

CURRICULUM FOR THREE YEAR DIPLOMA COURSE

IN

PAINT TECHNOLOGY

UNDER DEVELOPMENT

ANNUAL SYSTEM

Prepared By

CURRICULUM DEVELOPMENT CELL

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**Study & Evaluation Scheme For
Three Year Diploma In Paint Technology
(Effective From Session)**

First Year

Curriculum						Subject	Scheme of Examination								
Periods Per Week							Theory				Practical				Grand Total
L	T	D	L	W	T		Examination		Ses sio nal Ma rks	Total Mark s	Examination		Sessi onal Mark s	Tot al Ma rks	
e	u	r	a	o	o		Dur atio n	Ma rks			Dur atio n	Ma rks			
c	t	a	b	r	t										
t	o	w	k	a											
3	-	-	2	-	5	1.1 Professional Communications	2.5	50	20	70	3	20	10	30	100
3	1	-	-	-	4	1.2 Applied Mathematics-I	2.5	50	20	70	-	-	-	-	70
3	1	-	2	-	6	1.3 Applied Physics	2.5	50	20	70	3	40	20	60	130
3	-	-	2	-	5	1.4 Applied Chemistry	2.5	50	20	70	3	40	20	60	130
-	-	8	-	-	8	1.5 Engineering Drawing	2.5	50	20	70	-	-	-	-	70
2	-	-	2	-	5	1.6 Introduction to Paint & Polymer Technology	2.5	50	20	70	3	60	30	90	160
2	1	-	1	-	4	1.7 Applied Mechanics	2.5	50	20	70	3	40	20	60	130
2	1	-	-	-	3	1.8 Measuring Instrument & Measurement	2.5	50	20	70	-	-	-	-	70
-	-	-	-	8	8	1.9 Workshop Practices	-	-	-	-	4	60	30	90	90
19	4	8	9	8	4	Total	-	400	160	560		260	130	390	950
						Games/NCC/Social and Cultural Activity+Discipline (30+20)									50
						Aggregate									1000

Note:-

1. Each period will be 50 minutes duration.
2. Each session will be of 32 weeks.
3. Effective teaching will be at least 25 weeks.
4. Remaining periods will be utilized for revision etc.
5. Field visit and extension lecturer are to be organized and managed well in advance at institute level as per need.

**Study & Evaluation Scheme For
Three Year Diploma In Paint Technology
(Effective From Session)**

Second Year

Curriculum						Subject	Scheme of Examination								Grand Total
Periods Per Week							Theory				Practical				
L	T	D	L	W	T		Examination	Ses sio nal Ma rks	Total Mark s	Examination	Sessi onal Mark s	Tot al Ma rks			
e	u	r	a	o	o								Dur atio n	Ma rks	
3	1		-		4	2.1 Applied Mathematics-II	2.5	50	20	70	-	-	-	-	70
3	1		2		6	2.2 Electrical Technology & Electronics	2.5	50	20	70	3	40	20	60	130
1	-		3		4	2.3 Computer Application for Engineering	-	-	-	-	3	60	30	90	90
3	1		-		4	2.4 Process Plant Utility	2.5	50	20	70	-	-	-	-	70
3	1		6		10	2.5 Fluid Mechanics & Solid Handling	2.5	50	20	70	3	100	50	150	220
3	1		-		4	2.6 Pigments & Extenders	2.5	50	20	70	-	-	-	-	70
3	1		-		4	2.7 Natural & Synthetic Resins	2.5	50	20	70	-	-	-	-	70
3	1		4		8	2.8 Drying Oils & Paint Media	2.5	50	20	70	4	60	30	90	160
3	1		-		4	2.9 Fuel & Material Technology	2.5	50	20	70	-	-	-	-	70
25	8		15		48	Total		160	160	560	-	260	130	390	950
Games/NCC/Social and Cultural Activity+Discipline (30+20)														50	
Aggregate														1000	

Note:-

1. Each period will be 50 minutes duration.
2. Each session will be of 32 weeks.
3. Effective teaching will be at least 25 weeks.
4. Remaining periods will be utilized for revision etc.
5. Field visit and extension lecturer are to be organized and managed well in advance at institute level as per need.

**Study & Evaluation Scheme For
Three Year Diploma In Paint Technology
(Effective From Session)**

Final Year

Curriculum						Subject	Scheme of Examination								Grand Total				
Periods Per Week							Theory				Practical								
L	T	D	L	W	T		Examina tion	Sess iona l Mar ks	Tota l Mar ks	Examina tion		Sess iona l Mar ks	Tota l Mar ks						
e	u	r	a	o	o					Du rat ion	Mar ks			Du rat ion		Mar ks			
c	t	a	b	r	a														
t	o	w	k	k	a														
3	1	-	3	-	7	3.1 Heat & Mass Transfer Operations	2.5	50	20	70	4	60	30	90	160				
3	1	-	-	-	4	3.2 Chemical Reaction Engineering	2.5	50	20	70	-	-	-	-	70				
3	1	-	2	-	6	3.3 Automatic Process Control	2.5	50	20	70	3	20	10	30	100				
2	1	-	-	-	3	3.4 Industrial Management & Enterprenurship	2.5	50	20	70	-	-	-	-	70				
3	1	-	-	-	4	3.5 Pollution Control & Industrial Safety	2.5	70	30	100	-	-	-	-	100				
3	-	-	4	-	7	3.6 Coating Properties, Evaluation & Quality & Control	2.5	50	20	70	3	60	30	90	160				
3	1	-	4	-	8	3.7 Formulation & Manufacturing of Paint	2.5	50	20	70	3	60	30	90	160				
3	1	-	-	-	4	3.8 Elective (Any One) I. Printing &Packaging Technology II. Paint Application	2.5	50	20	70	-	-	-	-	70				
1	-	-	-	4	5	3.9 Project a. Project Problem b. Field Exposure	-	-	-	-	3	70 40	30 20	100 60	160				
2 3	7	-	1 2	6 4	8	Total		420	170	590		310	150	460	1050				
Games/NCC/Social and Cultural Activity+Discipline (30+20)														50					
Aggregate														1100					
30% carry over of Ist year														300					
70% carry over of IInd year														700					
Grand Total														2100					

Note:-

1. Each period will be 50 minutes duration.
2. Each session will be of 32 weeks.
3. Effective teaching will be at least 25 weeks.
4. Remaining periods will be utilized for revision etc.
5. Field visit and extension lecturer are to be organized and managed well in advance at institute level as per need.,

MAIN FEATURES OF THE CURRICULUM

1. Title of the Course : Diploma in Paint Technology
2. Duration of the Course : Three Years Duration
3. Type of the Course : Full Time Institutional
4. Pattern of the Course : Annual System
5. Intake : 60
6. Entry Qualification : 10 + with Science II and Mathematics II
7. Admission Criteria : State Joint Entrance Examination

LIST OF EXPERTS

List of experts whose deliberation helped the development of curriculum for three year diploma course in Paint Technology at I.R.D.T. U.P., Kanpur on 03.02.2009 and 26.6.2009 at H.B.T.I., Kanpur are honourably named below -

- | | | |
|-------------------------|---|---|
| 1. Dr. Pramod Kumar | Professor & Head
Deptt.of Oil & Paint Technology | H.B.T.I., Kanpur. |
| 2. Shree Arun Mathani | Asst.Professor
Oil&Paint Technology Deptt. | H.B.T.I., Kanpur. |
| 3. Dr. G.S.Tripathi | Director | Rama Institute of Engg.& Technology
Mandhana,Kanpur. |
| 4. Dr. S.Chandra | Retd.Professor | H.B.T.I., Kanpur |
| 5. Dr.M.S.Saxena | Retd. Professor
Paint Technology | H.B.T.I., Kanpur |
| 6. Shri Manish Yadav | Asst. Manager | Kansai Nerolac Paints Ltd.
Kanpur Dehat. |
| 7. Shri Lal Ji Patel | Lecturer (Chemical Engg.) | Govt.Polytechnic, Kanpur |
| 8. Shri A.K. Sharma | Lecturer Chemical Engg.) | Sanjay Gandhi Polytechnic,
Jagdishpur |
| 9. Shri Durgesh Chandra | Asst. Professor | I. R. D. T., Kanpur |

NEED ANALYSIS

Learning in general goes on with life informally but in Education systems there are always some patterns to partake knowledge to desirous ones in definite period and systematic manners, developing their knowledge and skill both.

Paint is a substance composed of solid colouring matter suspending in a liquid medium 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 ingredients-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.

JOB POTENTIAL/JOB OPPORTUNITIES

The employment potential in this industry is huge. 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 manufacturers, resin suppliers, polymer suppliers or additive suppliers.

The Indian economy today is one of the fastest growing economies 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 steady 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.

1.1 PROFESSIONAL COMMUNICATION

[Common to All Engineering/Non Engineering Courses]

L T P
3 - 2

Rationale:

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

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction to communication methods meaning, channels & media written and verbal.	5	-	-
2.	Development of comprehension of English & Hindi through study of text material & language exercises.	10	-	-
3.	Development of expression through A. Letters(English & Hindi) B. Report writing (English) Note making and minutes writing	10 10	-	-
4.	Paragraph writing, Essey writing, Proposal writing	10	-	-
5.	Composition	10	-	-
6.	Remecial Grammer & Vocabulary Building	20	-	-
	TOTAL	75	-	50

1. PART I : COMMUNICATION IN ENGLISH (40 Marks)

- 1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writing and speaking, Barriers in communication, Modern tools of communication- Fax, e-mail, Telephone, telegram, etc.
- 1.2 Technical communication Vs. General Communication : Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.
- 1.3 Development of expression through:
 - 1.3.1 Paragraph writing, Essay writing, Proposal writing.
 - 1.3.2 Business and personal correspondence (Letters) : Kinds of letters:- Official, demi-offical, unofficial, for reply or in reply, quotation, tender and order giving letters. Application for a job, Resume.
 - 1.3.3 Report writing and Note making and minutes writing.

- 1.4 Functional Grammar : Study of sentences and parts of speech (word class), Preposition, Verb, Articles, Abbreviations.
- 1.5 Vocabulary Building : Homophones, One word substitution, Idioms and Phrases.
- 1.6 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. **PART II : COMMUNICATION IN HINDI (10 Marks)**

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

Letter writing in Hindi:

Kinds of letters:-

Official, semi-official, unofficial, for reply or in reply, quotation, tender and order giving letters, Application for a job, Press release in Hindi, Report writing.

Note: Paper should be in two parts, part I - English and part II Hindi.

REFERENCE BOOKS

- 1. Bookshelf worksheet of Professional Communication, New Delhi : Bookshelf 2008
- 2. Functional Skills in language and literature by R. P. Singh, New Delhi : Oxford University Press.
- 3. Oxford English Hindi English Dictionary, New Delhi : Oxford 2008

LANGUAGE LAB PRACTICE

For the practice/exercise the following is suggested :-

- 1.A. Phonetic transcription
- B. Stress and intonation :
(At least 10 word for writing and 10 word for pronunciation)
- 2. ASSIGNMENT : (Written Communication)

Two assignment of approximately 400 word each decided by the teacher concerned.

