inch stroke with 2 H.P. motor 440 volts push button starter with vice 6 inch (Swivel base) — 2 — 20000 — 200000

NOTE:-

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

2. Above items are for 2 batches of 15 students each.

Additional Equipments For Second Year Mechanical Engg. Only)

1.	Crucibles (10-20 Kg.)	1	5000	5000
2.	Core Boxes	1 Set	8000	8000
3.	Plate form Weighing M/C (100 Kg. Capacity)	1	15000	15000
4.	Drying Oven	1	30000	30000
5.	Sand Sieves	1 Set	1000	1000
6.	Optical Pyrometer	1	10000	10000
7.	Electrical Discharge M/C(EDM)	1	50000	50000
8.	Misc.	LS		5000

Note:

1. Above items are for 2 batches of 15 students each.

Corrected and Approved By BTE 04.05.2017

INTRODUCTION TO COMPUTER (Common to all Trades)

COMPUTER CENTRE

S.No.	DESCRIPTION	QTY.	APPROX. COST (in Rs.)
1.	Core-2 Quad Processor, 4GB RAM 1 GB SATA HDD, 19" TFT Monitor/ Server of Latest Specification OS-Windows 2007/2008/Latest Version	02 Server	1,20,000=00
2.	General Desktop Computer-Intel i5 60 node or Higher(with latest Specification Pre loaded latest Anti Virus with Life time Subscription, Licence Media and Manual with UPS 660 VA with latest window OS Including licence OR Computer of latest Specification With latest window os including licence		36,00,000=00
3.	Software :((Latest Version)		
	i. MS OFFICE 2010/Latest Version		LS LS
	ii COMPILER 'C', C++, JAVA-7		LS LS
4.	Hardware		4,50,000.00 LS
	i. Switch-32 Port	02	
	ii. Router	02	
	iii. Hub	04(8 Port)	
	iv. Ext. Modem	02	
	v. Wireless N/W Adaptor	02	
	vi. Series Access Point	02	
	vii.LAN Cable Meter	05	
	viii. LAN Cable Analyzer	05	
	ix. Crimping Tool and all other accessories related to Networking	15	
5.	Scanner- Flat Bed A4/Auto Lighter (Bit depth 48)	02	20,000
6.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life	02	50,000
7.	Laser Jet-A4 All In one 20 page per min (2 Each)	04	50,000
8.	Desk Jet-A4 Photo Smart (2 Each)	04	40,000

Corrected and Approved By BTE 04.05.2017

9.	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.(For 2 Labs)	04	8,00000
10.	Split Air Conditioner 1.5 tones capacity with ISI mark along with electronic voltage stabilizer with over voltage and time delay circuit	08	35,0000
11.	Room preparation and furniture	LS	
12.	19" rack, 24-port switch. connector RJ-45 Cat-6 cabling for network	LS	10,0000
13.	2 KVA Inverter Cum UPS	02	6,0000
14.	Fire Extinguisher (2 Kg.)	04	15000
15.	Fire Extinguisher (5 Kg.)	04	25000
16.	Vacuum Cleaner	02	25000
17.	LCD Projector 3000 Lumen with all Accessories	02	350000
18.	Pen Drive 16 GB	10	10000
19.	DVD Writer External	02	10000
20.	HDD External 500 GB	02	15000
21.	PAD (Latest Configuration)	02	15000
22.	Broadband For Internet(Speed Min. 8mbps)	04	LS
23.	USB Modem	02	8000
24.	Generator 15 KVA Water Coolant	01	450000

UNIT OPERATION LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Apparatus to verify Bernoulli's Thorem	1 set	15000	15000
2.	Apparatus for conducting experiments on venturimeter with collecting and supplying tank	1 set	15000	15000
3.	Reynold's apparatus with storage tank and flow steadying arrangement with 1/2 HP pump and accessories	1 set	10000	10000
4.	Apparatus for determining Cc, Cv and Cd (with set & micrometer guage)	1 set	15000	15000
5.	Apparatus for determining various head losses in pipes (Fitted with all valves & Orificemeter along with storage tank)	1 set	25000	25000
6.	Notch apparatus with set of notches with v-type, square-type notch	1 set	13000	13000
7.	Model of Reciprocating pump-1.4"	1	5000	5000
8.	Model of Centrifugal pump	1	5000	5000
9.	Pressure gauge Borden's type Max. 4 Kg/Cm2/1/4" connection Nipple	1	5000	5000
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	6	20000	20000
11.	Misc. for tools, Manometer Pitot's tube, Differential manometer and minor equipments			20000
12.	Orifice Meter(Orifice Diameter 25mm)	1	1000	1000
13.	Rota Meter 40-400 lit. per. min. with all parts	1	10000	10000
14.	Stop Watch (1/10 racer)	3	1200	3600
15.	Centrifugal Pump with Motor 230 V, 1HP Single Phase	1	15000	15000
16.	Plate & Frame filter Press 240X240 mm, 6 No. of Folter Plate/5 Nos. of frame with stand, tray, tighting arrangement, filter cloth & moterized pump & tank	1		55000
17.	Sieve Shaker with Motor & Time Switch/stop watch	1		7000
18.	Test Sieve with FHP Motor through a reduction gear suitable to carry upto 7 sieve of 50 cm. or 20 cm. diameter	1 Set		15000

