

Curriculum For three-Years Diploma Course in  
PLASTIC MOULD TECHNOLOGY

**SYLLABUS FOR  
THREE YEAR - FULL TIME  
DIPLOMA COURSE IN PLASTIC MOULD  
TECHNOLOGY**

Effective From :-

UNDER DEVELOPMENT

Prepared by:

Curriculum development cell  
Institute of Research Development & Training,  
Kanpur

**STUDY EVALUATION SCHEME FOR THE PROPOSED  
THREE-YEAR DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY  
(EFFECTIVE FROM: - )**

**1<sup>ST</sup> YEAR**

Curriculum							SUBJECT	SCHEME OF EXAMINATION								
Periods Per Week								THEORY				PRACTICAL				
Lecture	Tutorial	Drawing	Lab	Work Shop		Total		EXAMINATION		Sess. Marks	Total Marks	EXAMINATION		Sessional Marks	Total Marks	Grand Total
							Dur (Hr.)	Marks			Dur	Marks				
3	-	-	2	-		5	1.1 Professional Communication	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	3.0	50	20	70	-	-	-	-	70
2	1	-	1	-		4	1.6 Applied Mechanics	2.5	50	20	70	3	40	20	60	130
3	-	-	-	-		3	1.7 Elementary Workshop Tech.	2.5	50	20	70	-	-	-	-	70
-	-	-	8	-		8	1.8 Workshop Practice	-	-	-	-	4	60	30	90	90
-	-	-	5	-		5	1.9 *Field Exposure-I (2 Weeks)	-	-	-	-	2	-	60	60	60
							Student Centred Activities	-	-	-	-					
17	3	8	20			48	<b>TOTAL</b>	-	350	140	490	-	200	160	360	850

Games/NCC/Social Activity/Community Development+Discipline (30+20)

50

**Total**

**900**

**NOTE:**

1. Each session will be of 32 weeks
2. Effective teaching will be at least 25 weeks
3. Remaining periods will be utilized for revision etc.
4. Each period will be of 50 minutes duration.
5. SI systems of units shall be used in each subject.
6. Student centred activities will comprise of various co-curricular activities like Seminar, extension lectures, field visits, NCC, NSS, Hobby clubs, Games and cultural activities.
7. \* Assessment at Instt. Level

**STUDY EVALUATION SCHEME FOR THE PROPOSED  
THREE-YEAR DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY  
(EFFECTIVE FROM: - )**

**II YEAR**

Curriculum						SUBJECT	SCHEME OF EXAMINATION								
Periods Per Week							THEORY				PRACTICAL				
Lecture	Tutorial	Drawing	Lab	Workshop	Total		EXAMINATION		Sess. Marks	Total Marks	EXAMINATION		Sessional Marks	Total Marks	Grand Total
							Dur (Hr.)	Marks			Dur	Marks			
3	1	-	-	-	4	2.1 Applied Mathematics-II	2.5	50	20	70	-	-	-	-	70
3	1	-	-	-	4	2.2 Hydraulics and Pneumatic Systems.	2.5	50	20	70	-	-	-	-	70
3	1	-	-	-	4	2.3 Metrology and Measuring Instruments.	2.5	50	20	70	-	-	-	-	70
3	1	-	-	-	4	2.4 Plastic Process Techniques-I.	2.5	50	20	70	-	-	-	-	70
3	1	-	-	-	4	2.5 Design of Dies & Moulds-I	2.5	50	20	70	-	-	-	-	70
2	1	-	-	-	3	2.6 Materials & Metallurgy.	2.5	50	20	70	-	-	-	-	70
3	-	-	-	-	3	2.7 Plastic Materials	2.5	50	20	70	-	-	-	-	70
-	-	-	4	-	4	2.8 Basics of Information Technology	-	-	-	-	3	60	30	90	90
2	-	-	-	-	2	2.9 Electrical Technology & Electronics	2.5	50	20	70	-	-	-	-	70
-	-	-	5	-	5	Student Centred Activities									
						<b>Practicals</b>									
-	-	-	2	-	2	2.10 Hydraulics and Pneumatic lab	-	-	-	-	3	20	10	30	30
-	-	-	2	-	2	2.11 Metrology lab	-	-	-	-	3	40	20	60	60
-	-	-	2	-	2	2.12 Materials & Metallurgy lab	-	-	-	-	3	50	20	70	70
-	-	-	2	-	2	2.13 Design of Dies & Moulds lab-I.	-	-	-	-	3	50	20	70	70
-	-	-	3	-	3	2.14 Plastic Process Tech.-I Lab	-	-	-	-	3	50	20	70	70
22	6	-	20	-	48	TOTAL	-	400	160	560	-	280	120	400	950

Games/NCC/Social Activity/Community Development+Discipline (30+20)

**Total**

50  
**1000**

**NOTE:**

1. Each session will be of 32 weeks
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4. Each period will be of 50 minutes duration.
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6. Student centered activities will compromise of various co-curricular activities like Seminar, extension lectures, field visits, NCC, NSS, Hobby clubs, Games and cultural activities.

**STUDY EVALUATION SCHEME FOR THE PROPOSED  
THREE-YEAR DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY  
(EFFECTIVE FROM: - )**

**III YEAR**

Curriculum						SCHEME OF EXAMINATION									
Periods Per Week						SUBJECT	THEORY				PRACTICAL				
Lecture	Tutorial	Drawing	Lab	w / s	Total		EXAMINATION		Sess. Marks	Total Marks	EXAMINATION		Sessional Marks	Total Marks	Grand Total
							Dur (Hr.)	Marks			Dur	Marks			
4	1	-	-		5	3.1 Environment & Pollution in Plastic Industries.	2.5	50	20	70	-	-	-	-	70
4	1	-	-		5	3.2 Plastic Process Techniques-II.	2.5	50	20	70	-	-	-	-	70
2	1	-	-		3	3.3 Industrial Management and Entrepreneurship Development.	2.5	50	20	70	-	-	-	-	70
4	1	-	-		5	3.4 Design of Dies & Moulds - II.	2.5	50	20	70	-	-	-	-	70
4	1	-	-		5	3.5 Plastic Testing & Quality Control	2.5	50	20	70	-	-	-	-	70
-	-	-	-		-	3.6 Field Exposure-II (4 Weeks)	-	-	-	-	-	40	20	60	60
-	-	-	2		2	3.7 Project.	-	-	-	-	3	100	50	150	150
			5		5	Student Centred Activities	-	-	-	-	-	-	-	-	-
						<b>Practicals</b>									
-	-	-	4		4	3.8 Plastic process-II lab	-	-	-	-	3	60	30	90	90
-	-	-	3		3	3.9 Environment & Pollution lab	-	-	-	-	3	50	20	70	70
-	-	-	4		4	3.10 Design of Dies & Moulds – II Lab	-	-	-	-	3	50	30	80	80
-	-	-	3		3	3.11 Plastic Testing & Quality Control Lab	-	-	-	-	3	50	30	80	80
-	-	-	4		4	3.12 Computer Aided Moulds Design Lab	-	-	-	-	3	50	20	70	70
18	5	-	25		48	TOTAL	-	250	100	350	-	400	200	600	950

Games/NCC/Social Activity/Community Development+Discipline (30+20) 50

**Total 1000**

**30% of 1st Year 300**

**70% of IInd Year 700**

**Grand Total 2000**

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4. Each period will be of 50 minutes duration.

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6. Student centered activities will comprise of various co-curricular activities like Seminar, extension lectures, field visits, NCC, NSS, Hobby clubs, Games and cultural activities.

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#### **II Year**

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## **II- MAIN FEATURES OF THE CURRICULUM**

Title of the course: Diploma Course in '**PLASTIC MOULD TECHNOLOGY**'

Duration: Three Years

Pattern of the course: Annual System

Intake: 60

Type of course: Full Time

Entry qualification: 10<sup>th</sup> (10+2 scheme) with Science & Mathematics.

Mode of admission: Through Joint Entrance Examination

### III-LIST OF EXPERTS

List of experts whose contribution helped the development of curriculum for Three Year Diploma Course in Plastic and Mould Technology are honorably named below -

1. Dr. Vijay Kumar, Dy. Director CIPET, Lucknow
2. Dr. U. K. Singh, Prof. & Head K. N. I. T, Sultanpur
3. Shri. S. Choudhry Manager (TS) CIPET, Lucknow
4. Dr. A. K. Nagpal Professor Plastic Engg. Dept. H. B. T. I, Kanpur
5. Dr. J. S. P. Rai Prof. & Head Plastic Engg. Dept. H. B. T. I, Kanpur
6. Dr. Reena Singhal Asstt. Professor Plastic Engg. Dept H. B. T. I, Kanpur
4. Smt. Shushma Gaud Director I. R. D. T. U. P. , Kanpur
5. Sh. Lal Singh Head Rubber & Plastic Govt. Polytechnic, Badaun
6. Smt. Kalpana Gaur Head Mech. Engg. Govt. Polytechnic, Kanpur
7. Sh. R. C. Soni Lecturer Mech. Engg. Govt. Polytechnic, Kanpur
8. Sh. M. K. Gupta Lecturer Mech. Engg. A. T. I, Airport Lucknow
9. Shri. M. P. Singh Bhadauria Asstt. Professor & C. D. C Co. ordinator I. R. D. T. U. P. , Kanpur
10. Sh. A. N. Mishra Computer Programmer I. R. D. T. U. P. , Kanpur
11. Sh. Ravinder Kumar Research Assistant I. R. D. T. U. P. , Kanpur



#### IV-NEED ANALYSIS AND CURRICULUM PROFILE

There has been significant development and acceptance of synthetic plastic goods in last few decades, mainly due to advances in organic chemistry. Uses of Moldable plastics are in today's day-to-day life is incredible, through extension of its use in all spheres of changing lifestyle. Since there is no competition material, the future of moldable plastic and professional opportunities is becoming unlimited.

The word "**Plastic**" is derived from Greek word "**Plastikos**" means "to form". Mostly in today's modern plastic era, the word plastic refers to groups of synthetic components of high molecular weight, which carries the moldable characteristic by heating and pressure which gives finished products by retaining its shape, dimension, and quality under normal usable condition.

The modern plastic industry predominantly addresses the Moldable Materials, Processing, Applications, Tooling and Plant and Equipment related to plastics. The professionals in plastics industries convert plastic granules (raw material) into finished products by different kind processing methods like Extrusion, Injection, Blow, Transfer, Compression, Thermo forming and thermo setting, based on part shape, size and its use, by using precision mould made up of high grade Die Metals. A typical Plastic industry includes different department like Plastic Product Design and Mould Design, Tool Room that fabricate moulds using high level CNC and EDM Machines to get perfect finish and intricate shape. Processing department converts raw materials into ready to use finished part or to fit in an assembly. Quality control tests the part mostly performs Distractive testing. The process differs based on the Shape, Use and Materials. To say few examples PET Jars are the Hollow components that normally uses Blow molding technique, and Industrial/house hold part are done by Injection molding methods. So the professionals differ from process to process like Designers, Mould maker, Processing and testing technicians. Role of Plastics:

There is dispute in use of all plastics as understands by common people and even well informed man understands in this way is really painful. The restriction is only applicable to 20 Micron thickness polyethylene bags and some of the non-recyclable, thus used/wasted bags/cups becoming pollution due to non-biodegradable. All thermoplastic materials are re-moldable thus no harm to human society. Simply to say what ever you touch in day to day life there may be almost 99% of plastic parts. It includes unimaginable Human body spare parts, Functional Artificial Limbs, Shelters, Robots, Seating system of all kind from locomotive to air capsules, All Automobile interior assemblies, Clothing and Foot wears and all except to be specific eatables.