THE FOLLOWING MODEL IS PROPOSED :

- 1. a picture/photograph
- 2. an opening sentence or phrase
- 3. a newspaper/magazine clipping or report
- 4. factual writing which should be informative or argumentative.
(The students may refer to "Bookshelf worksheet" for technical communication)
- 3. Oral Conversation:
 - 1. Short speeches/declamation : Bid farewell, Felicitate somebody, Celebrate a public event, Offer condolences
 - 2. Debate on current problems/topics

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

4. Aural :

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

The assignments/project work are to be evaluated by the internal/ external examiner. The distribution of 30 marks e.g. 10 marks for assignment (Given by subject teacher as sessional marks) 10 marks for conversation and viva-voce 10 marks for phonetic transcription

STRUCTURE OF THE PAPER OF PROFESSIONAL COMMUNICATION

Distribution of Marks

Theory Paper : 50 Marks

Sessional : 20 Marks

Practices : 30 Marks

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

- | | |
|---------------------------|----------|
| A. from English Text Book | 10 Marks |
| B. from Hindi Text Book | 5 Marks |

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

- | | |
|--------------------|---------|
| A. English Letters | 5 Marks |
| B. Hindi Letters | 5 Marks |

- Q3. Report Writing on given outlines 5 Marks

- Q4. There will be a number of short answer questions to test the candidates knowledge of functional grammar, structure and usage of the language. All the items in this question will be compulsory. The grammar questions has four parts -

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

- A. This part of the question has to do with the transformation of sentences. English uses several patterns of sentence formation and the same meaning can be expressed by several patterns e.g. Active to Passive voice and vice versa, Direct to Indirect and vice versa, Reframing sentences by changing part of speech e.g Noun to Adjective, Interchanging degree of comparison. Interchanging Moods - Affirmative to Negative, Assertive to Interrogative or to exclamatory
- B. The second part usually requires blanks in a sentence to be filled in with a suitable preposition and articles.

- C. The third part is usually an exercise on tenses.
- D. The fourth part concerns with one word substitution and abbreviation, uses of idioms and Phrases, homophones.

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

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

- A. the quality of the language employed, the range and appropriateness of vocabulary and sentence structure the correctness of grammatical construction, punctuation and spelling.
- B. The degrees to which candidate have been successfully in organising both the composition as a whole and the individual paragraphs.

1.2 APPLIED MATHEMATICS-I

(Common To All Engineering Subject)

L T P
3 1 -

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.

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Algebra-I	18	6	-
2.	Trigonometry	7	2	-
3.	Coordinate Geometry	15	5	-
4.	Differential Calculus-I	15	5	-
5.	Integral Calculus-I	20	7	-
TOTAL		75	25	-

DETAILED CONTENTS:

1. ALGEBRA-I :

1.1 Series : AP and GP; Sum, nth term, Mean

1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.

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

1.4 Vector algebra : Dot and Cross product, Scalar and vector triple product. Application to work done, Moment of a force, Plane geometry.

2. TRIGONOMETRY :

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

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

3. CO-ORDINATE GEOMETRY :

3.1 Standard form of curves and their simple properties -

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

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

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

Tangent and normal

3.2 Straight lines, planes and spheres in space -Distance between two points in space, direction crossing and direction ratios, Finding equation of a straight line, and shortest distance between two lines Under different conditions equation of a plane $lx+my+nz=c,$

relation between lines and planes, sphere $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz=d$

4. DIFFERENTIAL CALCULUS - I :

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

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

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

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

5. INTEGRAL CALCULUS - I :

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

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

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

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

1.3 APPLIED PHYSICS
(Common To All Engineering Subject)

L T P
3 1 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.	UNITS	COVERAGE TIME		
		L	T	P
1.	Measurement	4	1	-
2.	Vector	3	1	-
3.	Force and Motion	4	1	-
4.	Dynamics of rigid body (Rotational Motion)	4	1	-
5.	Fluid Mechanics and Friction	4	1	-
6.	Work, Power and Energy	4	2	-
7.	Elasticity	2	1	
8.	Simple Harmonic Motion	4	1	
9.	Simple Harmonic Motion	4	2	-
10.	Application of Sound Waves, Acoustics and Ultrasonic	6	2	-
11.	A. Optics	4	1	-
	B. Fiber Optics	4	2	-
12.	D.C. Circuits	4	1	-
13.	Dielectrics	4	2	-
14.	Magnetic Fields and Materials	4	2	-
15.	Semi Conductor Physics	5	1	-
16.	Nuclear Physics	4	2	-
17.	Laser & its Application	4	1	-
18.	Non-conventional energy sources	3	1	-
	TOTAL	75	25	50

DETAILED CONTENTS:

1. Measurement

a) Units and Dimensions

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

- i) Checking the correctness of physical equations,
- ii) Deriving relations among various physical quantities,
- iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.

b. Errors in measurements, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement(Combination of errors in addition, subtraction, multiplication and powers). Significant figures, and order of accuracy in respect to instruments, Standard deviation, Variance.

2. Vector :Scalar and vector quantities; Addition, Subtraction, Resolution of vector- Cartesian components of vector, Scalar and vector product of two vector.

3. Force and Motion

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

4. Dynamics of Rigid Body (Rotational Motion)

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

5. Fluid Mechanics & Friction

Surface tension, Capillaries, Equation of continuity ($A_1V_1=A_2V_2$), Bernoulli's theorem, stream line and Turbulent flow, Reynold's number. Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Static and dynamic frictional forces. Coefficients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.

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

7. Elasticity

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

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

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

10. Application of Sound Waves

Acoustics Standing waves, Closed and Open organ pipes, Resonance, End-correction. Definition of pitch, loudness, quality and intensity of sound waves. Echo and reverberation and reverberation time. Sabine's formula. Control of reverberation time (problems on reverberation time). Acoustics of building defects and remedy. Ultra-Sonic :Generation, Magnetostriction, Piezoelectric effect, Application in new technology

11.A Optics

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

B. Fiber Optics : Critical angle, Total internal reflection, Principle of fiber optics, Optical fiber, Pulse dispersion in step-index fibers, Graded index fiber, Single mode fiber, Optical sensor.

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

13. Dielectrics :Electric dipole; effect of electric field on dielectrics, polarization.

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

15. Semiconductor Physics

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

16. Nuclear physics

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

17. Lasers and its Applications

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

18. Non-conventional energy sources: (a) Wind energy : Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill, Indian wind energy programmer.

(b) Solar energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, Solar constant measurement of solar radiation by pyrometer, and by Isolation meter (suryamapi) uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector, Solar PV plants in India, Modern applications in technology.

PHYSICS LAB

Note: Any ten experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.
2. Determination of 'Y' (Young's Modulus) by Searle's Method.
3. Determination of 'g' by plotting a graph T^2 versus l and using the formula $g = 4\pi^2 c^2 / \text{Slope of the graph line}$
4. Determination of Spring constant.
5. Determination of viscosity coefficient of a lubricant by Stoke's law.
6. Determination of 'k' for good conductor (Searle's Method).
7. Determination of frequency of AC mains by melde's methods (Transverse and Longitudinal Mode)
8. Determination of velocity of sound by resonance tube.
9. Determination of E_1/E_2 by potentiometer.
10. Determination of specific resistance by Carry Foster bridge.
11. Determination of resistivity by P.O.Box.
12. Verification of Kirchoff's Law.
13. To observe Characteristics of p-n Junction diode on oscilloscope.
14. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.
15. To measure solar intensity (determine solar constant) with the help of Insolation meter (Suryamapi).
16. Demonstration of He-Ne laser (Interferometer)
17. Determination of internal resistance by potentiometer.

NOTE :

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

1.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

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3 - 2

Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge along with 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.	UNITS	COVERAGE TIME		
		L	T	P
1.	Atomic Structure	4	-	-
2.	Chemical Bonding	6	-	-
3.	Classification of Elements	3	-	-
4.	Instrumental Methods	4	-	-
5.	Electro Chemistry	6	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	3	-	-
8.	Solid State	3	-	-
9.	Colloids	3	-	-
10.	Lubricants	3	-	-
11.	Environmental Pollution and Control	3	-	-
12.	Water Treatment	5	-	-
13.	Corrosion	3	-	-
14.	Fuels	3	-	-
15.	Glass and Ceramics	3	-	-
16.	Stereochemistry of Organic Compounds	4	-	-
17.	Organic Reactions	6	-	-
18.	Organic Materials	9	-	-
	TOTAL	75	-	-

DETAILED CONTENTS

1. ATOMIC STRUCTURE :

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

2. CHEMICAL BONDING :

Overview of basic concept, Hydrogen bonding, Valence bond theory, Hybridization, VSEPR theory, Molecular orbital theory, Co-ordination bond, Crystal field theory for tetrahedral carbon.

3. CLASSIFICATION OF ELEMENTS :

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

4. INSTRUMENTAL METHODS :

UV-visible, IR and NMR spectroscopy, Basic principles, Beer-Lambert's Law and Application of spectroscopy.

5. ELECTRO CHEMISTRY :

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and its measurement by pH meter. Buffer solutions, Indicators, Solubility product, Common ion effect with their application, Redox reactions, Electrode potential (Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electrochemical series and its application. Concentration cells, reference electrodes (Hydrogen electrode) cells - Primary, Secondary and Fuel cell, Leclanche's or dry cell, Acid storage cell (Lead accumulator) and Alkaline storage cell (Edison accumulator), Fuel cell, Solar cell (Photovoltaic cell), Numerical problems based on topics.

6. CHEMICAL KINETICS :

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

7. CATALYSIS :

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

8. SOLID STATE :

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

9. COLLOIDAL STATE OF MATTER :

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

10. LUBRICANTS :

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

11. ENVIRONMENTAL POLLUTION AND ITS CONTROL :

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

12. WATER TREATMENT :

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

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

Analysis of Water :

A. Estimation of chlorides in water.

B. Determination of dissolved oxygen.

Disinfecting of Water :

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

13. CORROSION :

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

14. FUELS :

Definition of fuel, its classification and their composition, Calorific value and determination of calorific value of solid and liquid fuels by Bomb calorimeter by Dulong's formula. Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Diesel and Petrol), Benzol and Power alcohol. Knocking, Anti-knocking agents, Octane number and Cetane number Cracking and its type, Gasoline from hydrogenation of coal (Bergius process and Fischer tropsch's process) Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG, CNG and Solar energy Numerical Problems based on topics

15. GLASS AND CERAMICS :

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

16. STEREOCHEMISTRY OF ORGANIC COMPOUND:

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

17. ORGANIC REACTIONS :

1. Fundamental aspects -
 - A. Regents electrophiles and nucleophiles
 - B. Reaction Intermediates
 - i. Free radical
 - ii. Carbocation
 - iii. Carbanion
 - C. Various effects of substituents - Inductive, Mesomeric Electromeric.
2.
 - A. Mechanism of addition reaction (Markonicove's Rule, Cyanohydrin and Peroxide effect),
 - B. Mechanism of Substitution reactions (Nucleophilic- hydrolysis of alkyle halide, electrophilic substitution halogenation, Sulphonation, Nitration and friedel-Craft reaction.