Sl.No.	Name of Equipment	No.	Rate	Amount
19.	Sieve Plate(S.S.) Distillation Column Column dia 6-8" test size 200mm dia with Reboiler and condenser	1		75000
20.	U Tube Double Pipe Heat Exchanger 1800 mm length inside pipe 30mm OD 25 mm, welded leak proff with inlet and outlet valves & steam trip, all fitted on M.S. structure	1		55000
21.	Stainless Steel Spherical Jackted Open Pan Evaporator. 1X4' with jacket for cooling stirrer	1		50000
22.	Stainless Steel Crystalizer 500 Lit. with stirrer motor and Gear Box	1		40000
23.	Rotatory Dryer Drying Shell : Material Stainsteel 1.5 M Dia 110 mm, Feed Hopper, Product receiver, Heating Chamber, Heater, Temperature Sensors, Standard make on/off switch Main indicator, etc	1		100000
24.	M.S. Thickner	1		45000
25.	S.S. Spherical Jackted Open Pan Evaporator With Stirrer. 500 liter with Stirrer motor and gear box	1		50000
26.	Shell & Tube Heat Exchanger System water ro water (1-2 shell & tube type) Shell : Material Stainless Steel dia 220 mm, length 500 mm(Aprox.), Tube : OD 16 mm (Aprox.), Length 500mm (24 Nos.)	1		50000
27.	Tray Dryer Drying Chamber:Stainless Steel Material, Heater, Temperature Sensors, Digital Temperature Controller with standard make on/off switch	1		70000
28.	Rotary Vacuum Filter Drum Dia 1'-1.5 slurry through vaccum/suction pump	1		50000
29.	Electric Bioler with temperature control recorder & pressure guage (100-800hp, 15-300 psig)	1		80000
30.	Disintegrator Alongwith Wattmeter and voltmeter fitted with Motor and stand, hammer type	1		25000

Sl.No.	Name of Equipment	No.	Rate	Amount
	Common guage plate input hopper and discharge element (1 Horse Power)			
31.	Jaw Crusher alongwith Wattmeter and voltmeter 4"X4" 40 kg. per hour with 3 HP motor made of heavy steel body with meganetic steel jaws and stand	1		50000
32.	Ball Mill Moc : MS Chamber Size : 300(D) * 350 (L) mm Speed : 65 RPM with step pully arrangement Evevation : Centre line of the shell @ 50 cm high from the ground level 2 hp ac motor, 1440 rpm, single phase, 230V & 50 Hz with step pulleus to give Three different speed of drum. Accessories : Set of Step pulleys & Suitable belt 50 nos. 25 mm dia proelain Ball/ms balls 1 no. or product collection Tray of suitable size of MS with painted	1		600000
33.	Vacuum Pump Water Ring Type	1		
34.	Vacuum Pump Oil Ring Type	1		
35.	Valves (Gate, Gloves, Cock, Check, Butterfly, Steam trap, Safety valve, Ball valve.	1 Each		
36.	Fittings (Flange, Socket, Union, Nipple, Elbow, Reducer, T, Plug)	1 Each		
37.	Thermal Conductivity Meter (For Asbestos Powder)	1		