Working in plastic industry needs high grade skill, to convert the knowledge into reality and confidant to accommodate the fast changing design methods. Based on the process the performing professional varies, mainly Designer and Processing

Technologist are the specialized key players. Other professionals include Plastic Testing Technologist, Plastic Mould Makers and the Mould designers. The Plastic Part designers who design Industrial and Consumer parts by using high end CAD System. Mould Designer plays a vital role who extras Core and cavity of the Part Design and Build Automatic Mould Design adding Runner, Ejection system etc. Before releasing drawing he finalizes the design by doing mould flow analysis which addresses Solidification, Mould temperature, Gating, Clamping and Injection pressure, Shrinkage and Draft analysis. He is a professional who knows the entire process of Know-how of plastic industry and perform his duties on CAD/CAE/CAM System. Plastic Mould Maker converts the Mould design into reality; it is a highly skilled and honored job in Tool Room, a set-up with team of professional who makes all kinds of Moulds and Dies in CAM and CNC. Mould maker is on-hand Professional who converts Know-how to Do-how and is one of the important factor in Indian industries. After mounting the mould on machine, The Processing technician take care of the production normally done in lots. He sets the requires injection and claming pressure, cycle time, Mould temperature so that perfect finished part comes out at regular intervals. The finished part goes to the Quality control where a team of Plastic Testing Technicians works and uses UTM for Mechanical testing like tensile test, Flexural Testing, Compressive testing etc. They also perform Thermal tests like Specific heat, Thermal conductivity; linear coefficient expansion etc and also they perform Electrical Testing as per requirement. Testing is a kind of scientific job and enjoys the most privileged certifying authority for most critical products. This is the final stage which eligible the part for the shipment. The Polymers Professional studies and work on the science of polymer, more specifically raw material

Research and developments Institutions offering courses:

Though there are ample of varied unknown exciting opportunities across the country, but very few institutes offer course in Plastics mould Tech. and its related fields. CIPET, SIDO TRs, NTTF, Tamil Nadu State owned Institutions and few among others offers related courses in this field. These institutions's course curriculum mostly addresses Do-How along with know how. One can understand by visiting "Plast India" a largest organized industrial Expo of this kind, which exhibits the tremendous capability of Indian plastic market.

## V-JOB OPPORTUNITIES & CURRICULUM DESIGN

The plastics and polymer industry is growing at fast pace. The transport sector, household appliances and goods, packaging and electricity and telecommunication are the major areas, which demand plastics, hence are creating employment opportunities in this sector. For instance, synthetic rubber is now in great demand. In the public sector, plastics engineers / technologists and technicians may find employment in:

- The Ministry of Petroleum and Natural Gas
- Oil and Natural Gas Commission, and
- Oil India Laboratories
- Petrochemicals Engineering Plants
- Indian Institute of Petroleum
- Polymers Corporations of different states
- Petroleum Conservation Research Association of India
- Petrofiles Cooperative Limited and other such organizations.

Many private companies and MNCs that deal with the production and marketing of plastic commodities also offer employment to plastics technologists and engineers. Plastic technologists also play a significant role in the key sectors of the economy, including agriculture and water management, automobiles and transportation, building and construction, telecommunication and electronics, besides defense and aerospace, computers and power transmissions and even in manufacture of artificial limbs. Polymer use in India is very less as compared to the other developed countries, so this field offers a high potential of growth and so are the employment opportunities.

Designer and Processing Technologist are the specialized key players. Other professionals include Plastic Testing Technologist, Plastic Mould Makers and the Mould designers. The Plastic Part designers who design Industrial and Consumer parts by using high end CAD System. Mould Designer plays a vital role who extras Core and cavity of the Part Design and Build Automatic Mould Design adding Runner, Ejection system etc. Before releasing drawing he finalizes the design by doing mould flow analysis, which addresses Solidification, Mould temperature, Gating, Clamping and Injection pressure etc. He is a professional who knows the entire process of Know-how of plastic industry and perform his duties on CAD/CAE/CAM System. Plastic Mould Maker converts the Mould design into reality; it is a highly skilled and honored job in Tool Room, a set-up with team of professional who makes all kinds of Moulds and Dies in CAM and CNC. Mould maker is on-hand Professional who converts Know-how to Do-how and is one of the important factors in Indian industries. The Processing technician takes care of the production normally done in lots. The Polymers Professional studies and work on the science of polymer, more specifically raw material research and developments.

## I YEAR

### 1.1 PROFESSIONAL COMMUNICATION

[Common to All Engineering/Non Engineering Courses]

L	T	P
3	-	2

Rationale:

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

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

## 1. PART I: COMMUNICATION IN ENGLISH

- 1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writing and speaking, Barriers in communication, Modern tools of communication- Fax, e-mail, Telephone, telegram, etc.
- 1.2 Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.
- 1.3 Development of expression through:
  - 1.3.1 Letters :  
Kinds of letters:-  
Official, semiofficial, unofficial, for reply or in reply, quotation, tender and order giving letters.  
Application for a job.
  - 1.3.2 Report writing and Note making and minutes writing.
- 1.4 Grammar : Transformation of sentences, Preposition, Articles, Idioms and Phrases, One word substitution, Abbreviations.
- 1.5 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

## 2. PART II: COMMUNICATION IN HINDI

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

Letter writing in Hindi:

Kinds of letters:-

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

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

## COMMUNICATION AND PRESENTATION PRACTICES

1. A. Phonetic transcription

- B. Stress and intonation:

- (At least 10 word for writing and 10 word for pronunciation)

2. ASSIGNMENT: (Written Communication)

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

SUGGESTED ASSIGNMENTS:

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

3. Oral Conversation:

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

4. Aural:

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

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

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

10 marks for conversation and viva-voce

10 marks for phonetic transcription

## STRUCTURE OF COMMUNICATION TECHNIQUE PAPER

### Distribution of Marks

Theory Paper: 50 Marks

Sessional : 20 Marks

Practices : 30 Marks

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

A. from English Text Book 10 Marks

B. from Hindi Text Book 5 Marks

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

A. English Letters 5 Marks

B. Hindi Letters 5 Marks

Q3. Report writing on given outlines 5 Marks

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

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

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

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

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

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

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

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

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

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

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



## 1.2 APPLIED MATHEMATICS-I

[Common to All Engineering Courses]

L T P  
3 2/2 -

Rationale:

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

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

### DETAILED CONTENTS:

#### 1. ALGEBRA-I:

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

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

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

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

## 2. TRIGONOMETRY:

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

2.2 Complex number.

Complex numbers, Representation, Modulus and amplitude  
De Moivre's theorem, its application in solving algebraic equations, Mod. Function and its properties.

## 3. CO-ORDINATE GEOMETRY:

3.1 Standard form of curves and their simple properties -

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

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

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

Tangent and normals

3.2 Straight lines, planes and spheres in space -

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

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

## 4. DIFFERENTIAL CALCULUS - I:

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

differentiability.

- 4.2 Methods of finding derivative, - Function of a function, Logarithmic differentiation, Differentiation of implicit functions, Higher order derivatives, Leibnitz theorem.
- 4.3 Special functions (Exponential, Logarithmic, Hyperbolic, Inverse circular and function), Definition, Graphs, range and Domain and Derivations of each of these functions.
- 4.4 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, sketching of some simple curves (without assumptions, question, not to be asked in the examination), Rate, Measure, velocity, Acceleration, Errors and approximation.

## 5. INTEGRAL CALCULUS - I:

- 5.1 Methods of Indefinite Integration: - Integration by substitution, Partial fraction and by parts, Integration of special function of 4.3.
- 5.2 Meaning and properties of definite integrals, Evaluation of definite integrals.
- 5.3 Application: Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution, centre of mean of plane areas.
- 5.4 Simpsons and Trapezoidal Rule: their application in simple cases, Concept of error for simple function.

### 1.3 APPLIED PHYSICS

[Common to All Engineering Courses]

L T P  
3 2/2 2

Rationale:

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

#### TOPIC WISE DISTRIBUTION OF PERIODS

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

## DETAILED CONTENTS:

### 1. Measurement

#### a) Units and Dimensions

Fundamental and derived units:

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

i) Checking the correctness of physical equations,

ii) Deriving relations among various physical quantities,

iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.

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

### 2. Vector

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

### 3. Force and Motion

Parabolic motion, projectiles thrown horizontally and at an angle. Problems on time of flight, horizontal range, and maximum horizontal range. Central forces. Circular motion, angular velocity, angular acceleration and centripetal acceleration. Relationship between linear and angular velocity and acceleration. Centripetal and centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge. Gravitational force, Motion of satellites, Kepler's laws, Escape velocity, 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 of inertia, Theorems (Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. Of regular bodies, Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling down the slant planes.

#### **5. Fluid Mechanics & Friction**

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

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

#### **6. Work, Power and Energy**

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

#### **7. Elasticity**

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

#### **8. Simple Harmonic Motion**

Periodic Motion, characteristics of simple harmonic motion;

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

## 9. Heat Transfer and Radiation

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

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

B. 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 Box); potentiometer, Kirchhoff'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, polarisation.

## **14. Magnetic Fields & Materials**

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

## **15. Semiconductor Physics**

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

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



electric effect and photo devices.

## 16. Nuclear physics

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

## 17. Lasers and its Applications

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 programme.
- (b) Solar energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, Solar constant measurement of solar radiation by pyrometer, and by Insulation 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<sup>2</sup> versus l and using the formula  $g = 4C^2 / \text{Slope of the graph line}$
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<sub>1</sub>/E<sub>2</sub> by potentiometer.
10. Determination of specific resistance by Carey Foster bridge.
11. Determination of resistivity by P.O.Box.
12. Verification of Kirchhoff'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 Insulation meter (Suryamapi).
16. Demonstration of He-Ne laser (Interferometer)
17. Determination of internal resistance by potentiometer.

NOTE :

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

## 1.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L T P  
3 - 2

Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge 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.	Topics	L	T	P
1.	Atomic Structure	4	-	-
2	Chemical Bonding	6	-	-
3.	Classification of Elements	3	-	-
4.	Instrumental Methods	4	-	-
5.	Electro Chemistry	6	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	3	-	-
8.	Solid State	3	-	-
9.	Colloids	3	-	-
10.	Lubricants	3	-	-
11.	Environmental Pollution and Control	3	-	-
12.	Water Treatment	5	-	-
13.	Corrosion	3	-	-
14.	Fuels	3	-	-
15.	Glass and Ceramics	3	-	-
16.	Stereochemistry of Organic Compounds	4	-	-
17.	Organic Reactions	6	-	-
18.	Organic Materials	9	-	-
		75	-	50

## DETAILED CONTENTS

### 1. ATOMIC STRUCTURE

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

### 2. CHEMICAL BONDING

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

### 3. CLASSIFICATION OF ELEMENTS

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

### 4. INSTRUMENTAL METHODS

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

### 5. ELECTRO CHEMISTRY

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

Concentration cells, reference electrodes (Hydrogen electrode) cells - Primary, Secondary and Fuel cell,

Laclanche's or dry cell, Acid storage cell (Lead accumulator) and Alkali storage cell (Edison accumulator), Fuel cell, Solar cell (Photovoltaic cell ), Numerical problems based on topics.