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

18. ORGANIC MATERIALS :

A. POLYMERS :

1. Introduction to basic terms used in polymer chemistry and technology. Monomers, Average degree of polymerisation, Average molecular weight, Polymers, Polymerization.

2. Characteristics of Polymers and their classification

A. Addition polymers and their industrial application Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.

B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.

3. Free radical polymerisation (Mechanism)

4. General idea of Bio polymers

5. Brief idea of bio degradable polymers.

6. Inorganic polymers - Silicones

B. SOAPS AND DETERGENTS :

1. Introduction - A. Lipids, B. Fats and Oils

2. Saponification of fats and oils , Manufacturing of soap.

3. Synthetic detergents, types of detergents and its manufacturing.

C. EXPLOSIVES : TNT, RDX, Dynamite.

E. PAINT AND VARNISH

F. ADHESIVES

LIST OF PRACTICAL

1. To analyse inorganic mixture for two acid and basic radicals from following radicals

A. Basic Radicals :

NH_4^+ , Pb^{++} , Cu^{++} , Bi^{+++} , Cd^{++} , As^{+++} , Sb^{+++} , Sn^{++} , Al^{+++} , Fe^{+++} , Cr^{+++} , Mn^{++} , Zn^{++} , Co^{++}

Ni^{++} , Ba^{++} , Sr^{++} , Ca^{++} , Mg^{++}

B. Acid Radicals :

CO_3^{--} , S^{--} , SO_3^{--} , CH_3COO^- , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , SO_4^{--}

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 CaCO_3 by EDTA titration method using E Br indicator.

4. To determine the strength of given HCl solution by NaOH solution using pH meter

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

6. Determination method of temporary hardness of water sample by O-hener's method.

1.5 ENGINEERING DRAWING

(Common To Three Year Diploma Courses in Civil Engineering, Mechanical Engineering(Spl. In Production Engineering), Electrical Engineering, Chemical Engineering, Dairy Engineering, Ceramic Engineering, Textile Technology, Textile Chemistry)

(Also common to Four year part time diploma courses in Mechanical Engineering (Spl. In Production Engineering), Electrical Engineering)

(Also common to First Year Diploma Course in Chemical Technology Spl. In Fertilizer Technology & Rubber and Plastic Technology)

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Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, draftsmen and craftsmen in the industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus, for the effective and efficient communication among all those involved in an industrial system, it becomes necessary that the personnel working in different capacities acquire appropriate skills in the use of this graphic language in varying degrees of proficiency in accordance with their job requirements. Generally speaking, an engineering technician working at the middle level of the threeter technical manpower spectrum, is required to read and interpret the designs and drawings, provided to him by technologists and subsequently to translate them to the craftsmen for actual execution of the job. This course in Engineering Drawing has been designed, keeping in view, the above referred job functions of a technician in the industry. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects. The contents of the course have been selected as to form a core for the various deversified fields of engineering. It is expected that at the end of this session, the students acquire sufficient skill drafting and some ability in spetal visualization of simple objects.

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Drawing Instruents and their use	-	-	4
2.	A. Lettering techniques	-	-	8
	B. Introduction to scales	-	-	8
3.	Conventional Presentation	-	-	8
4.	Principles of projections	-	-	16
5.	Orthographic projection of simple geometrical solids	-	-	24
6.	Section of Solids	-	-	20
7.	Isomatic Projection	-	-	20
10.	Free Hand Sketching	-	-	16
11.	Development of surfaces	-	-	24
13.	Assembly and dissembly drawing	-	-	24
14.	Orthographics Projection of Machine Parts	-	-	12
15.	Practice on Auto Cad	-	-	16
	TOTAL			200

CONTENTS

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

1. Drawing, instruments and their uses.
 - 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 1 Sheet
 Printing of vertical and inclined, normal single stroke capital letters.
 Printing of vertical and inclined normal single stroke numbers. Stencils and their use.
- (b) Introduction to Scales 1 Sheet
 Necessity and use, R F Types of scales used in general engineering drawing. Plane, diagonal and chord scales.
3. Conventional Presentaion : 2 Sheet
 Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts.
4. (a) Principles of Projection 1 Sheet
 Orthographic, Pictorial and perspective. Concept of horizontal and vertical planes. Difference between I and III angle projections. Dimensconing techniques.
- (b) Projections of points, lines and planes. 1 Sheet
- 5 (a) Orthographic Projections of Simple 3 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 1 Sheet
 Concept of sectioning Cases involving cutting plane parallel to one of the reference planes and perpendicular to the others. Cases involving cutting plane perpendicular to one of the reference planes and 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 1 Sheet
 Parallel line and radial line methods of developments. Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).
10. Assembly and Disassembly Drawings 2 Sheet
 Plummer block Footstep bearings Couplings etc. Rivetted & Welded Joints
11. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet
 Nut and Bolt, Locking device, Wall bracket
12. PRACTICE ON AUTO CAD :
 To draw geometrical figures using line, circle, arc, polygon, ellipse, rectangle - erase and other editing commonds and osnap commands (two dimensional drawing only)

NOTE :

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

1.6 INTRODUCTION TO PAINT & POLYMER TECHNOLOGY

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TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Basics of paints	20	-	-
2.	Introduction to oils	10	-	-
3.	Fundamentals of Polymer	20	-	-
4.	Classification of polymer	15	-	-
5.	Polymerization techniques	10	-	-
	TOTAL	75	-	-

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 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 macro-molecular concept, monomers & polymers nomenclature of polymer, feature & characteristic of a polymer, definition of polymerization, rate of polymerization, average degree of polymerization, polymerization and functionality. oligomers 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 and Suspension, solution & emulsion polymerization.

INTRODUCTION TO PAINT & POLYMER TECHNOLOGY LAB

1. Physical testing of drying oils for colour, sp. gr. & R.I..
2. Physical testing of semidrying oils for colour, sp. gr. & R.I..
3. Physical testing of nondrying oils for colour, sp. gr. & R.I..
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.
10. Preparation of Polyacrylate by bulk emulsion.

1.7 APPLIED MECHANICS

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

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

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

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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.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	2	-	-
2.	Force Analysis	8	4	-
3.	Moment and Couple	4	2	-
4.	General condition of equilibrium	4	3	-
5.	Friction	6	3	-
6.	Machines	6	3	-
7.	Stress & Strain	8	4	-
8.	Beam & Trusses	6	3	-
9.	Thin cylindrical & spherical shells	6	3	-
	TOTAL	50	25	25

DETAILED CONTENTS

1. Introduction:

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

2. System of Forces :

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

3. Moment & couple:

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

4. General Condition of Equilibrium:

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

5. Friction:

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

6. Machines:

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

7. Stresses and strains:

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

8. Beams & Trusses:

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

9. Thin cylindrical and spherical shells:

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

APPLIED MECHANICS LAB : PRACTICALS

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

1.8-MEASURING INSTRUMENTS AND MEASUREMENTS

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

L T P
2 1 -

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction and Classification of Instruments	10	5	-
2.	Pressure and Vacuum gauges	10	5	-
3.	Thermometers and Pyrometers	10	5	-
4.	Flow meters	10	5	-
5.	Liquid level meters	10	5	-
	TOTAL	50	25	-

DETAILED CONTENTS

INTRODUCTION & CLASSIFICATION OF INSTRUMENTS:

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

2. PRESSURE AND VACUUM GAUGES:

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

3. THERMO METERS AND PYROMETERS:

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

4. FLOW METERS:

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

5. LIQUID LEVEL METERS:

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

1.9 WORKSHOP PRACTICE

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

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

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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.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Carpentry shop	-	-	24
2.	Painting & polishing shop	-	-	16
3.	Sheet metal and soldering shop	-	-	24
4.	Fitting shop	-	-	24
5.	A. Plumbing shop	-	-	16
	B. Foundry shop	-	-	20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
9.	Fastening Shop	-	-	12
	TOTAL			200

DETAILED CONTENTS

1. Carpentry Shop :
 - EX-1 Introduction & demonstration of tools used in carpentry shop
 - EX-2 Planing and sawing practice
 - EX-3 Making of lap joint
 - EX-4 Making of mortise and tenon joint
 - Ex-5 Making of bridle joint
 - EX-6 Making of dovetail joint
 - Ex-7 Making of any one utility article such as wooden picture frame, hanger, peg, name plate, etc.
2. Painting and Polishing Shop:
 - EX-1 To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.
 - Ex-2 To prepare metal surface for painting, apply primer and paint the same.
 - EX-3 To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.
 - * EX-4 Buffing and abrasive polishing of brass job.
 - Ex-5 Zinc coating by electroplating method.
 - Ex-6 To prepare any utility job.
 - * The sequence of polishing will be as below:
 - i) Abrasive cutting by leather wheel.
 - ii) Polishing with hard cotton wheel and with polishing material.