AUTOMATIC PROCESS CONTROL LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Electronic Microprocessors Based Balance 300/310 Gm. Accuracy 0.001 gm., reproductibility 0.001gm, stabilization +3ppm/oC sample pan size 135mm dia, min. Input weight reading 1gm. operating Temperature range 0oC-40oC RH-85%, Power supply AC Adopter 220V or other +10%-15%, 50-60 Hz supplied Acrylic wind shunt	1		35000
2.	Strip Chart Recorder	1		35000
3.	Automatic Rapid Moisture Tester.	1		32000
4.	Air Compressor (Single Stage) Single Phase	1		12000
5.	Aircompressor With Automatic Control Switch.	1		8000
6.	Bimetallic Thermometer	1		1500
7.	Stop Watch 1/10 sec. Magnetic 7 jwels	2		1500
8.	Platinum Resistance Thermometer	1		1500
9.	Thermo Couple With Indicator and Control Recorder	1		10000
10.	Recording Type Gas/Vapour Filled Thermometer (Single Pen)	1		9000
11.	Pressure Transducer With Indicator	1		16000
12.	Rate Meter 40-400 lit./min with all parts	1		10000
13.	Pneumatic Control Valve 1" twoway max, pressure 5kh. on/off (Diaphram Type)	1		8000
14.	Float & Tape Type Liquid Level Measuring Depth.	1		1500
15.	Flap or Nozzle Arrangement For Demonstration.	1		1000
16.	Pressure Regulator with Air Filter Niddle. (Max. Pressure 5 Bar 25 connector 1/4)	1		3000
17.	M.S. Tanks 1.5x1x0.7 M.	3		15000
18.	M.S. Tank Cylinderical With Inlet & Outlet type.	6		18000
19.	Bourdan Pressure Gauge	3		4500
20.	Tullo Pump of Minium Capacity 1/4 HP	3		15000
21.	Auto Transformer 2 amp	3		6000
22.	Voltage Stabilizer Input 80-280 V/Output 230 V	2		3000
23.	Millivoltmeter Milliameter Micrometer	3		24000

Each 0-100 Amp.

24. Hot Plate Heater/Water Heater 2 6000

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
19.	Power Supply 230 V.	1	1000	1000
20.	Moving Coil Ammeter 0-500 M.A.	1	1000	1000

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
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

9. INTRODUCTION TO PAINT & POLYMER TECHNOLOGY LAB

S.No.	Name of Equipment	@ 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 morter 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

Corrected and Approved By BTE 04.05.2017

36.	Glass cutting knife	1	75	75
37.	Spatula hard & nickel/steel	2 each	50	100
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.	Platinium 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

10. DRYING OILS & PAINT MEDIA LAB

1.	3-Neck Flasks	02	500	1000
2.	Condensers With Tubes & Heating Mental	01	1000	1000
3.	Stands With Clamps & Boss Head	15	20	300
4.	Beakers			
	(i) 250 ml	24	20	480
	(ii) 500 ml	10	25	250
	(iii) 1 leter	05	30	150
	(iv) 2 leter	05	50	150
5.	Filter Paper		100	
6.	Abel's Flash Points Apparatus		3000	
7.	Automatic pigment muller	01		
8.	Tiles 1' X 1'	08		
9.	Steel spetula 6 "	60		
10.	Burette stand	08		
11.	Burette	08		
12.	Measuring cylinder- 100 ml	08		
13.	Electronic weighing scale 0-200 gm	01		
14.	Pipette	08		
15.	Hot plate	08		

Corrected and Approved By BTE 04.05.2017

16. Steel tumbler 01
17. Thermometer 08
18. Glass Pannel 08
19. Conical Flask 08
20. Allyd Plank assembly

11. EQUIPMENT FOR TESTING & QUALITY CONTROL LAB

1. Brush
2. Glass Plate
3. Cup Wt/10Leter 2000
4. Balance 15000
5. Hegman Gauge 5000
6. Petri Dish
7. Oven 20000
8. Ford Cup No.-4 With Spatula 2000
9. DFT Gauge 30000
10. Mandred bend tester 10000
11. Scratch Hardness Tester 20000
12. Pencil Hardness Tester 20000
13. Impact Tester 15000
14. Glasso Meter 40000
15. Black and White Moris Chart 20 Per Pcs.
16. Spray Gun with Gravity Feed Cup 1000
17. Humidity chamber
18. Salt spray unit
19. Wt/Lit cup
20. Checker board

12. PAINT MAKING LAB

1. Pestle & Mortar Rs. 30
2. Lab Pal Mill/Bal Mill/ bead mill (1Leter) With Moter Rs. 5000
3. Lab stirrer(high speed)
4. Lab attritor

LIST OF LABORATORY EQUIPMENT(Energy Conservation)

Sr. No	Particulars	Qty	Estimated Cost (Rs)
1.	Multimeter	1	17,000
2.	Power Analyzer	1	20,000
3.	Luxmeter	1	5,000
4.	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25,000
5.	Centrifugal pump, 1 kW	1	15,000
6.	Variable Frequency drive	2	50,000
7.	Water Flow meter	1	10,000
8.	Pressure Gauge	1	2,000
9.	Experimental Set up for Valve Throttling vs VFD	1	50,000
10.	Compressor, 20 cfm, single-stage	1	50,000
11.	Air leakage meter	1	18,000
12.	Blower (2 HP)	1	8,000