## 6. CHEMICAL KINETICS

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

## 7. CATALYSIS

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

## 8. SOLID STATE

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

## 9. COLLOIDAL STATE OF MATTER

Concept of colloidal and its types, Different system of Colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electro dialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, Tyndale 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, Necessarily 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, Green house effect, Acid rain, Smog formation, Chemical and photochemical reaction, Various species in atmosphere. Specific industrial pollution like Euro-I and Euro-II.

## 12. WATER TREATMENT

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

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 Delong'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 tropesch's process)

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

Numerical Problems based on topics

#### 15. GLASS AND CERAMICS

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

#### 16. STEREOCHEMISTRY OF ORGANIC COMPOUND

- Isomerism
- Types of isomerism
  1. Structural isomerism
  2. Stereoisomerism (a) Geometrical (b) Optical
- Definition of chiral, achiral stereogenic centre, plane of

symmetry.

- Types of stereoisomer' s-
  1. Conformers or Rotamers (Only ethanes)
  2. Configurationally isomers
    - a. Enantiomers
    - b. Diastereoisomers

## 17. ORGANIC REACTIONS

1. Fundamental aspects -
  - A. Regents electrophones and nucleophiles
  - B. Reaction Intermediates
    - i. Free radical
    - ii. Carbonation
    - iii. Carbanion
  - C. Various effects of substituent' s - Inductive, Mesomeric, Electrometric.
- 2.A. Mechanism of addition reaction (Markonicove's Rule, Cyanohydrins and Peroxide effect),
- B. Mechanism of Substitution reactions (Nucleophilic-hydrolysis of alkyle halide, electrophillic substitution halogenations, Sulphonation, Nitration and friedel-Craft reaction.
- C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehydrohalogenation of primary alkyl halide.

## 18. ORGANIC MATERIALS

- A. POLYMERS :
  1. Introduction to basic terms used in polymer chemistry and technology. Monomers, Average degree of polymerisation, Average molecular weight, Polymers, Polymerisation.
  2. Characteristics of Polymers and their classification
    - A. Addition polymers and their industrial application-



Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.

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

3. Free radical polymerization (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. Specifications 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 :

$\text{NH}_4^+$ ,  $\text{Pb}^{++}$ ,  $\text{Cu}^{++}$ ,  $\text{Bi}^{+++}$ ,  $\text{Cd}^{++}$ ,  $\text{As}^{+++}$ ,  $\text{Sb}^{+++}$ ,

$\text{Sn}^{++}$ ,  $\text{Al}^{+++}$ ,  $\text{Fe}^{+++}$ ,  $\text{Cr}^{+++}$ ,  $\text{Mn}^{++}$ ,  $\text{Z}^{++}$ ,  $\text{Co}^{++}$

$\text{Ni}^{++}$ ,  $\text{Ba}^{++}$ ,  $\text{Sr}^{++}$ ,  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$

B. Acid Radicals :

$\text{CO}_3^{--}$ ,  $\text{S}^{--}$ ,  $\text{SO}_3^{--}$ ,  $\text{CH}_3\text{COO}^-$ ,  $\text{NO}_2^-$ ,

$\text{NO}_3^-$  ,  $\text{Cl}^-$ ,  $\text{Br}^-$  ,  $\text{I}^-$  ,  $\text{SO}_4^{--}$

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  $\text{CaCO}_3$  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 years Diploma Course in Mech Engg., Civil Engg., Electrical Engg., Chemical Engg., Dairy, Ceramic, Textile Technology, Textile Chemistry]

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

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

L	T	P
-	-	8

### Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, 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 three tier technical manpower spectrum, is required to read and interpret the designs and drawings, provided to him by technologists and subsequently to translate them to the craftsmen for actual execution of the job.

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

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.N.	Units	Coverage Time		
		L	T	P
1.	Drawing Instruments 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.	Isometric Projection	-	-	20
8.	Free Hand Sketching	-	-	16
9.	Development of surfaces	-	-	24
10.	Assembly and disassembly drawing	-	-	24
11.	Orthographic Projection of Machine Parts	-	-	12
12.	Practice on Auto Cad	-	-	16
		-	-	200

## DETAILED CONTENTS

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

### 1. **Drawing, instruments and their uses**

- 1.1 Introduction to various drawing, instruments.
- 1.2 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 Presentation 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.
- Dimensioning techniques.
- (b) Projections of points, lines and planes. 1 Sheet
- 5 (a) Orthographic Projections of Simple 3 Sheets**
- 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 reference planes.
- (b) Orthographic views of simple composite solids from their isometric views.
- (c) Exercises on missing surfaces and views
- 6. Section of Solids 1 Sheet**
- Concept of sectioning

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

Cases involving cutting plane perpendicular to one of the reference planes and inclined to the others plane, true shape of the section

**7. Isometric Projection** 2 Sheet

Isometric scale

Isometric projection of solids.

**8. Free hand sketching** 1 Sheet

Use of squared paper

Orthographic views of simple solids

Isometric views of simple job like

carpentry 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.

Riveted & Welded Joints

Screw and form of screw thread

**11. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS** 2 Sheet

Nut and Bolt, Locking device, Wall bracket

## 12. PRACTICE ON AUTO CAD

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

NOTE :

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

## 1.6 APPLIED MECHANICS

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

[ Also Common to Mechanical Engineering (Specialization In Production Engineering ) ]

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

L T P  
2 2/2 2/2

### RATIONALE

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

### TOPIC WISE DISTRIBUTION OF PERIODS

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

### DETAILED CONTENTS



## 1. Introduction

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

## 2. System of Forces

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

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).
  - (vii)

## 1.7 ELEMENTARY WORKSHOP TECHNOLOGY

L    T    P  
3    -    -

Rationale :

The knowledge of " Workshop Technology " is very basis of mechanical engineering practice. For a beginner to technician course, familiarity with hand tools is a matter of utmost importance. The classroom teaching and a practice in shop will meet this need well.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	General Introduction	3	-	-
2.	Carpentry			
	a. Fundamentals of Wood Working Operations.	3	-	-
	b. Common Carpentry Tools	6	-	-
	c. Joining of timber Components	3	-	
3.	Metal Fabrication			
	A. Metal Shaping			
	1. Smithy	9	-	-
	2. Sheet Metal Working	9	-	-
	B. Metal Joining			
	1. Permanent Jointing	9	-	-
	2. Temporary Jointing	6	-	-
	C. Familiarity With Tools	6	-	-
4.	Protection of Fabricated Structure from Weather			
	1. Painting	6	-	-
	2. Varnishing & Polishing	3	-	-
5.	Foundry Work	6	-	-
6.	Machine Shop	6	-	-
		75	-	-

## DETAILED CONTENTS

### 1. GENERAL INTRODUCTION

- (a) Scope of subject "Workshop Technology" in engineering.
- (b) Different shop activities and broad division of the shops on the basis of nature of work done such as
  - (i) Wooden Fabrication (Carpentry)
  - (ii) Metal Fabrication (shaping and Forming, Smithy, Sheet metal and Joining-welding, Riveting, Fitting and Plumbing.

### 2. CARPENTRY

- (a) Fundamental of wood working operations:

- Marking & Measuring.
- Holding & Supporting.
  
- Cutting & Sawing.
- Drilling & Boring.
- Turning.
- Jointing.

- (b) Common Carpentry Tools:

Their classification, size, specification (name of the parts and use only).

- (1) Marking and measuring tools:

Rules, try square, Bevel Square, Marking gauge, Mortise gauge, Scriber (marking knife). Combination set

- (2) Holding and supporting Tools:

Carpentry vice, Bench hold fast, Bar clamp, Bench hook, Hand clamp C and G clamp.

- (3) Cutting and Sawing Tools:

Saws: ( Grip or Hand, panel, cross cut, Tenon, dove tail, compass, key hole and bow saw),

Chisel: (Firmer, dovetail, mortise and gauge),

Planes: (Wooden & Iron plane. Jack plane, Smoothing plane).

- (4) Drilling and Boring tools: Auger, Gimlet, Hand drill, Brace and bits.
- (5) Striking Tools: Mallet and Claw hammer.
- (6) Turning Tools & Equipments: Wood working lathe and lathe tools.
- (7) Miscellaneous Tools: Screw driver, Rasp, Pincer, Oil stone, Triangular file and Saw set.

(c) Joining of Timber Components For Fabrication Works:

Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet , Groove, Tongue, Dowel, operations in assembly-Simple lap and butt, Mortise, Tenon, Dovetail, Miter & bridle joints. Uses of glue, dowel pin and screw in preparation of joints. Common defects likely to occur during and after joining, defects due to wrong use of tools, defects due to wrong operation, defects due to improper seasoning of timber-their identification and remedy. Safety (personal and equipment) to be observed.

### 3. METAL FABRICATION

(A) Metal Shaping :

Smithy:

- (1) Operations involved (concept only)-Preparation of fire, Supporting and holding the metal, cutting the metal in size, heating, drawing down or

fullering, upsetting, swaging, bending, punching, blanking, drifting and forge welding,

- (2) Tools and equipment used (Names, size, specification for identification only).
  - (3) Heating and fuel handling equipment—Smithy Forge, Blower, Shovel, Poker.
  - (4) Holding and supporting tools—Common tongs, anvil, swage block.
  - (5) Striking Tools—Ball peen, cross peen, Straight peen double face and sledge hammers.
  - (6) Cutting tools - Hot and cold chisel and shear set.
  - (7) Punching & Drifting Tools - Punch & Drift.
  - (8) Bending Tools and fixture.
  - (9) Forming & Finishing Tools - Fullers, Swage Flatters, Set hammers.
  - (10) Defects likely to Occur during and after operations their Identification and Remedy. Defects due to wrong operation, wrong tool and wrong heating.
  - (11) Safety of Personnel, Equipment & Tools to be observed.
- (2) !!Sheet metal working:
- (I) Tools and Operation:
- (1) Operations involved ( Names and concept only )  
Laying out, marking and measuring, cutting, shearing and blanking, Straightening bending and seaming, Punching and piercing, burring and stamping,
  - (2) Sheet metal joints - Lap, seam, Locked seam, hemp, wired edge, cup or circular, Flange, angular and cap.

- (3) Tools and equipments used (Name, size, specification for identification only).
- (4) Marking Tools- Scriber, Divider and Trammel, Protractor, Try square, Dot punch, Steel Rule, Steel tape, Sheet metal gauge.
- (5) Cutting and shearing Tools-hand Shear and lever, Snips, Chisels.
- (6) Straightening tool-Straight edge.
- (7) Striking Tools-Mallet, Hammer.
- (8) Holding Tools-Vice, Pliers, C or G clamps, Tongs.
- (9) Supporting Tools-Stakes and Anvil.
- (10) Bending Tools-Crimpers, Form dies, Round nose pliers, Rails.
- (11) Punching-Piercing and Drifting tools.
- (12) Burring Tools-Files.
- (13) Common defects likely to occur during and after operation-Their identification and remedy. Defects due to wrong operation or wrong tool.
- (14) Safety of Personnel, Equipment & Tools to be observed.