- iii) Buffing with cotton wheel or buff wheel.
- 3. Sheet Metal Working and Soldering Shop :
 - EX-1 Introduction & demonstration of tools used in Sheet metal working shop.
 - EX-2 Cutting, shearing and bending of sheet.
 - EX-3 To prepare a soap case by the metal sheet.
 - EX-4 To make a funnel with thin sheet and to solder the seam of the same.
 - EX-5 To make a cylinder and to solder the same.
 - EX-6 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired joints.
 - EX-7 Study and sketch of various types of stakes/anvil.
 - EX-8 To braze small tube/conduit joints.
- 4. Fitting Shop :
 - EX-1 Introduction & demonstration of tools used in Fitting Shop.
 - EX-2 Hacksawing and chipping of M.S. flat.
 - EX-3 Filing and squaring of chipped M.S. job.
 - EX-4 Filing on square or rectangular M.S. piece.
 - EX-5 Making bolt & nut by tap and die set.
 - EX-6 To drill a hole in M.S. Plate and tapping the same to create threads as per need.
 - EX-7 Utility article-to prepare a screw driver or paper weight, double open mouth spanner for 18" hexagonal head of a bolt.
- 5 A. Plumbing Shop :
 - EX-1 Cutting and threading practice for using socket, elbow and tee etc. and to fit it on wooden practice board.
 - EX-2 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc.
- 5 B. Foundry Work
 - EX-1 Study & sketch of the foundry tools.
 - EX-2 Study & sketch of cupola & pit furnace.
 - EX-3 To prepare the green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)
 - EX-4 Casting of non ferrous (lead or aluminium) as per exercise 3.
- 6. Smithy Shop :
 - EX-1 Study & Sketch of Tools used in smithy shop.
 - EX-1 To prepare square or rectangular piece by the M.S. rod.
 - EX-2 To braze M.S. Flats/Tipped tools on M.S. shank.
 - EX-3 To make a screw driver with metallic handle.
 - EX-4 To make a square or hexagonalhead bolt.
 - EX-5 To make a ring with hook for wooden doors.
 - EX-6 Utility article-to prepare a ceiling fan hook.
- 7. Welding Shop :
 - EX-1 Welding practice-gas and electric.
 - EX-2 Welding for lap joint after preparing the edge.
 - EX-3 Welding of Butt joint after preparation of the edge.
 - EX-4 'T' joint welding after preparation of edge.
 - EX-5 Spot welding, by spot welding machine.
 - EX-6 Welding of plastic pieces by hot strip method.
 - EX-7 Welding practice by CO₂ gas welding
- 8. Machine Shop
 - EX-1 Study & sketch of lathe machine.
 - EX-2 Plain and step turning & knurling practice.
 - EX-3 Study and sketch of planing/Shaping machine and to plane a Rectangle of cast iron.
- 9. Fastening Shop
 - EX-1 Practice of bolted joints
 - EX-2 To prepare a rivetted joint
 - EX-3 To make a pipe joint
 - EX-4 To make a threaded joint
 - EX-5 Practice of sleeve joint

2.1 APPLIED MATHEMATICS II

(Common TO All Engineering Subject)

L T P
3 1 -

Rationale :

The study of mathematics is an important requiremen 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.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Matrices	15	5	-
2.	Ordinary Differential Equations	15	5	-
3	Differential Calculus-II	15	5	-
4.	Integral Calculus-II	15	5	-
5.	Probability & Statistics	15	5	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. MATRICES :

1.1 Algebra of Matrices, Inverse :

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

1.2 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 vactors,Consistency of equations.

1.4 Types of Matrices :

Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular.

1.5 Eign 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. ORDINARY DIFFERENTIAL EQUATION :

2.1 Formation, Order, Degree, Types, Solution :

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

2.2 First Order Equations :

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

2.3 Second Order Linear Equation :

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

2.4 Simple Applications:

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

3. DIFFERENTIAL CALCULUS-II :

3.1 Function of two variables, identification of surfaces in space

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

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

3.2 Partial Derivatives :

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

3.3 Vector Calculus :

Vector function, derivatives, gradient, divergence and curl Some identities among these. Five integrals, double and triple integral, surface integral, Green, Gauss and Stokes theorem and application

4. INTEGRAL CALCULUS - II

4.1 Laplace Transform :

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

4.2 Beta and Gamma Functions :

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

4.3 Fourier Series :

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

5. PROBABILITY AND STATISTICS :

5.1 Probability :

Laws and Conditional probability

5.2 Distribution :

Discrete and continuous distribution.

5.3 Binomial Distribution :

Properties and application through problems.

5.4 Poisson Distribution :

Properties and application through problems

5.5 Normal Distribution :

Properties and applications through problems

2.2 ELECTRICAL TECHNOLOGY & ELECTRONICS

(Common with Three Year Diploma In Mechanical Engineering & Dairy Engineering)

L T P
3 1 2

Rationals :

The superiority of electricity as power over other means in use in home or industry can now be denied. So it is imperative to introduce the present technology student with electrical machines and their various uses.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Electric Induction	1	-	-
2.	A. C. Theory	4	2	-
3.	Three Phase Circuits	8	3	-
4.	Measurement & Measuring Instruments	14	3	-
5.	Electronics	8	3	-
6.	D. C. Machines	6	-	-
7.	Transformers	8	3	-
8.	Synchronous Machines	8	2	-
9.	Induction Motors	6	2	-
10.	Electro Heating	6	2	-
11.	Electro Plating	5	2	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. ELECTRIC INDUCTION:

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

2. A. C. THEORY:

Production of alternating e.m.f. Definition of cycle, Frequency, Amplitude, Time period, Instantaneous, Average, R.M.S. maximum values of sinusoidal wave. Form factor, peak factor. Representation of a sinusoidal quantity by a mathematical expression and phasor, phase and phase difference, Relationship of voltage and current for pure resistance, pure inductance and pure capacitive reactance, impedance. Solution and phasor diagrams of simple R.L.C. series and parallel circuits. Active and reactive power. Significance of P.F.

3. THREE PHASE CIRCUITS:

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

4. MEASUREMENT & MEASURING INSTRUMENTS:

- (i) Primary and secondary instruments – Indicating & Recording and Integrated instruments.
- (ii) Working principle and construction of the following instruments.
 - (a) Ammeter & Voltmeter (Moving coil & Moving Iron). Extension of their ranges.
 - (b) Dynamometer type wattmeter.

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

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

5. ELECTRONICS:

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

6. D. C. MACHINES:

D. C. Generator:

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

D. C. Motor:

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

7. TRANSFORMERS:

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

8. SYNCHRONOUS MACHINES:

(a) Alternator

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. ELECTRIC HEATING:

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

11. ELECTROPLATING:

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

ELECTRICAL TECHNOLOGY & ELECTRONICS LAB

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

2.3 COMPUTER APPLICATION FOR ENGINEERING

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

L T P
1 - 3

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction to Computer	5	-	-
2.	Introduction To Operating System MS DOS/Windows	3	-	-
3.	MS-Word	4	-	-
4.	MS-Excel	3	-	-
5.	MS-Power Point	3	-	-
6.	MS-Access	3	-	-
7.	Introduction to Internet	2	-	-
8.	Concept of Programming	2	-	-
TOTAL		25	-	75

DETAILLEL CONTENTS

1. Introduction to Computer:

Block Diagram of Computer, Types of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devicee and memories. Visual Display Unit, Keyboard, Floppy disk drive, Hard disc drive, CD-ROM Drive, Magnetic & Tape Drive Number system Conversion) Binary, Octal, Hexa decimal number system, Conversion from Decimal to Other System and vice-versa Bit, Byte and Word.

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

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

3. MS WORD:

File : Open, Close, Save, Savà 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, Bullete & Numbering, Borders & Shading, Column, Change case, Back ground, etc.

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

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

4. MS EXCEL:

- Introduction, Use of Tools/Icons for preparing simple applications.
- 5. MS POWER POINT :
 - Introduction, Use of Tools/Icons for preparing simple presentation of Power Point.
- 6. MS ACCESS:
 - Introduction, Use of Tools/Icons for preparing simple applications.
- 7. Introduction to Internet:
 - What is Network→ How to send & receive messages, Use of Search Engines, Surfing different web sites, Creating Mail ID→ Use of Briefcase, Sending/replying emails.
- 8. Concept of Programming :
 - Flowcharting, Algorithm techniques, etc.

COMPUTER APPLICATION FOR ENGINEERING LAB

List Of Practicals

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

2.4-PROCESS PLANT UTILITIES

(Common with Chemical Engineering, Chemical Technology (Rubber & Plastic, Fertilizer, Petro Chemical)

L T P
3 1 -

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Generation Process & Steam Properties	12	5	-
2.	Types of fuels used in boilers	4	1	-
3.	Steam Generator	8	2	-
4.	Steam Distribution	8	2	-
5.	Pressure Vacuum system	8	4	-
6.	Water	8	2	-
7.	Water Treatment Technique	9	3	-
8.	Demineralization	9	3	-
9.	Cooling Water	9	3	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. GENERATION PROCESS & STEAM PROPERTIE

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

2. TYPES OF FULEB USED IN BOILERS :

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

3. STEAM GENERATOR:

Type of steam generators (boilers)-Fire tube & water tub and their principles. Elementry concept and principles of modern water tube boilers. Boiler mountings and accessories. Quantity of heat spent in generation. Ideal cycle of a steam plant. Ways of increasing the efficiency to steam power plant (No numerical question).

4. STEAM DISTRIBUTION:

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

5. PRESSURE VACCUM SYSTEM:

Construction and working of Blowers. Fan, Compressures, Vacuum Pump, Steam Ejectors.

6. WATER :

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

7. WATER TREATMENT TECHNIQUE :

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

8. DEMINERALIZATION :

Demmineralization 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 probleme like sealing use of inhibitors, like sodium and chromates.

2.5 FLUID MECHANICS & AND SOLID HANDLING

(Common with Chemical Technology (Rubber & Plastic))

L T P
3 1 6

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
	A-			-
1.	Fluids	5	1	-
2.	Flow of incompressible fluids	10	2	-
3.	Measurement of flowing fluids	10	2	-
4.	Transportation of fluids	10	4	-
	B-			
1.	Introduction	5	3	
2.	Characterisation of Solid Particles	5	2	-
3.	Size Reducation	6	2	-
4.	Handling of Solids	8	3	-
5.	Mechanical Separation	6	3	-
6.	Mixing Equipments	10	3	-
	TOTAL	75	25	150

DETAILED CONTENTS

PART - A

1. FLUIDS

- (i) Properties
- (ii) Classification of Fluids.
- (iii) Flui 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) Reynols No. Elementry knowledge of laminar and turbulent flow, Reynols 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 numerical problems, Definition:-Coefficient 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, Grizzlies, trommels.

3. SIZE REDUCTION:

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

4. 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 equipment, their application and operation, sand filters, filter press, leaf filters, rotary filters, filter aids. Centrifugal filtration.

(ii) Classifiers.

(iii) Thickener

(iv) Cyclones.

6. MIXING EQUIPMENTS:

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

FLUID MECHANICS AND 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 (C_v), coefficient of discharge (C_d), coefficient of contraction (C_c) and verify the relation between them.
6. To determine friction losses in pipes and fittings.
7. To verify loss of head due to
 - (a) Sudden Enlargement.
 - (b) Sudden Contraction.
8. To verify Bernoulli'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 & draw a layout 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 filtration 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.

2.6 PIGMENTS AND EXTENDERS

L T P
3 1 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	15	5	-
2.	Inorganic Pigments	20	7	-
3.	Extenders	15	5	-
4.	Organic pigments	15	5	-
5.	Miscellaneous pigment	10	3	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. INTRODUCTION:

Concept of colour phenomenon, classification of pigments, testing of pigments, oil absorption value, bulking value, sp. Gravity, reflux index, mass tone, reducing power, tinting, resistance to heat. Definition of Dyes pigment, 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 chromates and molybdates, chrome green, 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 as 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 extender 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 PIGMENT:

Phthalocyanine blue and green, hansa alloys, rubine, toners, para reds, toluidine, metallic, phosphorescent, fluorescent, treated pigments. Testing and identification of organic compound.