LEARNING RESOURCE MATERIALS

1.	LCD Projector with Screen	1	--	20000
2.	Handicam	1	--	30000
3.	Cutting, Binding & Stitching equipment.	1	--	30000
4.	Desk Top Computer with Internet Core i5/i7- 760, Processor, Genuine Windiw 7, Professional 18 inch HD, Flat Panel Monitor Optical Mouse, Key Board & all related media or latest version	1	--	40000
5.	Home Theater Support Disc type CD. CDR/CDRW DVDR/DVDRW, VCD Supported with USB Port Support-DIVX/JPEG/MP3	1	--	25000
6.	Commerical P A System 16 W-220W output, AC & 24V DC Operated, 5 Mic. & 2 Auxilary input, Speaker output 4 Ohm, 8 Ohm, 17 V & 100 V	1	--	20000
7.	Interactive Board	1	--	50000

ote :

1. This center will be only one at the institute level irrespective of all branches.

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. Discripton 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. :

Corrected and Approved By BTE 04.05.2017

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

Corrected and Approved By BTE 04.05.2017

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

1. Presentations of Case Studies
2. Debate competitions
3. Poster competitions
4. Industrial visits
5. Visual Aids

COURSE OUTCOMES

After studying this course, a student will be able to co-relate and apply fundamental key concepts of energy conservation and energy management in industry, commercial and residential areas. A student will be able to:

- Define principles and objectives of energy management and energy audit.
- Understand Energy Conservation Act 2001 and its features.
- Understand various forms & elements of energy.
- Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- Identify areas of energy conservation and adopt conservation methods in various systems.
- Evaluate the techno economic feasibility of the energy conservation technique adopted.

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

REFERENCE BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi&Shashank Jain published by TERI. Latest Edition
5. **Important Links:**
   (i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.
   (ii) Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in.

(iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.

(iv) **Central Pollution Control Board (CPCB),** Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.

(v) Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.

(vi) Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

ANNEXURE-III QUESTIONNAIRE

INSTITUTE OF RESEARCH,DEVELOPMENT AND TRAINING U.P.KANPUR -208002

SUBJECT: Questionnaire for ascertaining the job potential and activities of diploma holder in Paint Technology.

PURPOSE: To design and develop Threer Year(Six Semester) diploma curriculum in Paint Technology .

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 organization :

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

3.Name of the department/section/ shop :

4.Importent functions of the department/section/shop :

5.Number of diploma holder employees under your charge in the area of Paint Technology . :

6.Please give names of modern equipments/ machines. handled by a diploma holder in Paint Technology :

1. 2. 3.

4. 5. 6.

7.What proficiencies are expected from a diploma holder in Paint Technology . :

1. 2. 3.

4. 5. 6.

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

1. Theoretical knowledge ----------%
2. Practical knowledge ----------%
3. Skill Development ----------%

Corrected and Approved By BTE 04.05.2017

9.Do you think " on the job training" / Industrial training should form a part of curriculum. (Yes/ No)
if yes then
(a) Duration of training ----------
(b) Mode of training 1. Spread over different semesters

2. After completion of course

3. Any other mode

10.What mode of recruitment is followed by your organisation.

1. Academic merit
2. Written test
3. Group discussion
4. Interview
5. On the job test.

11. Mention the capabilities/ Qualities looked for while recruiting diploma holder in Paint Technology .
(a) Technical knowledge :
(b) Practical skill :
(c) Etiquettes and behaviour :
(d) Aptitude :
(e) Health habit and social background :
(f) Institution where trained :

12. Does your organisation have any system for the survey of Home articles of different countries/States. Yes/No

13. Does your organisation conduct field survey to know users views regarding. Yes/No
1. Home Articles for different age groups and sex.
2. Effect of climatic conditions
3. Any other
If yes ; Please give brief account of each.

14. Which type of assignment do you suggest for an entrepreneur in Paint Technology .

15. In which types of organisations can a diploma holder in Paint Technology can work or serve.

1	2	3
4	5	6

16. Job prospects for the diploma holder in Paint Technology 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 Paint Technology Chemical .

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 finilisation of curriculum.

21. What changes in technologies are to be incorporated in the development of curriculum in Paint Technology .

(Signature)

Kindly mail the above questionnaire duly filled to:-

Lal Ji Patel
T.B.O
Institute of Research,Development & Training,U.P.
Govt. Polytechnic Campus
Kanpur-208002

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