(B) Metal Joining During Fabrication:

- (1) Permanent Joining:
  - (a) (1) Welding methods-Forge welding, gas welding (high and low pressure-oxyacetylene welding, types of flames.
  - (2) Electric welding- D.C. & A.C., Connected tools, operation, materials and safety measures.



(b) Soldering & Brazing:

For black Galvanized and Tin coated Iron sheet, brass and copper sheets only.

- (1) Its concept, comparison with welding as joining method and classification, electric soldering and forge soldering.
- (2) Soldering operation- edge preparation of joints, Pickling and degreasing, Fluxing, Tinning and Soldering.
- (3) Materials Used-Common fluxes, soft and hard solder, solder wire (Plain and Resin core) and sticks, spelters and their specifications and description ( For Identification Only), forge soldering bits.
- (4) Electric soldering iron.
- (5) Common defects likely to occurs during and after soldering.
- (6) Safety of Personnel, Equipment & Tools to be observed.

(c) Riveting:

- (1) Its comparison with welding as joining method.
- (2) Rivets and Materials.
- (3) Operation involved-Marking from given data, edge preparation, drilling and punching arrangements of joint elements (Lap, Butt with single cover plate and double cover plate) upsetting of rivet tail, shaping head and caulking.
- (4) Tools and equipments used- (Names, Size, Specification and uses)-Supporting and holding tools ( Stakes and Tongs)-Striking tools-Ball peen, Straight peen and Cross peen hammers and head forming tools (Shapes), drills punches and solid punches, drift, elementary knowledge about

working of pneumatic, hydraulic and electric riveter.

(2) Temporary Joining (Fasteners & Their Uses):

Introduction to

- (1) Various types of Bolts (Names of parts and specification) and various types of washers and nuts used with them and their uses, material they are made of, studs and foundation bolts.
- (2) Screws, keys, pins and cotters—their material and use.
- (3) Pipe connectors—Sockets, elbows, tees, cross and bends, unions, valves, glands packing and operation in use of pipe connectors—cutting, marking, threading, pipe bending, joining different pipe line fittings—(Steps of operation only).

Tools and equipment used in their operations (Name, Size, Specification and Description for Identification).

Supporting and holding tools—Pipe vices (Bench, leg and hand), Pipe wrenches, Spanners.

Cutting Tools— Hack saw and Pipe cutters.

Threading Tools— Pipe dies and Taps.

Materials Used for Joining—White lead, Cotton and Gasket.

Common defects likely to occur during and after operation and their remedies.

(3) Familiarity with The Use of Various Tools Used In Mechanical Engineering Workshop:

Marking & Measuring:

Steel rule, surface gauge, marking block, protractor, try square, scriber, punches, divider and calipers, surface plate, V. block, gauges- ( screw, pitch, radius, feeler), Vernier calipers, Micrometer, Vernier height and depth gauge, use of dial gauge.

Holding Tools:

Vices (Bench, leg and hand vice), clamps tongs, pliers,

Cutting Tools:

Hack saw (Fixed and Adjustable frame), chisels-flat, cross cut, diamond, round nose.

Files:

According to section-Knife edge, Flat, Triangular round, Square, Half round,

According to grade - Rough, Bastard, Second cut, Smooth and Dead smooth,

Drills and Allied Tools:

Parallel and taper shank Twist drill,

Thread Cutting Tools:

Taps and Dies,

Miscellaneous Tools:

Wrenches, Keys, Spanners, Pliers, Screw drivers their specification and many others which have not been named for use in various shops. They should be shown physically to each student for familiarity.

#### 4. PROTECTION OF FABRICATED STRUCTURES FROM WEATHER

##### 1. PAINTING:

Its need, Introduction to methods of paintings (Classification only); Manual, Machine (spray) and dip painting at room temperature, operations involved- description of steps only eg. surface preparation method for old and new surface in timber and iron structure- sanding, derusting, degreasing, filling of pore and dents, paint application- manual, machine (spray and dip painting drying of paint air drying and oven drying under coat and filler material (red oxide, putty, yellow clay), surface preparation materials (sand and emery papers); tools and equipments used ( Name, size specification for identification).

Brushes- Round and flat wire brush, scraper, trowel , spray gun, compressor.

Defects likely to occur in painting and their remedies

Safety of Personnel, Equipment & Tools to be observed.

##### 2. VARNISHING & POLISHING:

Its need operation involved (description of step only), surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and sprit polish, copal varnish. Defects likely to occur.

Safety of Personnel, Equipment & Tools to be observed.

##### 5. FOUNDRY WORK:

Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding.

##### 6. MACHINE SHOP:

Introduction to machine tools viz lathe, drilling machine, shaper and planer simple line and block diagram of components and their functions. Brief concept of NC and CNC machines.

## 1.8 WORKSHOP PRACTICE

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

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

L	T	P
-	-	8

### Rationale

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

### 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
5 B.	Foundry shop			20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
9.	Fastening Shop	-	-	12
		-	-	200

### DETAILED CONTENTS

- 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 copula & 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 aluminum) 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 CO<sub>2</sub> 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 riveted joint
- EX-3 To make a pipe joint
- EX-4 To make a threaded joint
- EX-5 Practice of sleeve joint

**1.9 Field Exposure-I**

See Annexure-I



## II YEAR

### 2.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L	T	P
3	1	-

Rationale :

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

#### 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	-
		75	25	-

#### DETAILED CONTENTS

##### 1. MATRICES :

###### 1.1 Algebra of Matrices, Inverse :

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

###### 1.2 Elementary Row/Column Transformation :

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

### 1.3 Linear Dependence, Rank of a Matrix :

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

### 1.4 Types of Matrices :

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

### 1.5 Eigen Pairs, Cayley-Hamilton Theorem :

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

## 2. ORDINARY DIFFERENTIAL EQUATION :

### 2.1 Formation, Order, Degree, Types, Solution :

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

### 2.2 First Order Equations :

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

### 2.3 Second Order Linear Equation :

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

### 2.4 Simple Applications :

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

### 3. DIFFERENTIAL CALCULUS-II :

3.1 Function of two variables, identification of surfaces in space

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

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

3.2 Partial Derivatives :

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

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  $f(x)$  -  $-c < x < c$  , 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

#### 5.6 Method of Least-square.

## 2.2 HYDRAULIC AND PNEUMATIC SYSTEMS

L T P

3 - 2

### RATIONALE

The diploma holders are supposed to have knowledge of hydraulic and pneumatic systems. Hence this subject has been introduced.

### DETAILED CONTENT

#### 1. Introduction

Properties of liquid, intensity of pressure, pressure head, centre of pressure, total pressure on vertical and inclined flat surfaces. Gauge pressure and absolute pressure, atmospheric pressure, vacuum differential pressure with simple problems.

(6 hrs)

#### 2. Pressure Measurement

Measurement of pressure by piezometer tube, manometer, inclined manometer, differential manometer, inverted differential manometer, simple problems, bourdon's pressure gauge. Pressure gauge calibration.

(6 hrs)

#### 3. Flow Measurement

Types of flow, total energy, velocity head, pressure head, potential head, measurement of velocity, Bernoulli's theorem, applications of Bernoulli's theorem, simple problems.

(8 hrs)

#### 4. Flow Through Orifices

Types of orifices, jet of water, vena contracta. Hydraulic coefficients, relation between C, Cv and Cd. Time for emptying a tank.

(4 hrs)

#### 5. Pumps

Study of Pumps. Reciprocating and Centrifugal.

(4 hrs)

#### 6. Flow Through Pipes

Minor and Major losses, darcy's equation, chezy's equation (Without proof), simple problems.

(6 hrs)

#### 7. Hydraulic Circuits

Study of construction of elements of hydraulic power pack such as

(4 hrs)

hydraulic pump, filter & reservoir, cooler, heater, oil level gauge & temperature gauge.

#### 8. Pneumatic Systems

Comparison of pneumatics with fluids, elements of pneumatic system, types of compressors- reciprocating, rotary. Selection of compressor.

Air receivers. Industrial applications of pneumatics. Air filters, pressure regulator, and lubricators. Pneumatic valves- direction control valve, pilot operated valve. Pneumatic actuators. Pneumatic tools- rotary, piston type, hammer type.  
(10 hrs)

## 2.3 METROLOGY AND MEASURING INSTRUMENTS

[ Common to Three years Diploma Course in Mech Engg.]

L T P  
3 1 3

### Rationale:

Measuring is the very basis of every decision making activity. How should we measure is a matter of still more importance. Metrology is the philosophy of subject and measuring instruments are means. Both are equally important for engineer's at every stage of their work pursuit. The paper aims to enable the student to envisage such aspects of the job at hand.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction	6	-	-
2.	Principle & Classifications of Measuring Instruments	9	3	-
3.	Transducers	6	2	-
4.	Comparators	9	3	-
5.	Surface Finish	6	2	-
6.	Various Types of Instruments Used For i. a. Physical Measurement b. Liquid Level & Viscosity ii. Mechanical Quantities	12	4	-
7.	Temperature Measurement	6	2	-
8.	Special Measuring Devices	6	2	-
9.	Measurement of Vibrations	6	2	-
10.	Inspection of Geometrical Errors	9	3	-
		75	25	75

### DETAILED CONTENTS

## 1. INTRODUCTION:

Meaning and scope of metrology in field of engineering. standards and types of measurements (Line and Wave length, Primary, Secondary and Tertiary measurement concept only). Limits, Fits and Tolerances. Interchangeability, precision and accuracy, Sources of error.

## 2. PRINCIPLES AND CLASSIFICATIONS OF MEASURING INSTRUMENTS:

### (A) Principle of Mechanical Measuring Instruments:

Lever method, vernier method, screw and screwnut method, compound gearing and helical spring methods.

### (B) Principles of Optical Instruments:

Reflection, Refraction, Interference, Polarisation, Optical prisms, Lenses and Optical projection (Magnification)

### (C) Principle of Electrical measuring instruments

### (D) Principle of Hydraulic and Pneumatic Instruments.

## 3. TRANSDUCERS:

Definition, various types of transducers such as resistive, capacitive, inductive, electromagnetic, photo electric, piezo electric and their use in instrumentation.

## 4. COMPARATORS:

General principles of constructions, balancing and graduation of measuring instruments, characteristics of comparators, use of comparators, difference between comparators, limit gauges and measuring instruments. Classification of comparators, construction and working of dial indicator, johanssen "Mikrokator", read type mechanical comparator, mechanical-optical, zeiss optotest, electro limit, electromechanical, electronics, pneumatic comparators, gauges, tool makers microscope.

## 5. SURFACE FINISH:



Geometrical characteristics of surface roughness- Wavyness. Lay, flaws. Effect of surface quality on its functional properties. Factor affecting the surface finish. Drafting symbols for surface roughness. Evaluation of surface finish. RMS and CLA values. Methods of measuring surface roughness. Qualitative and quantitative methods. Comparison of surfaces produced by common production methods.

## 6 VARIOUS TYPES OF INSTRUMENTS USED FOR:

- (i) (a) Physical Measurements such as - Length, Depth height, Thickness, Gaps, Curvature, Angle, Taper, Area, Undulations, Surface finish, Thread and Gear measurement.
- (b) Liquid Level & Viscosity - Liquid level measuring methods and devices Viscometer - Plate and Cone viscometer, Two float viscometer, Rheo viscometer.