2.7 NATURAL & SYNTHETIC RESINS

L T P
3 1 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction to natural resins	9	3	-
2.	Resins and Shellac	6	2	-
3.	Bitumin	6	2	-
4.	Fundamental of Synthetic film formers	9	3	-
5.	Alkyd resin	12	4	-
6.	Amino resin	12	4	-
7.	Polyurethanes	12	4	-
8.	Vinyl and acrylic	9	3	-
TOTAL		75	25	-

DETAILED CONTENTS

1. INTRODUCTION TO NATURAL RESINS :

Classification and properties of natural resins, Processing of natural resins like copal congo etc, Resins sources, oleoresin and its composition, Recovery of resin and turpentine from aloe resin, properties and deficiencies resin film, modification of rosin-calcium rosinates, Zinc and polymerization rosin, maleopimaric acid from rosin etc, Identification of rosin.

2. RESINS AND SHELLAC:

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

3. BITUMIN:

Bitumin, pitched, gums and glue, natural bitumin like gilsonite and petroleum in Bit pitches general properties and uses of gums and glues cellulose source, properties, modification of cellulose for use in surface coatings like cellulose esters, ethers.

4. FUNDAMENTAL OF SYNTHETIC FILM FORMERS:

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

5. ALKYD RESIN:

Alkyd resin, raw material, chemistry and formulation of various alkyd, carothers and its application, alkyd constant manufacturing process classification, properties and application of various types alkyd, modification of alkyd such as co polymerized alkyds, natural & synthetic resins modified alkyd, water soluble alkyd, polyester resin, saturated polyesters, components and 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, novalac and cresols resin production properties and application of various phenolic water soluble phenolic.

6. AMINO RESIN:

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

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

7. POLYURETHANES:

Poly urethanes: various isocyanates used, reaction of the isocyanate group and their hazards, classification of poly urethanes, properties and application of various single and two pack system; silicone resin; synthesis of silicone resin's, structural properties relationship, modified silicone, properties and application of silicone resins.

8. VINYL AND ACRYLIC:

Vinyl and acrylic : vinyl and acrylic monomer type of vinyl resin used in surface coating . Use vinyl co polymer and their properties, thermo plastic and thermo settling acrylic, water soluble acrylic , hydro carbon resin , cumerone and indene resin, resin from petroleum products, terpene resin, miscellaneous resin : fluoro polymers, ketone resin, poly carbonate etc.

2.8 DRYING OILS & PAINT MEDIA

L T P
3 1 4

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	15	5	-
2.	Driers	15	5	-
3.	Solvent	15	5	-
4.	Plasticizers	15	5	-
5.	Additive	15	5	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. INTRODUCTION:

Properties and uses of some commonly used drying, semi drying & non drying oils, yellowing of oils modifies oils like heat treated oils, malenised oils, co polymerized oils, dehydrated coaster oils, isomerized oils, segregated, reconstituted oils etc.

2. DRIERS:

Introduction of driers, types of driers like primary, secondary and auxillary. Function of metals as well as, acid part of driers, their of drying action, 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 organize radical of metal organize driers.

3. SOLVENT:

Solvent: 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:

Plasticizers: definition, importance, mechanism of plasticization, types of plasticizers with their properties, evaluation of plasticizers.

5. ADDITIVE:

Additive: function of additives, additives for solvent thinned like wetting, and dispersing agents, anti settling and bodying agents anti skinning agents and anti flooding agents etc, additives for latex paints like surface – active agents, antifoam agents, thickening agents, preservatives coalescing agents etc.

DRYING OILS & PAINT MEDIA LAB

1. Preparation & testing of stand oils.
2. Preparation & testing of boiled oils.
3. Preparation & testing of maleinised oils.
4. Preparation & testing of dehydrated coaster oils.
5. Preparation & testing of lead naphthenol driers.
6. Preparation & testing of cobalt octerate driers.
7. Testing of volatile solvent for Distillation Range.
8. Testing of volatile solvent for Flash Point.

2.9-FUEL MATERIAL TECHNOLOGY

(Common with Chemical Engineering, Chemical Technology (Fertilizer, Petro Chemical))

L T P
3 1 -

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
	A-			-
1.	Introduction	5	2	-
2.	Solid Fuels	10	3	-
3.	Liquid Fuels	10	3	-
4.	Gaseous Fuels	8	2	-
5.	Combustion Calculation	8	2	-
	B-			
1.	Introduction	5	2	-
2.	Ferrous Materials	7	2	-
3.	Other Materials	8	3	-
4.	Heat Treatment	7	3	-
5.	Corrosion	7	3	-
	TOTAL	75	25	150

DETAILED CONTENTS

PART-A FUEL TECHNOLOGY

1. INTRODUCTION

Introduction of various Solid, Liquid and Gaseous fuels.

2. SOLID FUELS:

Wood, Charcoal, Coal (Peat, Lignite, Bituminous and Anthracite and Coke) Calorific value Definition and experimental determination by bomb calorimeter and calculations Washing of coal, Purpose of washing, Principle description and operation of Jig and washers, Carbonization (Low temperature and High temperature).

3. LIQUID FUELS:

- (i) Fuel Oil, Gasoline, Diesel Fuels, Kerosene.
- (ii) Properties (Density, Viscosity, Flash & fire Point, Octane no., Cetane no. & Ignition delay).
- (iii) Advantages and disadvantages of liquid fuels.

4. GASEOUS FUELS:

Natural Gas & LPG – Advantages and disadvantages of gaseous fuels.

5. **COMBUSTION CALCULATION:**

Calculation of percentage of products of combustion. numerical Questions.

PART-B MATERIAL TECHNOLOGY

1. **INTRODUCTION:**

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

2. **FERROUS MATERIALS:**

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

3. **OTHER MATERIALS:**

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

B. Non-metallic materials of construction

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

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

4. **HEAT TREATMENT:**

Various types of heat treatment like annealing, hardening, Edge hardening and cold work of metals.

5. **CORROSION:**

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

3.1 HEAT TRANSFER OPERATIONS & MASS TRANSFER OPERATIONS

(Common with Chemical Technology (Rubber & Plastic))

L T P
6 2 4

Rationale:

The subject already dealt as mechanical operations & Solid handling fluid mechanics in first and second year was the fundamentals. To further study the subject Heat transfer Operations is included to get the knowledge of modes of Heat transfer like conduction, convection and radiation. Different heat exchangers, condensers, evaporators, crystallisers, insulators used in chemical plant. Different types of simple numerical will be dealt to get the chemical engineering students aware of the problems generally occurring the industries. It is the further step of Unit Operation deals with the gas absorption, distillation, boiling point diagrams, extraction operation, humidification and drying processes in chemical industry. The subject have experiments as well, to be aware of the facts involved in actual process.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
	A-			-
1.	Modes of Heat transfer	3	1	-
2.	Conduction.	4	1	-
3.	Convection.	4	1	-
4.	Radiation.	4	1	-
5.	Heat Exchanger	5	2	-
6.	Condenser.	4	1	
7.	Evaporaters.	5	2	
8.	Crystallisers.	4	1	
9.	Insulation.	4	1	
	B-			
1.	Mass Transfer	5	2	-
2.	Packed Tower	8	3	-
3.	Distillation	10	4	-
4.	Extration	7	2	-
5.	Humidification	5	2	-
6.	Drying	3	1	
	TOTAL	75	25	150

DETAILED CONTENTS

PART-A

1. MODES OF HEAT TRANSFER: Conduction, convection & radiation.
2. CONDUCTION: Fourier's law, Thermal conductivity, Conductance, flat Wall, Multilayer flat wall, Hollow cylinder, Multilayer cylinder log mean area, geometric mean area & Arithmetic mean area, Simple numerical problems in S.I. Units.
3. CONVECTION: Natural and forced convection, Physical significance of dimensionless number. Reynold No., Prandtl No., Nusselt No., Stanton No., Peclet No., Grashoff No., Dittus Boelter's equation-simple numerical

problems using Dittus Boelter equation. Fouling factor. Individual heat transfer coefficient and over all heat transfer coefficient.

4. RADIATION: Reflection, absorption and transmission of radiation, Kirchoff law, Emissive power, Wein's displacement law, the stefen Boltman law, Heat transfered by radiation exchange of energy between two parallel planes of difference emissivity, Radiant Heat transfer coefficient, Solar radiation, gray surfaces or gray body.

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

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

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

7. EVAPORATORS: Construction and description of

1. Horizontal tube types.
2. Standard vertical type or calendria type.
 - (a) Natural and forced circulation type.
 - (b) Entrainment and foam formation.
 - (c) Method of feeding evaproators-Forward,Backward & cross,mixed multi effect evaproation.

(d) BOILING : Nucleare boiling, film boiling, Transition boiling, Maximum flux and critical temperature drop, construction & description of Kettle type boilers. Boiling point rise (B.P.R) and effect, steam economy for single effective evaporator (Simple Numerical Problem).

8. CRYSTALLIZERS: Classification of crystallizers; construction and description of

1. Swensen walker.
2. Vacuum crystalizer.

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

PART-B

1. MASS TRANSFER:

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

Derivation of the following relations.

$$I. \frac{1}{K_T} = \frac{1}{G_T \cdot a} + \frac{m}{k_T \cdot L_T \cdot a}$$

$$II. \frac{1}{K_T \cdot L_T \cdot a} = \frac{1}{k_T \cdot L_T \cdot a} + \frac{m}{m \cdot k_T \cdot G_T \cdot a}$$

2. PACKED TOWER:

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

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

3. DISTILLATION:

Various distillation methods:-

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

Types of distillation columns:-

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

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

4. EXTRACTION :

1. Applications of this operation.
2. Choice of solvent.
3. Steps of extraction operation
4. Solid Liquid extraction, construction and description of
 - A. Bed Basket type oil seed extractor or Bollman extractor.
 - B. Rotocel extractor.
5. Liquid extractor; description and construction of
 - A. Mixer settler extraction system.
 - B. Perforated plate and baffle towers.

5. HUMIDIFICATION:

Definition and calculation of

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

6. DRYING

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

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

HEAT & MASS TRANSFER LAB.

LIST OF EXPERIMENT

(At Least 7 experiment to be Performed)

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

3.2 CHEMICAL REACTION ENGINEERING (CRE)

(Common with Chemical Engineering, Chemical Technology (Fertilizer, Petro Chemical)

L T P
3 1 -

Rationale:

Chemical reaction engineering is concerned with all those engineering activities which involves exploitation of chemical reactions on a commercial scale. The subject involves homogeneous chemical reactions and their equilibrium, chemical kinetics and types of reactor heterogeneous reaction.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	5	2	-
2.	Homogenous Reactions	15	5	-
3.	Interprtation of constation volume batch reactor data	20	7	-
4.	Ideal Reactors	20	8	-
5.	Introduction to Heterogenous reacting systems	15	3	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. INTRODUCTION :

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

2. HOMOGENEOUS REACTIONS :

Concentration dependent term of a rate equation, single and multiple reaction, series and parallel reactions. Elementary and Non-elementary reactions, Kinetic view for elementary reactions molecularity and order of reaction, Rate constant K. Representation of a reaction rate, Temperature dependant term of a rate equation, Temperature dependency 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.

3.3-AUTOMATIC PROCESS CONTROL

(Common with Chemical Engineering, Chemical Technology (Fertilizer, Petro Chemical)

L T P
3 1 4

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	10	3	-
2.	Elements of control system	15	7	-
3.	Process Characteristics	20	5	-
4.	Controller Characteristics	15	5	-
5.	Closed loop in Auto control	15	5	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. INTRODUCTION:

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

2. ELEMENTS OF CONTROL SYSTEM:

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

3. PROCESS CHARACTERISTICS:

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

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

(a) 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) Continuous stirred tank chemical reactor with Ist order chemical reaction.

(b) IInd order system or oscillatory type element.

- (i) Bulb in thermo well.
- (ii) Mechanical damper.
- (iii) Fluid manometer or U tubes.

Response of 1st order system to step, ramp, impulse and sinusoidal inputs, Response of 2nd order system to step change (Transient response).

4. CONTROLLER CHARACTERISTICS OR MODES OF CONTROL ACTION:

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

5. CLOSED LOOP IN AUTOMATIC CONTROL:

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

(i) Proportional control at stirred tank heater for set point change and for load change.

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

AUTOMATIC PROCESS CONTROL LAB

LIST OF EXPERIMENT

(At Least 8 experiment to be Performed)

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

3.4 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT (Common with all Engineering Courses)

L T P
2 2/2 -

Rationale:

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

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Principles of Management	10	4	-
2.	Human Resource Management	3	2	-
3.	Human and Industrial Relations	4	3	-
4.	Personnel Management	6	3	-
5.	Financial Management	6	3	-
6.	Material Management	4	3	-
7.	Labour, Industrial and Tax Laws	4	2	-
8.	Entrepreneurship Development	8	4	-
9.	Intellectual Property Rights	5	1	-
TOTAL		50	25	-

DETAILED CONTENTS

1. PRINCIPLES OF MANAGEMENT :

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

2. HUMAN RESOURCE DEVELOPMENT :

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

3. HUMAN AND INDUSTRIAL RELATIONS :

Human relations and performance in organisation, Understand self and others for effective behavior, Industrial relations and disputes, Characteristics of group behavior and Trade unionism, Mob psychology, Labour welfare, Workers participation in management.

4. PERSONNEL MANAGEMENT :

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

5. FINANCIAL MANAGEMENT :

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

6. MATERIAL MANAGEMENT :

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

7. LABOUR, INDUSTRIAL AND TAX LAWS :

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

8. ENTREPRENEURSHIP DEVELOPMENT :

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

9. INTELLECTUAL PROPERTY RIGHTS :

Introduction to IPR (Patents, Copy Right, Trade Mark), Protection of undisclosed information, Concept and history of patents, Indian and International Patents Acts and Rules, Patentable and Nonpatentable invention including product versus Process.

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

3.5-POLLUTION CONTROL & INDUSTRIAL SAFETY

(Common with Chemical Engineering, Chemical Technology (Rubber & Plastic, Fertilizer, Petro Chemical)

L T P
3 1 -

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	Introduction	5	1	-
2.	Air Pollution	8	2	-
3.	Water Pollution	12	5	-
4.	Environment Protection	12	5	-
5.	Radioactive Pollution	10	2	-
6.	Pollution Acts	10	4	-
7.	Safety in Chemical Industry	12	4	-
8.	Solid Waste Management	4	1	-
9.	Disaster Management	2	1	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. INTRODUCTION:

What is environment ? What is Pollution? Classification of pollution e.g. Land, Water, Air, Noise. Impact assessment 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, SO_x, NO_x, 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. ENVIRONMENT PROTECTION :

Environmental protection from hazardous Chemicals & Waste :-

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

5. RADIO ACTIVE POLLUTION:

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

6. POLLUTION ACTS:

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

7. SAFETY IN CHEMICAL INDUSTRY:

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

8. SOLID WASTE MANAGEMENT:

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

9. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan. Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

3.6 COATING PROPERTIES, EVALUATION AND QUALITY CONTROL

L T P
3 - 4

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	COATING PROPERTIES	20	7	-
2.	CLASSIFICATION OF PAINT TEST	15	5	-
3.	TESTING OF PAINT	15	5	-
4.	ANALYSIS OF PAINTS & VARNISHES	10	3	-
5.	QUALITY CONTROL	15	5	-
	TOTAL	75	25	-

DETAILED CONTENT

1. COATING PROPERTIES:

General properties of oil paints, enamel varnishes and lacquers, their comparative merits, classification of paints, properties and he sivr and cohesion properties, factors affecting adhesion wetting power, optical properties , color, gloss, hiching etc, physical, chemical and mechanical properties of paint film factor affecting coating properties rheological properties, Newtonian and non Newtonian liquids, thixo- tropy, factor affecting viscosity influence of the rheological behaviour.

2. CLASSIFICATION OF PAINT TEST:

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 capacity and dry hiding, spreading capacity and spreading rim wet & dry rim thickness, drying time etc.

3. TESTING OF PAINT:

Test of dried coatings, color and color fastness, light fastness, gloss, flexibility, adhesion impact test, hardness mar resistance, abrasion, resistance water and moisture resistance water vapour transmission, 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. QUALITY CONTROL:

Ageing properties of coatings, weatherometry natural 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 paints, varnishes & lacquers such as color.
2. Determination of the physical properties of paints, varnishes & lacquers such as wt/ litre
3. Determination of the physical properties of paints, varnishes & lacquers such as, fireness of grind,
4. Determination of the physical properties of paints, varnishes & lacquers such as non volatile viscosity
5. Determination of the physical properties of paints, varnishes & lacquers such as D.F.T.
6. Determination of the physical properties of paints, varnishes & lacquers such as Drying Time.
7. Determination of mechanical properties of paints, varnishes & lacquers such as scratch hardness.
8. Determination of mechanical properties of paints, varnishes & lacquers such as flexibility & adhesion.
9. Determination of mechanical properties of paints, varnishes & lacquers such as paint oil hardness.
10. Determination of mechanical properties of paints, varnishes & lacquers such as impact resistance.
11. Determination of optical properties of paints, varnishes & lacquers such as spreading capacity.
12. Determination of optical properties of paints, varnishes & lacquers such as wet capacity.
13. Determination of chemical properties of paints, varnishes & lacquers such as water resistance.
14. Determination of chemical properties of paints, varnishes & lacquers such as acid resistance.
15. Determination of chemical properties of paints, varnishes & lacquers such as alkali resistance.
16. Determination of chemical properties of paints, varnishes & lacquers such as solvent resistance.

3.7 FORMULATION & MANUFACTURING OF PAINTS

L T P
3 1 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	INTRODUCTION	15	5	-
2.	STEP IN PAINT MANUFACTURING	15	5	-
3.	EQUIPMENT USED IN PAINT MANUFACTURING	20	7	-
4.	GENERAL HAZARDS	10	3	-
5.	SAFETY MEASURE PROTECTION	15	5	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. INTRODUCTION:

Principles of paint formulation, formulation elements, mathematics & steps : PVC, CM, P/B ratio, sp gravity etc, Typical formulation of primers, under coat and finish coats industrial and site applied coating for steel work mild, moderate and sever conditions.

2. STEP IN PAINT MANUFACTURING:

Step in paint manufacturing, phenomenon of wetting, grinding dispersion important consideration & in pigment dispersion, important consideration in pigment dispersion rheology.

3. EQUIPMENT USED IN PAINT MANUFACTURING:

Heavy duty mixtures; double blade mixture W& P banding, sigma kneaders pug mills, dough mixers, change can, 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 cyno mill , pearl mills etc, miscellaneous mills, colloid mills , high higher speed and im pigment mill kady mills etc.

4. GENERAL HAZARDS:

Mill base let down source of the let down condition, let down of non aqueous and latest paints, fire and health hazards, general industrial hazards, prime cause fire and explosion precautionary measure.

5. SAFETY MEASURE PROTECTION:

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

PAINT MAKING LAB

LIST OF EXPERIMENT

1. Pigment Preparation
2. Resin Preparation
3. Preparation of dry distemper
4. Preparation of oil bond distemper
5. Preparation of cement paint
6. Preparation of olio-resinous varnish
7. Preparation of primer
8. Preparation of glossy paint

3.8 ELECTIVE –I: PAINT APPLICATION

L T P
3 1 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	SUBSTRATE PREPARATION	20	7	-
2.	PRE-TREATMENT	15	5	-
3.	PAINT APPLICATION INVOLVING ATOMIZATION	15	5	-
4.	PAINT APPLICATION NOT INVOLVING ATOMIZATION	10	3	-
5.	DRYING & CURING	15	5	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. SUBSTRATE PREPARATION:

Substrat Preparation : Substrat, Decreasing rust & oxide removal non metallic substrat investigation into methods of decreasing mild steel preparation of samples of wood by a sequence of staining, filling and sealing.

2. PRE-TREATMENT:

Pre treatment : Phosphate pre treatment other pre treatment, investigation into phosphate pre treatment.

3. PAINT APPLICATION INVOLVING ATOMIZATION:

Paint application involving atomization air assisted spraying, airless spraying, electrostate spraying, compare hot and cold sprarying.

4. PAINT APPLICATION NOT INVOLVING ATOMIZATION:

Paint application not involving atomization: Dipping, electrodeposition, roller coating, coil & curtaing coating , other application methods- brushing, hand rolling trowelling , silk screeing tumbling , flow coating.

5. DRYING & CURING:

Acceleration of drying and curing . Drying and curing process, infrared curing summary- factors affecting choice of methods.

3.8 ELECTIVE –II: PRINTING & PACKAGING TECHNOLOGY

L T P
3 1 0

TOPIC WISE DISTRIBUTION OF PERIODS

SL.NO.	UNITS	COVERAGE TIME		
		L	T	P
1.	MAJOR PRINTING SYSTEM	10	4	-
2.	TESTING&EVALUATION OF RAW MATERIAL	10	4	-
3.	PRINCIPLES OF INK FORMULATION	10	4	-
4.	TYPES OF INK	5	2	-
5.	PRINTING INK MANUFACTURE	8	3	-
6.	PACKAGING	8	2	-
7.	HAZARDS	8	2	-
8.	PACKAGING FORMS	8	2	-
9.	TYPES PACKAGING	8	2	-
	TOTAL	75	25	-

DETAILED CONTENTS

1. MAJOR PRINTING SYSTEM:

Major printing system : principles of printing, description and schematic diagram e.g; Typographic , Planographic , Gravurs 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 sub-stracts 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.

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.