### (ii) Mechanical Quantities:

- (a) Displacement, velocity, acceleration, speed, torque-Use of transducers and electronic counters, stroboscope, vibrating reeds and techno meters.
- (b) Pressure and Vacuum - Idea of atmospheric pressure, Gauge pressure and vacuum - Use of instruments such as manometers and pressure gauge using elastic elements such as diaphragm, Capsule, Bellows, Bourdon tube and various transducers and thermo couple, vacuum gauges.
- (c) Strain circularity (By dial gauge and telerod). Gauge - Use of strain gauge and load cells.

## 7. TEMPERATURE MEASUREMENT:

Various types of thermometers, thermocouples, pyrometers (Radiation and optical type both).

## 8. SPECIAL MEASURING DEVICES:

Computerized 3-D measuring machine (Working Only).

## 9. MEASUREMENT OF VIBRATIONS:

Use of seismic Accelerometer, Potentio metric type and L. V. D. T. type, piezoelectric type accelerometer.

10. INSPECTION OF GEOMETRICAL ERRORS:

Construction and working of auto collimeter, checking of straightness, flatness, squareness and parallelism,

## 2.4 PLASTICS PROCESSING TECHNIQUES -I

L T P

4 - 4

### RATIONALE

After fabrication of the product post processing operations are necessary to make the product commercially presentable. Finishing and other decorating and printing operations are instrumental in enhancing the aesthetics and visual appeal of the product. The emphasis is given especially on printing, lamination, coating techniques, compression and transfer moulding and rotational moulding.

### DETAILED CONTENTS

#### 1. Compression moulding

General principles and working of compression molding machine.

Types of compression molding machine – hand operated, automatic, single and multi daylight machines, bulk factor, preheating of molds, cycle time ,process variables and their control. Effect of process variables on product properties, compression molding of Semiconductor and DMC compounds

(12 hrs)

#### 2. Transfer Moulding

Principles of transfer molding. Types of transfer molding machines, molding cycle ,theoretical calculation of line pressure, injection ram pressure, clamping pressure, pot capacity, compression of transfer molding and compression molding

(10 hrs)

#### 3. Introduction to Pultrusion, hand lay up technique (4 hrs)

#### 4. Forming

Basic principles, method of forming – straight forming, free forming, plug assist forming, drape forming, matched mold forming, slip forming, snap back forming, reverse draw forming, limitations and advantages of forming, materials for thermoforming, types of heating systems

(10 hrs)

#### 5. Casting

Introduction, casting of PMMA, unsaturated polyesters and phenolic resins

(6 hrs)

#### 6. Calendering

Introduction to calendering, types of calenders, advantages, limitations of calendering and major applications

(6 hrs)

#### 7. Rotational moulding of large containers (4 hrs)

## **8. Foam Moulding**

Definition of molding, processes, blowing agents, applications  
(4 hrs)

## **9. Finishing of Plastics**

Cutting, turning, drilling, sanding, polishing different types of welding  
(8 hrs)

## 2.5 DESIGN OF DIES AND MOULDS-I

L T P

4 - 2

### RATIONALE

A diploma holder in plastic technology is engaged in manufacturing plastic components for which design of moulds and dies is essential. This subject will impart them requisite knowledge and skill in design of moulds and dies.

### DETAILED CONTENTS

1. Basic concept of mould designing, shrinkage, flash line, taper and draft  
(3 hrs)
2. Materials used for dies and moulds and their characteristics  
(3 hrs)
3. General design considerations for various types of moulds  
(3 hrs)
4. Machining methods - general introduction to lathe machine, grinder, shaper, milling, spark erosion, CNC wirecut  
(5 hrs)
5. Impressions - Core and cavity. Types of cavity and core, their advantages and disadvantages. Bolster plate and its types, guide pillar, guide bush, register ring and their types. Mould clamping - direct, indirect  
(6 hrs)
6. Parting surface - Types of parting surface, selection of parting surface  
(5 hrs)
7. Feed system
  - Runners - Sprue, runners and its types, balancing of runners, size of runners
  - Gates - Types of gates, size of gates  
(12 hrs)
8. Ejection system - Ejector grid, ejector plate assembly  
(11 hrs)
9. Cooling system - Cooling methods, cooling circuits for an integer and insert core cavity moulds e.g. U-type, rectangular and Z-type  
(7 hrs)
10. Injection mould - Types of moulds; 2-plate mould, 3-plate mould, split mould, runnerless mould  
(9 hrs)

## 2.6 MATERIALS AND METALLURGY

L T P

3 - 2

### RATIONALE

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Materials and Metallurgy has been designed to cover the above aspects.

### DETAILED CONTENTS

#### 1. Importance of Materials

Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys

Names of common metals, their alloys and non-metals used in Industry

Properties of metals and alloys

Physical properties - Appearance, luster, colour, density and melting point

Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue and creep.

Thermal and electrical conductivity

Corrosion, causes, effects and prevention.

(4 hrs)

#### 2. Metallurgical Considerations

Solidification of metals from liquid to solid state of pure metals, cooling curves of pure metals, dendritic solidification, crystal formation, types of crystal structure. Phase diagram of:

(i)

Solid-state solubility.

(ii)

Partial solubility.

(iii)

Nil solubility i.e. eutectic solution (Binary only). Effects of all alloying elements on engineering materials. Effect of grain size on mechanical properties.

(6 hrs)

#### 3. Ferrous Metals and Alloys

Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram.

Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades

Effect of alloying elements such as Aluminium, chromium, Nickel,

Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous on steels.

Composition, properties, grades and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.

Heat treatment: Iron-carbon diagram, objectives and practical aspects of Heat treatment. Brief description and uses with examples of principal Heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications. Examples in heat-treating engineering components time, temperature transformation curve.

(12 hrs)

#### **4. Non-ferrous Metals and Alloys**

Copper: Properties and uses

Composition, properties and uses of copper alloys.

Brasses: Cartridge brass, Nickel silver.

Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.

Properties and uses of Aluminium.

Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium

Properties and uses of alloys of lead, tin and magnesium.

Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and tri-metallic bushes

(12 hrs)

#### **5. Identification and Examination of Metals and Alloys**

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure. Different types of etchants for preparation of surface structure.

(1 hrs)

#### **6. Other Important Materials**

Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses and grades.

Composite materials.

Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.

Electrical insulating materials. Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber, felt.

Sound insulating materials: Cork, fibre boards.

Fabrication materials: Wood, plywood, rubber - natural and synthetic, Glass - plate glass, toughened glass, safety glass.

Refractory materials: General characteristics and uses of dolomite,

ceramics.

Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating.

Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.

(10 hrs)

**7. Selection, specifications and commercial availability of materials**

Practical considerations for selection of material for different purposes

ISO/Bureau of Indian standard specifications for metals, non-metals,

various components and materials.

(3 hrs)



## 2.7 PLASTIC MATERIALS

L T P

3 - -

### RATIONALE

This subject gives a detailed description of polymeric materials in category of thermoplastics, thermosets and thermoplastic elastomers. The students acquire the knowledge of advanced engineering and speciality polymers so that he/she can select the right type of materials for processing to make the product.

### DETAILED CONTENTS

1. Genral Purpose Thermoplastics:  
Polyolefines:LDPE, LLDPE, HDPE, PP, EVA, UHMHDPE.  
Styrene Plastics:Polystyrene,high impact polystyrene, ABS, SAN and PAN.  
Vinyl Polymer: PVC, PVDC.
2. Advanced thermosets, epoxies, poly urethanes  
(6 hrs)
3. Engineering thermoplastics – poly carbonates, polyamides, PEEK, poly phenylene oxide, acetals, Nylons:Nylon6, Nylon66, Polycarbonate, Polyacetol, PET and PBT, PPS, PPO, Polysulphone, PMMA, Polyurethanes.  
Thermoset Materials: PF, UF, MF, EPOSY, ALKUD, POLYSTER  
(8 hrs)
4. Reinforced plastics – principles of composite reinforcement, effect of reinforcement on strength of plastics. Role and nature of binders and coupling agents, properties and applications of fibres in reinforcement (glass and carbon). Miscellaneous fillers (Talc, mica, glass beads). Properties and applications of FRPs (un-saturated polyesters, epoxies, PU, nylon)  
(10 hrs)
5. Polyblends and alloys – Definition, advantages of polymers, blends and alloys, role of composition, properties and applications of parameters for compability, PVC – Nitrile rubber, ABS-PVC and PP-EPDM  
(6 hrs)
6. High performance polymers – polytetrafluroethylene, Teflon, polysulphones, liquid crystalline polymers  
(8 hrs)
7. Preliminary concept of new materials such as conducting polymers, biopolymers, onto-electronic plastics, nano-polymeric materials and plastics in biomedical applications, interpenetrating polymer networks, polymer concretes  
(10 hrs)

## 2.8 BASICS OF INFORMATION TECHNOLOGY

L T P

- - 4

### RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools of MS office; using internet etc. form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

### Note:

1. *Teaching of theory should be dovetailed with practical work*
2. *The following topics may be taught in the laboratory along with the practical exercises.*

### DETAILED CONTENTS

#### Relevant Instructions for Practical' s

1. Information Technology – its concept and scope
2. Computers for information storage, information seeking, information processing and information transmission
3. Elements of computer system, computer hardware and software; data – numeric data, alpha numeric data; contents of a program, processing
4. Computer organization, block diagram of a computer, CPU, memory
5. Input devices; keyboard, mouse etc; output devices; VDU and Printer, Scanner, Plotter
6. Electrical requirements, inter-connections between units, connectors and cables
7. Secondary storage; magnetic disks – tracks and sectors, optical disk (CD and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
8. Exercises on file opening and closing; memory management; device management and input – output (I/O) management with respect of windows
9. Installation concept and precautions to be observed while installing the system and software
10. Introduction about Operating Systems such as MS-DOS and Windows
11. Special features, various commands of MS word and MS-Excel
12. About the internet – server types, connectivity (TCP/IP, shell); applications of internet like: e-mail and browsing
13. Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)
14. Basics of Networking – LAN, WAN, Topologies

## LIST OF PRACTICALS

1. Given a PC, name its various components and list their functions
2. Identification of various parts of a computer and peripherals
3. Practice in installing a computer system by giving connection and loading the system software and application software
4. Installation of DOS and simple exercises on TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP commands
5. Exercises on entering text and data (Typing Practice)
6. Installation of Windows 2000 or XP etc.