3.9 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

The students will be required to undertake training in the paint industry after IInd year for specified period and submit its report after completion for evaluation and oral examination in the in final year

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.	@	Floor Area Sq.m Sq.m.	
1.	Class Room	2	60	120	
2.	Drawing Hall	1	90	90	
3.	Physics Lab		75		
4.	Chemistry Lab		120		
5.	App. Mechanics Lab.		60		
6.	Electrical Engg. Lab.		120		
7.	Unit Operation-I,II		120		
	Over Head Tank 2000 Litre Cap;				
	Under Ground Tank 600 Litre Cap;				
8.	Unit Operation-III,IV		120		
9.	Automatic Process Control Lab.		75		
10	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		

[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) including kitchen & store	45	

[E] STAFF RESIDENCES

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

Priority to be given in following order

(1)

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

(2)

- a. Hostel
- b. Students 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 version should be purchased.

1. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Brass ball with hook 2 cm. dia	2	20	40
2.	Stop clock least count 0.1 Sec	2	500	1000
3.	Wall bracket with clamping arrangement	2	50	100
4.	Meter scale	5	20	100
5.	Convex lenses of focal length 10 cm., 20 cm., 50 cm. and 100 cm. 2 nos. of each	8	10	80
6.	Optical bench steel with pin and lens holders	2	500	1000
7.	Astronomical telescope	1	500	500
8.	Searl's conductivity apparatus with copper & steel rods 25 X 4 cm. diameter with all accessories	1 set	1000	1000
9.	Lee's conductivity app. complete with all accessories	1 set	1000	1000
10.	Constant water flow arrangement	2	400	800
11.	Boiler made of copper 2 lt. cap.	4	200	800
12.	Platinum resistance thermometer	2	800	1600
13.	Potentiometer - 10 wires with jockey	1	500	500
14.	Meter bridge complete	1	250	250
15.	Lead accumulator 2.2 V. and 20 amp. hour capacity	2	250	500
16.	Moving coil galvanometer	3	200	600
17.	Moving coil ammeter 0-1 amp., 0-5 amp., 0-10 amp., 1 no of each	3	250	750
18.	Moving coil voltmeter 0-1 V., 0-5 V., 0-10 V. 1 No of each	3	250	750
19.	Leclanchi cell complete	3	100	300
20.	Resonance col. of steel tube with tuning forks and other accessories	1	500	500
21.	Tuning forks set of different frequencies	1 set	1000	1000
22.	App. for determining coefficient of friction on a horizontal plane	1 set	1000	1000
23.	Apparatus for determining characteristics of P-N junction diode complete with all accessories	1 set	1500	1500
24.	Post office box dial type	1	1200	1200
25.	Resistance box 0-10 ohm., 0-100 ohm. 2 nos. each	4	400	1600

26. Rheostat of different ohm.capacity	8	250	2000
27. Physical balance with weight box	2	800	1600
28. Set of fractional weights	10	20	200
29. Fortin's barometer with mercury	1	2500	2500
30. Battery eliminator 6 V. & 3 amp.	1	250	250
31. Lab tables	3	8000	24000
32. Lab stools	10	100	1000
33. Anemometer cup type	1	1000	1000
34. Anemometer hand held	1	1000	1000
35. Suryamapi	1	1500	1500
36. Insolation meter	1	1500	1500
Misc.	LS		5000

2. APPLIED CHEMISTRY LAB

S.No.Name of Equipment	No.	@ Rs.	Amt.in Rs.
1. Test tube stand	15	10	150
2. Funnel stand	15	10	150
3. Burette stand	15	30	450
4. Pipette stand	15	10	150
5. Chemical balances with analytical weights 1gm -200gms	5	1500	7500
6. Fractional weights set with rider	5sets	25	125
7. Kipp's apparatus 1000 ml. polythen	2	500	1000
8. Reagents bottles			
250ml	120	10	1200
500ml	5	15	75
1000ml	5	25	125
9. Wide mouth bottle 250 ml	15	15	225
10. Winchester bottle 2.5 litre	15	30	450
11. Test tubes 1/4" x 6"	75	1	75
12. Boiling tube 1" x 6" hard glass	24	10	240
13. Pestle and mortar 10 cms	2	30	60
14. Watch glass 7.5 cms	15	5	75
15 Beakers			
100 ml.	10	15	150
250 ml.	24	20	480
400 ml.	12	25	300
1000 ml.	5	30	150
16. Weighing bottle 10 ml with lid	15	10	150
17. Wash bottles	15	15	225
18. Conical flask 250 ml.	15	30	450
19. Flat bottom flask 500 ml.	6	40	240
20. Flat bottom flask 250 ml.	15	25	375
21. Burette 50 ml.	15	60	900
22. Pipette 25 ml.	15	20	300
23. Measuring flask 250 ml. with stopper	15	50	750
24. Measuring cylinder of various sizes (250 ml, 500 ml, 1000 ml) 3 no. of each	9	LS	250
25. Bunsen's burner of brass	15	50	750
26. Gas plant petrol 10 to 20 burners			

automatic	1	5000	5000
27. Spirit lamp	15	30	450
28. Tripod stand	15	10	150
29. Wire gauge 15 X 15 cm. with asbestos	15	15	225
30. Test tube holder	15	10	150
31. Porcelain plates	15	20	300
32. Funnel 15 cm.	15	16	240
33. Blow pipe & work tools with electric blower for glass blowing	1 set	10000	10000
34. Cork borers with sharpn	2 set	100	200
35. Cork pressure	1 set	250	250
36. Glass cutting knife	1	75	75
37. Spatula hard & nickel/steel	2 each	50	100
38. Water tapes with gooseneek	6	200	1200
39. Gas taps two way	10	150	1500
40. Pinch cock & screw	15	20	300
41. Distilled water units (electrical)	1	5000	5000
42. Distilled water units (solar)	1	5000	5000
43. Open balance 1000 gms./10 mg.	1	600	600
44. Platinum wire	5	25	125
45. Brush for cleaning various type	40	10	400
46. Jars 20 Lit. for keeping distilled 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

3. APPLIED MECHANICS LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Polygon of Forces Apparatus	1	700	700
2.	Universal Force Table	1	1500	1500
3.	Principle of Moment Appratus Bell Crank lever	1	500	500
4.	Combined Inclind plane &			

Friction apparatus	1	900	900
5. Simple wheel and axle	1	800	800
6. Differential wheel and axle	1	1200	1200
7. Double sleeve Pulley Block	1	400	400
8. Simple Screw Jack	1	200	200
9. System of pulleys (Any I,II,III)	1	1200	1200
10. Worm & Worm wheel	1	1200	1200
11. Apparatus for Reaction at support	1	1000	1000
12. Jib Crane	1	500	500
13. Jointed Roof Truss Apparatus	1	500	500
Misc.		Lum Sum	2000

4. WORKSHOP PRACTICE

(A). CARPENTRY SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	60 cm.rule	10	15	150
2.	Flexible steel rule 2 metre	2	20	40
3.	T square 23 cm. steel	10	20	200
4.	Bevel square 23 cm. steel	2	30	60
5.	Marking knife 25 cm. steel	10	30	300
6.	Marking gauge wooden & brass 25 cm.	10	30	300
7.	Mortise gauge wooden & brass 25 cm.	10	50	500
8.	Caliper inside, steel 20 cm.	2	50	100
9.	Caliper outside , steel 20 cm.	2	50	100
10.	Compass steel 20cm.	2	40	80
11.	Devider steel 20 cm.	2	40	80
12.	Plumb	2	20	40
13.	Wooden bench vice steel 20 cm.	10	200	2000
14.	Bench hold fast steel 30 cm.	10	40	400
15.	Bar clamp 2 m.	2	300	600
16.	G clamp of flat spring steel 20x30 cm.	4	60	240
17.	Rip saw 40-45 cm.	10	80	800
18.	Cross cut saw 40-45 cm.	2	80	160
19.	Tennon saw 30-35 cm.	10	50	500
20.	Dovetail saw 30-35 cm.	2	60	120
21.	Compass saw 35 cm.	4	60	240
22.	Key hole saw or pad saw 30-35 cm.	2	25	50
23.	Bow saw	2	25	50
24.	Frame saw	2	25	50
25.	Chisel fish brand 1" to 1/8" firmer	3 set	100	300
	Dovetail	3 set	100	300
	Mortise	3 set	100	300
26.	Gauge or Golchi 1" to 1/8"	3 set	150	450
27.	Wooden jack plane complete	10	100	1000
28.	Wooden smoothing plane	10	80	800
29.	Iron jack plane complete	10	200	2000
30.	Iron rebate plane complete	3	80	240
31.	Iron grooving plane complete	3	120	360
32.	Iron compass plane complete	3	200	600
33.	Wooden moulding plane complete	3	200	600

34. Bradawl	3	150	450
35. Gimlet drills set	1 set	150	150
36. Center bit	2	120	240
37. Twist bit	2	80	160
38. Auger bit	2	40	80
39. Dovetail bit	2	15	30
40. Counter shank bit	2	20	40
41. Ratchet brace machine	2	175	350
42. Grand drill machine 1/4"	2	200	400
43. Wooden hand drill burmi	5	200	1000
44. Wooden mallet	10	25	250
45. Claw hammer	3	30	90
46. Carpenters hammer	10	30	300
47. Cutting tool for Universal wood working machine	3 set	800	2400
48. Screw driver 18" & 15"	6	50	300
49. Adze 500 gm.	10	50	500
50. Pincer 175 mm.	6	75	750
51. Plier 150 mm.	4	90	360
52. Oil stone 8"	4	75	300
53. Rasp file 12"	4	100	400
54. Half round file 12"	4	80	320
55. Round file 12"	4	80	320
56. Triangular file 5", 4"	8	60	480
57. Water stone	4	20	80
58. Carpentry work benches	4	2000	8000
59. Band saw machine complete	1	30000	30000
60. Circular saw machine	1	15000	15000
61. Double Ended Electric Bench grinder	1	6000	6000
62. Universal wood working machine misc. for foundation of machines	1 LS	15000	15000 10000

(B). SMITHY SHOP

1. Anvil 150 Kg. with stand	5	2500	12500
2. Swage block 50x30x8cm.&45x45x10cm.	2	1250	2500
3. Hammers			
Ball peen 0.8 Kg. (Approx.)	10	150	1500
Cross peen 0.8 Kg. (Approx.)	10	150	1500
4. Beak iron 25 Kg.	1	500	500
5. Swages different types	6	40	240
6. Fullers different types	6	30	180
7. Leg vice 15 cms. opening	1	150	150
8. Electric blower with motor	1	5000	5000
9. Furnace chimney with exhaust pipe	5	5000	25000
10. Sledge hammer - 5 Kg.	2	200	400
Misc. tools	LS	2500	