Features of Windows as an operating system

- Start
- Shutdown and restore
- Creating and operating on the icons
- Opening closing and sizing the windows
- Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
- Creating and operating on a folder
- Changing setting like, date, time color (back ground and fore ground)
- Using short cuts
  
- Using on line help

### 7. MS-WORD

- File Management:

Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, Giving password protection for a file

- Page Set up:

Setting margins, tab setting, ruler, indenting

- Editing a document:

Entering text, Cut, copy, paste using tool- bars

- Formatting a document:

Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods

- Aligning of text in a document, justification of document ,Inserting bullets and numbering

- Formatting paragraph, inserting page breaks and column breaks

- Use of headers, footers: Inserting footnote, end note, use of comments

- Inserting date, time, special symbols, importing graphic images, drawing tools

- Tables and Borders:

Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table

- Print preview, zoom, page set up, printing options
  - Using Find, Replace options
  - Using Tools like: Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels
  - Using shapes and drawing toolbar,
  - Working with more than one window in MS Word,
  - How to change the version of the document from one window OS to another
- Conversion between different text editors, software and MS word

## 8. MS-EXCEL

- Starting excel, open worksheet, enter, edit, data, formulas to calculate values, format data, create chart, printing chart, save worksheet, switching from another spread sheet
  - Menu commands:  
create, format charts, organise, manage data, solving problem by analyzing data, exchange with other applications. Programming with MExcel, getting information while working
  - Work books:  
Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays
  - Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet
  - Creating a chart:  
Working with chart types, changing data in chart, formatting a chart, use chart to analyze data
  - Using a list to organize data, sorting and filtering data in list
  - Retrieve data with MS – query: Create a pivot table, customising a pivot table. Statistical analysis of data
  - Customise MS-Excel:  
How to change view of worksheet, outlining a worksheet, customise workspace, using templates to create default workbooks, protecting work book
  - Exchange data with other application: linking and embedding, embedding objects, linking to other applications, import, export document.
- ## 9. Internet and its Applications
- a) Log-in to internet
  - b) Navigation for information seeking on internet
  - c) Browsing and down loading of information from internet
  - d) Sending and receiving e-mail
- Creating a message

- Creating an address book
  
- Attaching a file with e-mail message
- Receiving a message
- Deleting a message

## 2.9 ELECTRICAL TECHNOLOGY & ELECTRONICS

(Common With Mech. Engg., Dairy Engineering)

L T P  
2 - 2

Rationale :

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

### TOPIC WISE DISTRIBUTION OF PERIODS

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

### 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 applications in rectifiers. Transistors-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, e.m.f. equation, Types of generators and their applications.

D. C. Motor:

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



**7. TRANSFORMERS:**

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

**8. SYNCHRONOUS MACHINES:**

(a) Alternators:

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

(b) Synchronous Motors:

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

**9. INDUCTION MOTORS:**

(a) Three Phase Induction Motors:

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

(b) Single Phase Induction Motors:

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

**10. ELECTRO HEATING:**

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

**11. ELECTROPLATING:**

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

## 2.10 HYDRAULIC AND PNEUMATIC LAB

### LIST OF PRACTICALS

1. Study of piezometer tube, manometer and pressure gauge and its calibration.
2. To verify Bernoullie's Theorem.
3. To find coefficient of discharge for a venturimeter.
4. To determine coefficient of contraction, coefficient of velocity and coefficient of discharge for a given orifice.
5. Study of following equipment with a view to illustrate its constructional details, common problems and their remedies.
  - a. Centrifugal pumps
  - b. Single acting reciprocating pump
  - c. Hydraulic jack
6. Study of hydraulic circuit in general and its application on a surface grinder.
7. To study pneumatic circuit of any available machine or of Pneumatic brake of a vehicle.
8. To find the velocity of water flowing through pipe and also calculate the major head loss due to friction.

## 2.11 METROLOGY LAB

1. Measurement of angle with the help of sine bar/vernier Bevel protractor.
2. Study and sketch of various types of optical projectors.
3. Use of comparators for measurement
4. To measure the diameter of a hole with the help of precision balls.
5. Measurement of Taper by standard balls and rollers.
6. To test the squareness of a component with autocollimeter.
7. To measure the pitch, angle and form of thread of a screw.
8. Measurement of gear elements by using gear tooth vernier.
9. To measure the straightness of the edge of a component with the help of autocollimeter.
10. Use of linear measuring instrument such as vernier calliper

and micrometer.

11. Use of height gauge and vernier callipers.
12. Calibration of vernier callipers/micrometers with slip gauge.
13. Calibration of height gauge/depth gauge with slip gauge.
14. Measurement of Thread Parameter by using tool maker's microscope.
15. Use of slip gauge in measurement of centre distance between two pin.
16. Checking of accuracy of a plug gauge with micrometer.
17. Measurement of surface roughness of a surface.
18. Use of feeler, wire, radius and fillet gauges for checking of standard parameters.

NOTE:

Institute is at liberty to develop and conduct practical according availability of items to be measured by the instrument. Every year the items to be measured, shall be change to perform practical so that the repeatation may be avioded. The student shall conduct and tabulate the experiments individually and teachers will evaluate each student.

## 2.12 MATERIALS AND METALLURGY LAB

### LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts in material lab, identify and indicate the type of materials with respect to their properties
2. Study of metallurgical microscope.
3. To prepare microscopic structure for examination and to examine the micro structure of specimens of various metals and alloys.
4. Study of heat treatment furnaces.
5. To study the effects of heat treatments processes on the following materials:
  - (i) Low carbon steel
  - (ii) Mild steel
  - (iii) High Carbon Steel

## **2.13 DESIGN OF DIES AND MOULDS-I LAB**

### **LIST OF PRACTICALS**

1. To design and draw various mould parts
2. To design and draw a two plate injection mould
3. To design and draw a three plate injection mould
4. To design and draw a split mould
5. To design and draw a runner less mould
6. To design & draw unscrewing.

Note: Maximum 10 sheets will be prepared by the students

## **2.14 PLASTICS PROCESSING TECHNIQUES -I LAB**

### **LIST OF PRACTICALS**

1. To produce small components on hand operated compression molding machine
2. To produce components on automatic/semi automatic compression molding machine
3. To produce articles on vacuum forming machine
4. Preparation of FRP sheet by hand lay up technique

### III YEAR

#### 3.1 ENVIRONMENT AND POLLUTION IN PLASTIC INDUSTRY

L T P

3 - 2

#### RATIONALE

The objective of this subject is to create awareness in the students about the pollution aspects related to the plastic solid waste disposal, air pollution by plastics waste, Incineration, reusability and reprocessing of plastics and biodegradation of plastics.

#### DETAILED CONTENTS

##### **1. Environment**

Environment and its components; water, soil, air and living things. Ecosystems, ecological balance, interaction of environment with humans. Cause of ecological imbalance  
(6 hrs)

##### **2. Classification of Plastic Materials**

Natural and synthetic polymer and their compatibility with surroundings (starch and proteins, silicon's and other man made fabrics). Life expectancy of different plastics in environment and thermal degradation, biodegradation and photo degradation. Agents for increasing life expectancy of polymers  
(8 hrs)

##### **3. Pollution and Hazards related to Plastics**

Pollution caused by plastics, loading of toxic chemicals from plastics into soil and water (including additives, flame retardants, chonnated additives etc.)  
ISI Standards regarding limits of these chemicals in effluents  
(8 hrs)

##### **4. Reusability and Reprocessing of Plastics**

Need and importance of reprocessing. Stages in recycling (primary, secondary and tertiary), Advantages and disadvantages of recycling  
(10 hrs)

##### **5. Plastic Waste Management**

Public awareness regarding hazards caused by indiscriminate use of plastics, proper disposal of plastics. Collection of recyclable plastics. Landfill. Incineration of plastics  
(8 hrs)

##### **6. Use of Plastics in Conservation of Natural Resources**

Mulching, waste water recovery by membrane separation, use of plastics in rain water harvesting, plastic pipes for transportation of

potable water (as compared to iron pipes) and canal lining.  
(8 hrs)

### **7. 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. 2 PLASTIC PROCESSING TECHNIQUES - II

L T P

4 - 4

### RATIONALE

The purpose of this subject is to equip the students with the knowledge of processes utilized in extrusion and blow moulding. This subject develops the competence of the students in major industrially practiced processing techniques.

### DETAILED CONTENTS

#### a) INJECTION

Basic concept of injection moulding: Hand injection, Semiautomatic injection (vertical and horizontal) and features of machine.

Automatic injection moulding machine: Various machine parts like; hopper, screw, barrel, heating devices, clamping unit etc. Injection moulding process and process control, machine parameter, shot capacity, injection pressure, injection speed, day light, limit switch etc., Basic concept of injection cycle, machine control, microprocessor controlled injection moulding, open loop and close loop control, multi colour injection moulding, gas assisted injection moulding, isotactic moulding, faults and remedies in injection moulding process like: Shrinkage, shrink mark, weld line parting line, flash etc.

#### b) EXTRUSION

##### 1. Introduction

Introduction to extrusion process, different types of extruders:- single screw and twin screw extruder, vented barrel extruder, general principles of operation, die swell, function of various parts i.e. barrel, screw, screenpack, die, breaker plate, adaptor. (6 hrs)

2. Types of screws in use for processing different plastics, Feed, Compression and Metering zone, Die zone, L/D ratio and its significance. (3 hrs)

3. Nip rolls, Irishring, bubble casing, winding equipment, cutting devices, stretching and orientation. (3 hrs)

4. Extruder performance and their curves, faults & remedies. (4 hrs)

5. Blown film extrusion, extrusion of pipes, wires and cables, sheets and Filaments. (8 hrs)

6. Co extrusion of films and sheets. (6 hrs)

7. Printing techniques – flexographic printing, gravure printing, pad printing, screen printing, hot stamping. (4 hrs)

8. Conversion of plastic films into laminate e.g. metal plastic laminates, paper- plastic laminates, plastic - plastic laminates. Advantages of multi-layer packaging, disadvantages of multi layer packaging. (4 hrs)



**c) BLOW MOULDING**

7. Basic principles of blow moulding, Types of blow moulding :-  
Extrusion blow moulding, injection blow moulding. Blow molding irregular containers. (8 hrs)
8. Materials for blow moulding. (2 hrs)
9. Production of parison, a). by extrusion b). by injection. Parison wall thickness control, Parison blowing systems, air requirement for blowing, effect of process variables on product design and properties. Parison programming, mould venting. (8 hrs)
10. Newer concepts including extrusion- stretch blow moulding, injection stretch blow moulding, multi layer moulding etc. (8 hrs)

### 3.3 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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	-
		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

**2. HUMAN RESOURCE DEVELOPMENT**

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

**3. HUMAN AND INDUSTRIAL RELATIONS**

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

**4. PERSONNEL MANAGEMENT**

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

**5. FINANCIAL MANAGEMENT**

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

**6. MATERIAL MANAGEMENT**

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

**7. LABOUR, INDUSTRIAL AND TAX LAWS**

Importance and necessity of industrial legislation, Types of labour laws and dispute, Factory Act 1948, Payment of Wages Act 1947, Employee State Insurance Act 1948, Various types

of taxes - Production Tax, Local Tax, Trade tax, Excise duty, Income Tax.

## **8. ENTREPRENEURSHIP DEVELOPMENT**

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

## **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 organized at a stretch for two or three days. Lectures will be delivered on Entrepreneurship by industries experts at institute level.

### 3.4 DESIGN OF DIES AND MOULDS - II

L T P

4 - 2

#### **RATIONALE**

A diploma holder in Plastic Mould Technology is engaged in manufacturing plastic components for which design of moulds and dies is essential. This subject will impart them requisite knowledge and skills in design of moulds and dies.

#### **DETAILED CONTENTS**

##### **Dies**

1. General features of extrusion dies  
(3 hrs)
2. Die materials  
(3 hrs)
3. Design features dies – Polymer melt flow, die geometry, material of construction, ease of maintenance and cleaning. Die land, die swell  
(8 hrs)
4. Heating system and temperature control  
(2 hrs)
5. Types of dies  
(2 hrs)
6. Dies for rod, flexible tube, wire coating  
(10 hrs)

##### **Compression Mould and Transfer Moulds**

7. Types of compression molds – positive, semi-positive, flash and landed positive type  
(8 hrs)
8. Calculation of clamp pressure, ram pressure, platen size, no. of impressions. Selection of compression molding machine  
(5 hrs)
9. Principles of transfer molding, pot capacity, design of sprue, runner and gates  
(7 hrs)

##### **Blow Moulds**

10. Materials for flow moulds  
(2 hrs)
11. Extrusion blow moulds – cavity and pinch off  
(6 hrs)
12. Injection blow moulds – neck design, mandrel design, Parison thickness control  
(5 hrs)
13. Mould cooling (3 hrs)

### 3.5 PLASTIC TESTING AND QUALITY CONTROL

L T P

3 - 4

#### RATIONALE

It is necessary to test the raw materials and the products during various stages of their manufacture to control the quality. This subject provides the essential knowledge and skills to the students for doing this function.

#### DETAILED CONTENTS

##### Testing

1. Overview of various testing methods and organisations such as ASTM, BIS, DIN and ISO  
(2 hrs)
2. Test specimens preparation : milling, punching, template, cutting from sheets or films product  
(4 hrs)
3. Identification of plastic
  - Visual, burning, heating
  - Element, detection, analysis; chemistry, groups analysis(4 hrs)
4. Physical properties  
Specific gravity, Water absorption, Moisture content analysis  
(4 hrs)
5. Mechanical Properties
  - Short term Mechanical properties - Tensile strength, impact strength (izod & charpy), flexural strength, fatigue resistance, compression strength, tear test
  - Long term Mechanical properties - creep and stress relaxation.
  - Hardness, shore and rockwell hardness, Abrasion resistance.(6 hrs)
6. Thermal properties  
Melting point, Vicat softening point, heat distortion temperature  
(6 hrs)
7. Electrical properties  
Dielectric strength, Arc resistance, Insulation resistance, Volume and surface resistivity  
(6 hrs)
8. Optical properties  
Light transmittance, Haze, Gloss, refractive index  
(4 hrs)
9. Flow properties  
Melt flow index, capillary rheometer, cone and plate viscometer  
(4 hrs)

##### Quality Control

10. Basic concept of statistical quality control, Visual inspection, Testing of a finished product, Analysis of test data to control finished product in relation to service requirement, Special tests on individual products to improve the quality  
(8 hrs)

### 3.6 FIELD EXPOSURE-II

SEE ANNEXURE-II



### 3.7 PROJECT

The project paper will be of two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and Environmental pollution control.

#### Part-A

Choose any one problem of mould for any type of plastic products used in daily life in commercial or domestic.

#### PART-B:

The student will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygienic conditions, Education facilities and various Programmes/projects running for the development and the personnel's and agencies involved in the work. He will also make observation on environmental pollution and ecological disturbances and will make a mention of that in his report with its reason, suggesting remedies or ways to minimise it. Without it the project will not be taken as complete. The student will also do some constructive work for pollution Control as advised by the guiding teacher.

### **3. 8 PLASTIC PROCESSING TECHNIQUES - II LAB**

#### **LIST OF PRACTICALS**

1. To study the specification of extruder available in the lab
2. To produce pipe of different diameters on extruder
3. To study the specification of automatic Blow Moulding Machine
4. Production of component on hand operated blow molding machine, using at least 3 moulds
5. Production of components on semi automatic blow machine by setting the process parameters
6. To do gravure printing
7. To do printing with pad printing machines

### **3. 9 ENVIRONMENT AND POLLUTION LAB**

#### **LIST OF PRACTICALS**

Demonstration/operation of the following practicals (5 experiments)

1. To conduct recyclability test
2. Collection of different plastic wastes and their segregation in various groups
3. Conversion of collected samples into plastic granules
4. Property modification of plastic granules by adding natural material like cellulose
5. Determination of BOD and COD of given samples of effluents of plastic industry
6. Mixing of virgin polymers with recycled polymers (both by melt method and solvent method)
7. To carry out plastic waste management of at least one department/section of the polytechnic

### **3. 10 DESIGN OF DIES AND MOULDS - II LAB**

#### **LIST OF PRACTICALS**

1. Design and drawing of a single impression compression mould
2. Design and drawing of a multi-impression compression mould
3. Design and drawing of a transfer mould
4. Design and drawing of elbow mould
5. Design and drawing of a die for pipe/tubing

Note: Minimum 10 sheets will be prepared by the students.

### **3. 11 PLASTIC TESTING AND QUALITY CONTROL LAB**

#### **LIST OF PRACTICALS**

1. To carry out volume and surface resistivity test on given samples of plastic
2. To determine the tensile strength, flexural strength of plastics specimen.
3. To determine impact strength of different plastics specimen.

4. To determine hardness (shore and rockwell) of different specimen of plastics.
5. To carry out dart impact test on given plastics films/laminates.
6. To determine the Melt Flow Index of given samples of plastics.
7. To carry out (i) heat detection test on given samples of plastics.  
(ii) vicat softening point test on given samples of plastics
8. To measure gloss of plastic specimen.
9. To carry out environmental stress cracking resistance test on given samples of Plastics with notch cutting equipment.

### 3.12 COMPUTER AIDED MOULD DESIGN

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- - 4

In this practical subject, the students are required to learn the basics of software such as :

Mechanical Desktop, Mould Creator, Mould Flow etc. and further to design at least 2 moulds for given components using these software.

**DIPLOMA IN PLASTIC MOULD TECHNOLOGY**  
**STAFF STRUCTURE**

Intake of the Course 60  
Pattern of the Course Annual Pattern

Sl. No.	Name of Post	No.
1.	Principal	1
2.	H. O. D. (Mechanical)	1
3.	Lecturer Plastic/Mech. Engineering	1/3
4.	Lecturer in Electrical Engg.	1
5.	Lecturer in Maths	1 Part Time
		OR
6.	Lecturer in Chemistry	1 Common with
7.	Lecturer in Physics	1 other
		discipline
8.	Lecturer in Comm. Tech.	1
9.	Computer Programmer	1
10.	Steno Typist	1
11.	Accountant / Cashier	1
12.	Student / Library Clerk	1
13.	Store Keeper	1
14.	Class IV	6
15.	Sweeper	Part time or as
		per requirement
16.	Chaukidar & Mali	as per
		justification
17.	Lecturer in Computer	1 (Only for Computer Aided Design Group.)

Note :

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

## SPACE STRUCTURE

### [A] ADMINISTRATIVE BLOCK

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

### [B] Academic Block

Sl.No.	Detail of Space	No.	@ Sq. m	Floor Area Sq. m.
1.	Class Room	2	60	120
2.	Drawing Hall	1	120	120
3.	Physics Lab			90
4.	Chemistry Lab			120
5.	App. Mechanics Lab. / Elements of Mechanical Engg Lab.			120
6.	Material Science Lab.			120

7.	Thermal Engg. Lab.	120
8.	Hydraulics Lab.	120
9.	Electrical Technology & Electronics Lab or Common with Electrical Engineering.	90
10.	Metrology Lab.	90
11	Computer Lab (Air Cond.Glass Partition and Special type pvc flooring and false ceiling )	60
12.	Advance Welding Lab/Shop	90

[C] Work shop

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

[D] Student's Amenities

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

[E] STAFF RESIDENCES

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

Priority to be given in following order

(1)

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

(2)

- a. Hostel
- b. Students Amenities

(3)

Residences of employees



## LIST OF EQUIPMENTS

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

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

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

### I. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
1.	Brass ball with hook 2 cm. dia	2	20	40
2.	Stop clock least count 0.1 Sec	2	500	1000
3.	Wall bracket with clamping arrangement	2	50	100
4.	Meter scale	5	20	100
5.	Convex lenses of focal length 10 cm., 20 cm., 50 cm. and 100 cm. 2 nos. of each	8	10	80
6.	Optical bench steel with pin and lens holders	2	500	1000
7.	Astronomical telescope	1	500	500
8.	Searle'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.	Lechlanchi 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 character- istics 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

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S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
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.	Insulation meter	1	1500	1500
	Misc.	LS		5000

## II. APPLIED CHEMISTRY LAB

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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 sharpen	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 gooseneck	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

S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
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. height 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 bottles each set	4	2000	8000
50.	Digital balance electronic	1	10000	10000
51.	Hot plates 7-1/2", 3" dia controlled 2000 watts	1	1000	1000
52.	Hot air oven thermostatically controlled with selves and rotary switches 350 x 350 x 25 high	1	8000	8000
53.	pH Meter	1	1000	1000
54.	Glass Electrode	2		
55.	Reference Electro	2		
	Miscellaneous	LS		10000

#### APPLIED MECHANICS LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Polygon of Forces Apparatus	1	700	700
2.	Universal Force Table	1	1500	1500

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

### III. WORKSHOP PRACTICE

#### CARPENTRY SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
1.	60 cm. rule	10	15	150
2.	Flexible steel rule 2 metre	2	20	40
3.	T square 23 cm. steel	10	20	200
4.	Bevel square 23 cm. steel	2	30	60
5.	Marking knife 25 cm. steel	10	30	300
6.	Marking gauge wooden & brass 25 cm.	10	30	300
7.	Mortise gauge wooden & brass 25 cm.	10	50	500
8.	Caliper inside, steel 20 cm.	2	50	100
9.	Caliper outside, steel 20 cm.	2	50	100
10.	Compass steel 20cm.	2	40	80
11.	Divider 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

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S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
49.	Adze 500 gm.	10	50	500
50.	Pincer 175 mm.	6	75	750
51.	Pliers 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	1	15000	15000
	misc. for foundation of machines	LS		10000

#### SMITHY SHOP

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

#### SHEET METAL, SOLDERING & BRAZING

1.	Dividers - 15cm.	5	60	300
2.	Trammel 1 m.	1		
3.	Angle protector	5	60	300
4.	Try square 30 cm.	5	40	200
5.	Centre punch	5	20	100
6.	Steel rule 30 cm. , 60 cm. ,	5	25	125
7.	Sheet metal gauge	1	120	120
8.	Straight snips 30 cm.	2	250	500
9.	Curved snips 30 cm.	2	300	600
10.	Bench shear cutter 40 cm.	1	5000	5000
11.	Chisel 10 cm.	5	100	500
12.	Hammer	5	150	750
13.	Bench vice 13 cm.	5	1000	5000
14.	Pliers	5	50	250
15.	Nose pliers	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

#### 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, Die set, Hexa frames etc.		LS	10000

#### WELDING SHOP

1.	Electric welding set oil cooled	1	10000	10000
2.	Industrial regulator type oil cooled arc welder	1	12000	12000



3.	Air cooled spot welder	7.5 KVA	1	15000	15000
4.	General accessories for air cooled spot welder of 7.5 KVA				8000
5.	Gas welding set with gas cutting torch and complete with all accessories		1	15000	15000
6.	Misc. work benches			LS	20000

#### PAINTING & POLISHING SHOP

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 chromium Nickel plating.		1	10000	10000
	Misc.			LS	2000

#### 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 pliers	4	50	200
6.	Pipe die set 2" set	2 set	600	1200
7.	Pipe bending device	1	5000	5000
8.	Work benches	4	4000	16000
9.	Set of various types of plumbing fittings e.g. Bib cock Cistern, Stop cock, Wheel volve, Gat volve etc.		LS	2000
10.	Misc. Hacksaw frame and others		LS	2000