(C). SHEET METAL, SOLDERING & BRAZING

1. Dividers - 15cm.	5	60	300
2. Trammel 1 m.	1		
3. Angle protector	5	60	300
4. Try square 30 cm.	5	40	200

5. Centre punch	5	20	100
6. Steel rule 30 cm. , 60 cm.,	5	25	125
7. Sheet metal gauge	1	120	120
8. Straight snips 30 cm.	2	250	500
9. Curved snips 30 cm.	2	300	600
10. Bench shear cutter 40 cm.	1	5000	5000
11. Chisel 10 cm.	5	100	500
12. Hammer	5	150	750
13. Bench vice 13 cm.	5	1000	5000
14. Plier	5	50	250
15. Nose plier	5	60	300
16. Sheet metal anvil/stakes	5	2000	10000
17. Shearing machine 120 cm.	1	2500	2500
18. Solder electric	2	500	1000
19. Solder furnace type	2	250	500
20. Brazing equipments and accessories	1	5000	5000
21. Blow lamp	2	250	500
22. Sheet bending machine	1	10000	10000
Misc.	LS	5000	

(D). FITTING SHOP

S.No.Name of Equipment	No.	@ Rs.	Amt.in Rs.
1. Bench vice jaw 10 cm.	10	300	3600
2. Surface plate 45x45 cm.	2	2000	4000
3. V. Block 10x7x4 cm.	5	350	1650
4. Try square	10	40	400
5. Bevel protractor 30 cm.	1	2100	2100
6. Combination set	1	2500	2500
7. Divider	5	60	300
8. Centre punch	5	20	100
9. Calipers (Different sizes)	12	20	240
10. Vernier calipers 30 cm.	2	600	1200
11. Micrometer 0-25, 25-50 m.m.	4	500	2000
12. Vernier depth gauge	1	350	350
13. Feeler gauge--15 blades	1	30	30
14. Radius gauge	1	100	100
15. Angle gauge	1	100	100
16. Thread gauge	1	100	100
17. Bench drilling machine 13 mm.	1	5000	5000
18. Double ended electric grinder	1	4000	4000
19. Drill set	1set	1000	1000
20. Reamer set	1set	2000	2000
21. Tap set	1set	2000	2000
22. Adjustable wrenches (15 cm.,20cm. 30 cm.)	1set	500	500
23. Allen key set	1set	350	350
24. Spanners	6	60	360
25. Work benches	6	2000	12000
26. Power hacksaw	1	4000	4000
Misc. Files, Dieset, Hexa frames etc.	LS	10000	

(E). WELDING SHOP

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

(F). PAINTING & POLISHING SHOP

1. Air compressor complete with 2 HP motor	1set	12000	12000
2. Spray gun with hose pipe	1	1000	1000
3. Stoving oven	1	3000	3000
4. Buffing machine with leather and cotton wheels	1	4000	4000
5. Electroplating Equipment for cromium Nikle plating.	1	10000	10000
Misc.	LS	2000	

(G). PLUMBING SHOP

S.No.Name of Equipment	No.	@ Rs.	Amt.in Rs.
1. Pipe vice 5 cm.	4	250	1000
2. Chain wrenches	5	250	1250
3. Ring spanner Set	5	125	625
4. Wheel pipe cutter	2	300	600
5. Water pump plier	4	50	200
6. Pipe die set 2" set	2 set	600	1200
7. Pipe bending device	1	5000	5000
8. Work benches	4	4000	16000
9. Set of various types of plumbing fittings e.g. Bib cock Cistern, Stop cock, Wheel volve, Gat volve etc.	LS	2000	
10. Misc. Hacksaw frame and others	LS	2000	

(H). FOUNDRY SHOP

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

(I). MACHINE SHOP

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

NOTE:-

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

5. UNIT OPERATION LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Apparatus to verify Bernoulli's Thorem	1 set	12000	12000
2.	Apparatus for conducting experiments on venturimeter with collecting and supplying tank	1 set	12000	12000
3.	Reynold's apparatus with storage tank and flow steadying arrangement with 1/2 HP pump and accessories	1 set	8000	8000
4.	Apparatus for determining Cc, Cv and Cd	1 set	12000	12000
5.	Apparatus for determining various head losses in pipes	1 set	8000	8000
6.	Notch apparatus with set of notches	1 set	9000	9000
7.	Model of Reciprocating pump	1	2000	2000
8.	Model of Centrifugal pump	1	2000	2000
9.	Pressure gauge Borden's type	1	2000	2000
10.	In place of item no. 1,2,4,5 & 8 Hydraulic bench may be purchased with all accessories or such institution if already have above items may purchase one unit, Otherwise 6 units One Unit cost Six units cost		15000 90000	
11.	Misc. for tools, Manometer Pitot's tube, Differential manometer and minor equipments		10000	
12.	Orifice Meter	1	500	500
13.	Rota Meter	1	5000	5000
14.	Stop Watch	3	500	1500
15.	Centrifugal Pump with Motor	1	8000	8000
16.	Plate & Frame filter Press	1		10000
17.	Sieve Shaker with Motor & Time Switch	1		7000
18.	Test Sieve	1 Set		3000
19.	Sieve Plate(S.S.) Distillation Column	1		45000

20. U Tube Double Pipe Heat Exchanger	1	6000
21. Stainless Steel Spherical Jackted Open Pan Evaporator.	1	25000
22. Stainless Steel Crystalizer	1	25000
23. Rotatory Dryer	1	50000
24. M.S. Thickner	1	25000
25. S.S. Spherical Jackted Open Pan Evaporator With Stirrer.	1	30000
26. Shell & Tube Heat Exchanger	1	25000
27. Tray Dryer	1	35000
28. Rotary Vacuum Filter	1	35000
29. Boiler	1	50000
30. Disintegrator Alongwith Wattmeter and voltmeter (1 Horse Power)	1	25000
31. Jaw Crusher alongwith Wattmeter and voltmeter (1 Horse Power)	1	25000

6. AUTOMATIC PROCESS CONTROL LAB

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

7. COMPUTER APPLICATION FOR ENGINEERING (Common to all Trades)

COMPUTER CENTRE

S.No.	DESCRIPTION	QTY.	APPROX. COST (in Rs.)
1	PENTIUM-IV 2.4 Ghz or latest RAM-256 MB or latest HDD-80 GB latest MONITOR COLOUR 17" AGP 16 MB 52X MM KIT(52x CD Drive, Speaker,sound card) FDD - 1.44 MB Key Board - 107 Keys Multimedia Mouse - Optical Fibre Mouse 32 Bit PCI ETHERNET CARD(10/100) Mbps Pre loaded Windows XP OR WINDOWS 2000 Pre loaded Norton Anti Virus with licence media and manual	16	8,000,00=00 (15+1Server)
	OR		
	Computer of latest Specification Software :		
	i. Noval Netware/NT Latest Version	01	55000
	ii WINDOWS - XP/WINDOWS 2000 /Windows NT	01	6000
	iii. MS OFFICE XP	01	17000
	iv. Dos latest version.	01	5,000
	v. FoxPro 2.5 or Latest Version	01	
	vi.* Mechanical DeskTop Power Pack (*->Only For Mechanical Engg.)	01	70000
3.	Hardware		
	i. Internal Modem 56 kbps		
	ii. Hubs-16 port, all accessories related to Networking.		
	iii.Scanner- A4	01	10,000
4.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life	01	15,000
5.	Laser Jet	01	20,000
6.	5 KVA on line UPS with minimum 30 minute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries with network connectivity.	01	1,75000
7.	Window Air Conditioner 1.5 tones capctity with ISI mark alongwith electronic voltage stablizer with over viltage and time delay circuit	04	30,000(EACH)

8. Room preparation and furniture

LS

8. 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.	Flouroscent 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
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 mortar 10 cms	2	30	60
14.	Watch glass 7.5 cms	15	5	75
15.	Beakers			
	100 ml.	10	15	150
	250 ml.	24	20	480
	400 ml.	12	25	300
	1000 ml.	5	30	150
16.	Weighing bottle 10 ml with lid	15	10	150
17.	Wash bottles	15	15	225
18.	Conical flask 250 ml.	15	30	450
19.	Flat bottom flask 500 ml.	6	40	240
20.	Flat bottom flask 250 ml.	15	25	375
21.	Burette 50 ml.	15	60	900
22.	Pipette 25 ml.	15	20	300
23.	Measuring flask 250 ml. with stopper	15	50	750
24.	Measuring cylinder of various sizes (250 ml, 500 ml, 1000 ml) 3 no. of each	9	LS	250
25.	Bunsen's burner of brass	15	50	750
26.	Gas plant petrol 10 to 20 burners			

	automatic	1	5000	5000
27.	Spirit lamp	15	30	450
28.	Tripod stand	15	10	150
29.	Wire gauge 15 X 15 cm. with asbestos	15	15	225
30.	Test tube holder	15	10	150
31.	Porcelain plates	15	20	300
32.	Funnel 15 cm.	15	16	240
33.	Blow pipe & work tools with electric blower for glass blowing	1 set	10000	10000
34.	Cork borers with sharpn	2 set	100	200
35.	Cork pressure	1 set	250	250
36.	Glass cutting knife	1	75	75
37.	Spatula hard & nickel/steel	2 each	50	100
38.	Water tapes with gooseneek	6	200	1200
39.	Gas taps two way	10	150	1500
40.	Pinch cock & screw	15	20	300
41.	Distilled water units (electrical)	1	5000	5000
42.	Distilled water units (solar)	1	5000	5000
43.	Open balance 1000 gms./10 mg.	1	600	600
44.	Platinum wire	5	25	125
45.	Brush for cleaning various type	40	10	400
46.	Jars 20 Lit. for keeping distilled water	5	100	500
47.	Lab table 2 m. x 1.2 m. x 1 m. high 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

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. Mandel 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

12. PAINT MAKING LAB

1. Pestle & Mortar	Rs. 30
2. Pal Mill/Bal Mill/Attritor(1Leter) With Moter	Rs. 5000

4. LEARNING RESOURCE MATERIALS

1.	Over Head Projector	01	20000.00
2.	Digital Camera	01	25000.00
3.	LCD Projector	02	200000.00
4.	Vaccum Cleaner	02	15000.00
5.	Audio CD Recorder Cum Player	01	10000.00
6.	Radio With All Band	01	2000.00
7.	Colour TV	01	15000.00
8.	Cutting, Binding & Stitching Equipment	01	30000.00
9.	Photo Copier Machine	01	150000.00
10.	Fire Extinguisher (2 Kg.)	04	15000.00
11.	Fire Extinguisher (5 Kg.)	04	30000.00

ANNEXURE - I

FORMAT FOR FIELD EXPOSURE

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

ANNEXURE - II
TRAINEES ASSESSMENT

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

1. Name of the trainee :

2. Date of
 - i. Joining. :
 - ii. Leaving. :

3.
 - i. Regularity & Punctuality :
 - ii. Sense of responsibility :
 - iii. Readiness to work/learn :
 - iv. Obedience :
 - v. Skill aquired :

4. Name of the sections of the unit he attended during his stay. :
His activities/worth of being there.

5. Any thing specific

Sinnature of the Assessor

Date :-

Designation

ANNEXURE-III QUESTIONNAIRE

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

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

PURPOSE: To design and develop Threeer Year 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 -----%

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 finalisation 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:-

Durgesh Chandra
Asstt. Professor
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)