#### FOUNDRY SHOP

1.	Moulding boxes	25	6000
2.	Ladles	5	1000

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

#### MACHINE SHOP

1.	Lathe machine 4.5 feet "V" bed. Height of centers 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

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	1000	2000
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.	Fluorescent 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

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S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
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21.	Moving Coil Voltmeter 0-250 V.	1	1000	1000
22.	Energy Meter Single Phase 230 V., 5 Amp	1	2000	2000
	Misc.		LS	1500

#### METROLOGY LAB

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S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
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1.	(i) Sine bar	2	3000	6000
	(ii) Vernier Bevel Protractor	2	2000	4000
	(iii) Universal Bevel Protractor	2	2500	5000
2.	Optical Profile Projector	1	6000	6000
3.	Mechanical Comparator	1	8000	8000
4.	Precision balls of various sizes	1		
5.	(i) Precision Rollers of various sizes	1		
	(ii) Taper gauge set	1	2000	2000

6.	Auto Collimator with Accessories	1	8000	8000
7.	Screw Pitch gauge set	1	500	500
8.	Micrometers (0-25, 25-50 mm.)	2	500	1000
9.	(i) Height gauge	1	1000	1000
	(ii) Vernier Calipers set	1	500	500
10.	Feeler gauge set	1	1000	1000
11.	Tool Makers Microscope	1	10000	10000
12.	(i) Slip gauge set	1	10000	10000
	(ii) Snap gauge Adjustable	1	2000	2000
	(iii) Plug gauge set	1	2000	2000
13.	Polar Planimeter digital	1	5000	5000
14.	(i) Radius gauge set	1	500	500
	(ii) Wire gauge 0-36 swg	1	1000	1000
	(iii) Filet gauge set	1	500	500
15.	Surface Roughness tester	1	50000	50000
16.	Surface Plate with stand	2	4000	8000
17.	Depth Micrometer	2	500	1000
18.	Miscellaneous	LS	5000	

#### PLASTIC PROCESSING LAB-I & II

Sr.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
1.	Hand injection moulding Machine With heaters and(15gm/20gm./25gm.) Temp. controllers.	3	10000	30000
2.	Hand blow moulding machine (15gm./30gm.)	2	10000	40000
	nos.each			
3.	Semi-automatic moulding/ Blow moulding machine(15gm.)	1	1.5lakhs	1.5lakhs
4.	Hand compression moulding Machine(20 ton)	1	60000	60000
5.	Automatic compression Moulding machine-(30ton)	1	3lakhs	3lakhs
6.	Vacuum forming m/c (smallest size)single chamber	1	2lakhs	2lakhs
7.	Scrap grinding m/c(small)	1	50000	50000
8.	PVC Welding m/c/hot welding Machine.	2	20000	20000
9.	Different moulds for all Machines.	-	20000/moulds.	
10.	Extruder machine(one inch)	1	10lakhs	10lakhs
11.	gravure printing m/c	1	2lakhs	2lakhs
12.	Pad printing m/c	1	50000	50000

PLASTIC TESTING LAB

Sr.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
1.	Restivity test equipment	1	70000	70000
2.	U.T.M m/c (2ton)	1	1.5lakhs	1.5lakhs
3.	Impact testing machine	1	40000	40000
4.	Hardness testing machine	1	20000	20000
5.	film dart Impact testing machine	1	25000	25000
6.	Melt flow machine	1	2lakhs	2lakhs
7.	HDT machine	1	1lakh	1lakh
8.	Software' s as per requirements	one each	-	5lakhs

COMPUTER AIDED MOULD DESIGN LAB:

Sr.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
1.	Inventor software (auto desk-multi user)	1	3lakhs	3lakhs.(aprox.)
2.	Mould creator	1		
3.	Mould flow software	1		

## ANNEXURE - I

### FIELD EXPOSURE - I

Plastic & Mould Technology students after First year exam. will undergo a two week Industrial Exposure, (in small scale units at least) arranged and supervised by the institute staff. They may try their hands on simple tools and machines and will incorporate following points in their reports.

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.
  - i. Names of the sections of the unit visited.
  - ii. Number of person engaged.
  - iii. Activities in the section.
  - iv. Name of tools/machines/instruments used.  
simple sketch of tools & instruments.
  - v. Source of power.
5.
  - i. What is learnt. (Give on separate field)
  - ii. What interested him most. (Give details)

## ANNEXURE - II

### FIELD EXPOSURE - II

After second year exam. in the summer vacation students of Plastic & Mould Technology will have a four week Industrial Training in units not less than small scale industries. It should preferably be arranged in manufacturing (producing moulds, plastic products or their parts), processing organizations. They will work and focus their attention on following points to incorporate them in their reports.

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
10. Name of checking and Inspecting Instruments and their details.  
Quality controls measures taken.
11. Details of hydraulics/pneumatic/thermal units or appliances used if any.
12. Description of any breakdown and its restoring.
13. Use of computer
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 & hygienic.

## RECOMMENDED BOOKS

### **1) ENVIRONMENT AND POLLUTION IN PLASTIC INDUSTRY:**

1. Plastic Waste Management by Nabil Mustufa; Marcel Dekker
2. Chemistry of Waste Management by Clark
3. Elements of Polymer Degradation by Leo Rich and Stivala; McGraw Hill Company
4. Environmental Sanitation by Baljeet S Kapoor; S Chand and Company, New Delhi
5. Introduction to Environmental Engineering and Science by Gilbert M Masters; Prentice Hall of India, New Delhi
6. Recycling and Recovering of Plastics by Brandrup (Hanser Publications)

### **2) BASICS OF INFORMATION TECHNOLOGY:**

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Computers Today by SK Basandara, Galgotia publication Pvt ltd. Daryaganj, New Delhi
3. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
4. A First Course in Computer 2003 Edition with CD by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Mastering Windows 95, BPB Publication, New Delhi
6. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
7. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

### **3) PLASTICS PROCESSING TECHNIQUES:**

1. Basic Engineering Handbook by Michael L Berins
2. Plastic Processing Data Handbook by Rosato and Rosato
3. Process of plastic by A S ATHALYE

### **4) DESIGN OF DIES AND MOULDS:**

1. Injection Mould Design by R.C.W Pye; Longman Scientific and Technical Publication

2. Plastic Mould Engineering Hand Book by J. Harry Don Bose and Mayne I pribble, Van Nostrand Reinhold Company Publication
3. Injection Moulding Handbook by Dominick V Rosato and Donald V Rosato
4. Plastic Engineering Handbook by Joel Frados; Van Nostrand Reinhold Company Publication.
5. Plastic Engineering by RJ Crawford; Maxwell Macmillan International edition Publication
6. Injection Mould Design by R.C.W Pye; Longman Scientific and Technical Publication
7. Plastic Mould Engineering Hand Book by J. Harry Don Bose and Mayne I pribble, Van Nostrand Reinhold Company Publication
8. Injection Moulding Handbook by Dominick V Rosato and Donald V Rosato
9. Plastic Engineering Handbook by Joel Frados; Van Nostrand Reinhold Company Publication
10. Plastic Engineering by RJ Crawford; Maxwell Macmillan International editions Publication

**5) ENGINEERING AND SPECIALITY POLYMERS, PLASTIC MATERIALS:**

1. Polymer Science & Technology by Premamoy Ghosh
2. Polymer Blends and Alloys by Arends
3. Polymers Science & Technology by JR Fried
4. Plastics Materials by Brydson, PHI Publication
5. Engineering Polymers by Dyson, PHI Publication
6. Polymer Materials and Processing by Jean Michael Charrier.

**6) PLASTIC TESTING AND QUALITY CONTROL:**

1. Testing of Plastics by Roger Brown
2. Plastics – Materials and Processing by A brentstrong
3. Plastics Testing by Vishu Shah
4. Identification of Plastics by CIPET
5. Identification of Plastics by AS Athalye

**7) ENGINEERING METROLOGY AND MEASUREMENTS:**

1. Jain R.K., Engineering Metrology, Khanna Publishers.
2. Alan S. Morris, The Essence of Measurement, Prentice Hall of India.
3. Gupta S.C, Engineering Metrology, Dhanpat rai Publications.
4. Jayal A.K, Instrumentation and Mechanical Measurements, Galgotia Publications.
5. Beckwith T.G, and N. Lewis Buck, Mechanical Measurements, Addison Wesley.
6. Donald D Eckman, Industrial Instrumentation, Wiley Eastern.

**8) MATERIALS AND METALLURGY:**

1. Material Science by GBS Narang, Khanna Publishers, New Delhi.
2. Material Science and Metallurgy by RB Choudary, Khanna Publishers, New Delhi.
3. Material Science by RK Rajput; SK Kataria and Sons, Delhi.
4. Materials and Matallurgy by D.S. Nutt. SK Kataria and Sons, Delhi.

**9) HYDRAULIC AND PNEUMATIC SYSTEMS:**

1. Hydraulics and hydraulic machines by Sarao and Khosla.
2. Hydraulics and Hydraulic machine by D.R. Malhotra.
3. Fluid Power and Tribology by Anil Agarwal and ML Bhatia, Scientific Publishers (India), Jodhpur – 342 001.
4. Hydraulics & Fluid Mechanics by Dr. Jagdish Lal; Metropolitan Book Co. Pvt., Ltd.
5. Hydraulics by R.S Khurmi.
6. Hydraulics: Fluid Mechanics and Fluid Machines by S. Ramamurthan; Dhanpat Rai & Sons, Delhi.

## QUESTIONNAIRE

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

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

**PURPOSE:** New development of Three Year Diploma curriculum in Plastic Mould Technology.

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

1. Name of the organisation: \_\_\_\_\_  
\_\_\_\_\_

2. Name & Designation of the officer \_\_\_\_\_  
Filling the questionnaire \_\_\_\_\_  
\_\_\_\_\_

3. Name of the Department/section \_\_\_\_\_  
\_\_\_\_\_

4. Important functions of the \_\_\_\_\_  
Department/section \_\_\_\_\_  
\_\_\_\_\_

5. Number of diploma holder employees  
under your charge in the area of \_\_\_\_\_  
Plastic Mould Technology..

6. Please give names of latest equipments/machines handled by a  
Diploma holder in Plastic Mould Technology..

- |    |    |    |
|----|----|----|
| 1. | 2. | 3. |
| 4. | 5. | 6. |

7. What proficiencies are expected from a diploma holder in  
Plastic Mould 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 years
  - 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 Plastic Mould 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 domestic articles of different countries/States.

Yes/No

13. Does your organisation conduct field survey to know users views regarding.

Yes/No

- 1. Domestic Articles for different age groups and sex.
- 2. Effect of climatic conditions
- 3. Any other

If yes; Please give brief account of each.-----

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14. Which type of assignment do you suggest for an entrepreneur? -----  
in Plastic Mould Technology..

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

1	2	3
4	5	6

16. Job prospects for the diploma holder in Plastic Mould 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 Plastic Mould Technology..

Theory-----	Practical-----
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18. Kindly mention particulars regarding topics/areas which  
should be given more emphasising 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.------

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21. What latest trends in technologies are to be incorporated? -----  
for the development of curriculum in Plastic Mould Technology.-----

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(Signature)

Kindly mail the above questionnaire duly filled to:-

M.P.Singh Bhadauria  
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 )